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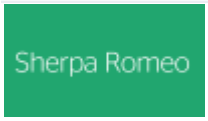

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Does Machine Learning Forecast Investor's Risk Appetite?

Makine Öğrenmesi Yatırımcının Risk İştahını Öngörür mü?

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ABSTRACT

Risk appetite is an important indicator that is monitored with interest by financial market participants. One of the risk appetite indices is nominated "RISE risk appetite index" calculated to measure the riskiness of the Turkey market in general. There are very limited studies in the literature on RISE risk appetite, and most of them use simple econometric methods to predict the risk appetite. To the best of our knowledge, there is no study using machine learning algorithms. Therefore, it creates curiosity on how the success will be in estimating the risk appetite using machine learning algorithms. Thus, the aim of this paper is to measure the estimation success of the RISE index using Long Short-term Memory (LSTM) and Multi-Layer Perceptron (MLP). The analysis is based on a weekly frequency dataset covering the years 2008 to 2023. The results are compared as per RMSE values, and LSTM presents rather high prediction success compared to MLP. Due to the forecasting ability of BIST 100 index on RISE, the current and lagged values of BIST 100 are compared, and lagged values of BIST 100 are found to have a higher ability to estimate RISE, approximately twice as much as current values. It is expected that this valuable finding will be a guide for market participants and financial analysts to shape their investment preferences by using deep learning algorithms in predicting market expectations and to make well-directed investments.

Keywords:
Risk Appetite,
RISE Index,
Forecasting,
LSTM,
MLP

Jel Codes:
C32, C45, G17

ÖZET

Risk iştahı, finansal piyasa katılımcıları tarafından ilgiyle izlenen önemli bir göstergedir. Risk iştahı endekslerinden biri olan "RISE risk iştahı endeksi", genel olarak Türkiye piyasasının risk derecesini ölçmek için hesaplanmaktadır. Literatürde RISE risk iştahıyla ilgili sınırlı sayıda çalışma bulunmakta ve bu çalışmaların çoğu, risk iştahını tahmin etmek için basit ekonometrik yöntemleri kullanmaktadır. Bildiğimiz kadarıyla, makine öğrenmesi algoritmalarını kullanan bir çalışmaya rastlanmamıştır. Bu nedenle, makine öğrenmesi algoritmaları kullanılarak risk iştahının tahminlenmesi merak uyandırmaktadır. Bu çalışmanın amacı, RISE endeksinin tahmin başarısını Uzun Kısa Süreli Hafıza (LSTM) ve Çok Katmanlı Algılayıcı (MLP) kullanarak ölçmektir. Analiz, 2008'den 2023'e kadar olan yılları kapsayan haftalık frekanslı veri setine dayanmaktadır. Sonuçlar, RMSE değerlerine göre karşılaştırılmış olup, LSTM algoritması MLP'ye kıyasla daha yüksek bir tahminleme başarısı sunmaktadır. RISE endeksi üzerinde BIST 100 endeksinin tahmin yeteneği göz önüne alındığında ise BIST 100 endeksinin mevcut ve gecikmiş değerleri karşılaştırılmış ve gecikmeli BIST 100 değerlerinin RISE' ı tahmin etme yeteneğinin, mevcut değerlere göre yaklaşık olarak iki kat daha yüksek olduğu belirlenmiştir. Bu değerli bulgunun, piyasa katılımcılarına ve finansal analistlere, piyasa beklentilerini tahmin etmede derin öğrenme algoritmalarını kullanarak yatırım tercihlerini şekillendirmelerine ve doğru yatırımlar yapmalarına rehberlik edeceği beklenmektedir.

Anahtar Kelimeler:
Risk İştahı,
RISE Endeksi,
Tahminleme,
LSTM,
MLP

Jel Kodları:
C32, C45, G17

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1. INTRODUCTION

Risk appetite refers to the investor's desire and tendency to engage in transactions involving various financial instruments in financial markets. In addition, risk appetite is, to some extent, a different concept from the investor's aversion to risk. Particularly, Gai & Vause (2004) argue that the difference lies in the fact that risk aversion does not show a time-dependent change and that investors differ in the point at which they will internally avoid risk. Financial difficulties and periods of macroeconomic uncertainty lead to variations in investors' risk appetite (Misina, 2005).

If we scrutinize deeper the subject, the concepts of "risk appetite," "risk premium," and "risk aversion" concepts emerge, and although these terms are sometimes used interchangeably, they represent distinct concepts. Investors dislike uncertainty surrounding the future consumption on their assets. When expressed as a willingness to take risks, risk appetite depends on an investor's level of discomfort with uncertainty and the degree of uncertainty. The level of uncertainty is determined by macroeconomic conditions. An investor's level of discomfort with uncertainty reflects their preferences for gambling. On the other hand, risk aversion is inherently internal for an investor and does not change consistently over time. These concepts differ from each other, for example, risk appetite varies over periods based on financial distress and macroeconomic uncertainties. In adverse conditions, investors demand higher expected returns for each unit of risk, leading to a decrease in risk appetite—essentially the inverse of the risk price. The price of risk, when considered alongside the amount of risk inherent in a specific asset, is the risk premium, representing the expected return for holding that asset. It is depicted in Figure 1. Distinguishing risk appetite from risk aversion is rather hard; an increase in either leads to a decrease in asset prices and an increase in the risk premium (Gai & Vause, 2006).

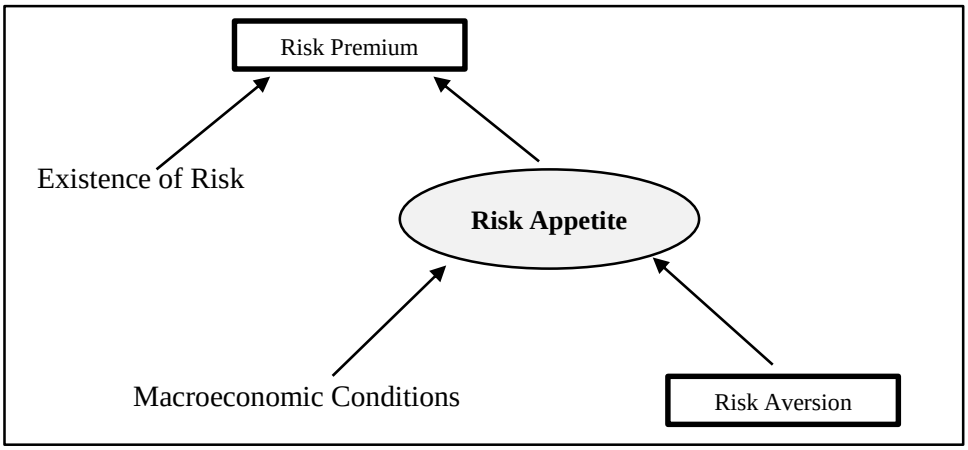

Figure 1. The Relationship between Risk Premium, Risk Aversion
Source: Gai & Vause, 2006, p.169.

Therefore, as shown in Figure 1, the two main factors fundamentally influencing risk appetite are the uncertainty stemming from macroeconomic conditions and the investor's risk aversion attitude. Considering that the investor's risk aversion attitude is an integral part and doesn't change significantly across periods, we can conclude that risk appetite is affected by the times of increased financial or macroeconomic uncertainties.

The risk appetite for financial instruments tends to rise and decline in certain periods. Behind these fluctuations, there are sometimes global and sometimes national factors. These factors can be financial and economic events, as well as political or even sociological events. These influences can sometimes affect markets in a domino effect. A decrease in risk appetite in one market can manifest as an increase in another financial market or instrument. Therefore, while global risk appetite can be measured, it is also possible to measure the risk appetite for a specific region, market, or financial instrument. However, for risk appetite measured with various indicators explaining changes in asset prices, it generally does not exhibit directly observable characteristics. In calculations, attempts are made to create a risk appetite index by combining different indicators from several markets (Hermasillo, 2008).

In this study, we aim to predict the RISE risk appetite index via machine learning methods. In the literature review, it is noticed that few studies are conducted on the RISE risk appetite, and the majority rely on basic econometric methods for prediction. As far as we know, no research has employed machine learning algorithms for this purpose. This raises curiosity about the potential success of using machine learning algorithms to estimate the

RISE risk appetite index. This study will demonstrate that machine learning algorithms can be used to predict RISE risk appetite. Therefore, it is expected to contribute to the literature by showing the prediction success of machine learning methods on the estimation of investor risk appetite. The remainder of this paper is organized as follows. Section 2 summarizes the local and international risk appetite measures. Section 3 provides the previous studies on risk appetite measures. Section 4 is the data and model, and Section 5 shows the results of the research. Section 6 concludes.

2. RISK APPETITE INDEXES

Various studies have been conducted to measure risk appetite in international markets, and different indicators have been calculated. Among these indicators, the most recognized and considered a significant measure of risk is the VIX index. The VIX index is known as the gauge of anxiety or fear arising from increased volatility in the markets, and is therefore also referred to as the "fear index." It measures the market's expectation of volatility based on S&P 500 index options. The symbol for the VIX index is the Chicago Board Options Exchange (CBOE) Volatility Index. Although the VIX is the most well-known and popular index, countries worldwide have their own calculated indices. These indices can be categorized into market-based indicators and model-based criteria. Examples of indices created based on model-based criteria include the Investor Risk Appetite developed by Gai & Vause (2005), State Street's Investor Confidence Index (ICI), Goldman Sachs Risk Aversion Index (GS), Tarashev, Tsatsaronis, & Karampatos' Risk Appetite Index (BIS), and Credit Suisse's Global Risk Appetite Index (CS). In the category of market-based indicators, VIX is at the forefront. These indicators are simple statistical measures based on implied volatility and trading variances. Others in this category include JP Morgan's Risk Tolerance Index (JPM G-10 RTI and JPM EM RTI), Merrill Lynch's Option Volatility Expectation Index (MOVE Index), Westpac Risk Appetite Index (WPRA), Dresdner Kleinwort's Total Risk Perception Index (ARPI), Merrill Lynch Risk Aversion Indicator (ML RAI), Lehman Brothers' Market Risk Sensitivity Index (MARS), and Bank of America Risk Appetite Indicator (RAM) (ECB, 2007).

Market-based measurements are focused on the measurement of market volatility, also known as market risk. The most popular risk appetite index, measured according to the expected volatility of the stock option market, is the VIX index, calculated by the CBOE. The VIX Index is closely monitored by market participants. It is calculated based on the implied volatility of the S&P 500 stock index. The calculation of this index involves using the implied volatility of buying and selling options. In its simplest form, the index represents the 30-day anticipated volatility of the U.S. stock market. It reflects the market's perception of risk. Therefore, a high index value indicates increased risk and a worsening perspective for future expectations, meaning that fear and tension in the markets may rise. Levels at 30 and above suggest that volatility may show significant increases. Hence, the VIX index is nominated as the "fear index." Figure 2 displays the graph of the VIX index for the period from 2019 to 2023. The graph apparently shows the dramatic increase in the index at the times of Covid-19 pandemic outbreak that's because uncertainty and fear dominate all over the world and reverberate the risk appetite index values almost concurrently.

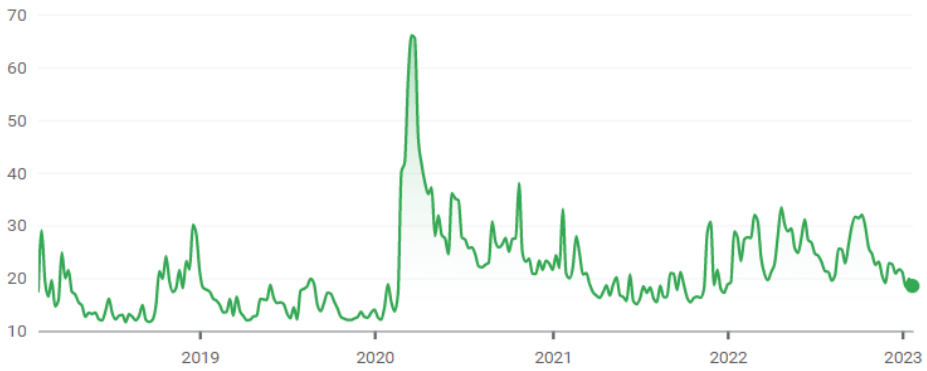

Figure 2. VIX Fear Index for the Period of 2019-2023
Source: Google Finance, 2023.

In Turkey, a collaboration between the Central Securities Depository of Turkey (MKK) and Özyeğin University has generated a risk appetite index to measure the overall market risk appetite. This index, known by abbreviation as RISE, is calculated weekly and is published on MKK's website at the end of every Friday. The data for this index goes back to 2008. The RISE index is calculated for various investor groups, including all investors,

domestic investors, foreign investors, domestic individuals, domestic legal entities, domestic funds, and qualified investors. They all are regularly announced on MKK's website.

The index is calculated on the basis of the weekly changes in the portfolio values of approximately 1.7 million investors. The weekly portfolio changes are used for calculation. The calculation considers the total weekly changes in the portfolios of investors in A-type funds and equities held on Fridays. It is adjusted for changes in the BIST 100 index, and the deviation of investors' changes in the relevant week from the weighted average of the values of the previous 52 weeks is obtained. The scoring method, which assigns investors a score between 0 and 100, is used in the calculation. Subsequently, these scores are used to calculate the weighted average of investors' portfolio sizes for the relevant week relative to the market portfolio size. Finally, the result of this process is an index of market risk appetite (Saraç et al., 2016).

3. LITERATURE REVIEW

Kumar & Persaud's (2002) study is considered one of the pioneering works in the international literature on risk appetite. The authors conducted various analyses to explain the relationship between financial contagion and risk appetite and to measure the changes in investors' risk appetite. They used the spot and forward exchange rates of 17 currencies for this purpose. In calculating risk, they employed the excess returns and return volatilities of assets and computed a Risk Appetite Index (RAI) that reflects changes in an investor's risk aversion. The calculation was based on the Spearman rank correlation between expected excess asset returns and the riskiness of the asset. Empirical results suggested that the RAI could be a useful measure for understanding financial crises.

Haugen (2006) conducted research on the dependence of risk appetite on macroeconomic conditions. The results revealed statistical evidence illustrating the interaction between risk appetite and macroeconomic conditions. Baek (2006) investigated the driving and attracting factors behind portfolio investments in Asian and Latin American economies. Similar to Kumar & Persaud (2002), the author generated a risk appetite index. The findings indicated that the factors attracting and pushing foreign portfolio investments in Asian and Latin American economies were different. In Asian economies, investor risk appetite was found to be the dominant driving force behind portfolio investments. Shen & Hu (2007) aimed to measure the relationship between the risk appetites (RAI) of banks and macroeconomic variables in Taiwan. The authors conducted an analysis to explain the relationship between bank risk appetite indices and periods of financial crises or significant economic events. It is found that local crises affecting the country significantly led to a decrease in bank risk appetite. Adrian et al. (2009) examined the relationship between the VIX fear index and exchange rates of country markets that cover fourteen emerging markets and nine developed markets. Turkey was among the emerging markets in the study, and the results indicated a significant relationship between risk appetite and exchange rate changes. Pericoli & Sbracia (2009) calculated the Risk Appetite Index (RAI) using Kumar & Persaud's (2002) method with monthly data for Dow Jones Euro STOXX and S&P 500 market stocks. They concluded that RAI and CAPM yielded similar predictions when the variance of returns was sufficiently smaller than the variance of the asset's risk. Sarwar (2012) investigated the relationships between the VIX index and the national stock indices of Brazil, Russia, India, China, and the United States for the period 1993 to 2007. They found a statistically significant and negative relationship between them.

It is accurate to say that there is not an extensive literature on studies examining the RISE risk appetite since 2008. A number of research concentrates on exploring the relationships between various macroeconomic and financial indicators and risk appetite. However, there are limited studies on the determinants of risk appetite. One of the pioneering studies in this regard was conducted by Saraç et al. (2016). In this study, the authors examined the predictability of the RISE risk appetite index for the period of 2008 and 2013. The researchers found that the data on domestic investors' risk appetite were linear and did not exhibit a threshold effect. Additionally, the non-linearity of the risk appetite series of foreign investors indicates the presence of a threshold effect.

Çelik et al., (2017) conducted analyses using time series regressions for the period from 2008 to 2017, focusing on macroeconomic variables that could be used in predicting risk appetite. The results indicated that an increase in interest rates and exchange rates has a negative effect on risk appetite, while an increase in money supply and foreign exchange reserves has a positive effect. The statistically significant macroeconomic variables in the model can only explain 5% of the variation in investors' risk appetite. The remaining 95% implies the existence of other macroeconomic and financial indicators that could influence risk appetite.

Akdağ (2019) attempts to determine Turkey's financial and macroeconomic indicators influenced by the VIX index. According to the Granger causality test results, changes in the VIX fear index were found to be the Granger cause of changes in BIST 100 index, In the study by Akdağ & İskenderoglu (2019), the authors tested whether risk appetite in rising (bull) and falling (bear) markets, could be parametrically separated into regimes using the Markov Regime model. The results indicated that the RISE risk appetite could be divided into two regimes: high and low volatility. The authors noted that events such as earthquakes, economic and political crises, and terrorist incidents coincided with the high volatility regime, which they referred to as turmoil.

İskenderoğlu & Akdağ (2019) conducted a study investigating the causality relationship between risk appetite and oil prices, exchange rates, gold prices, and interest rates using weekly data from 2008 to 2015. The findings of the study indicated that changes in oil prices were sensitive to changes in investors' risk appetite in the long term. On the other hand, regarding exchange rates, it was observed that both in the long and short term, risk appetite was influenced by changes in exchange rates.

Demirez & Kandır (2020) examined the relationship between stock returns, the RISE risk appetite index, and the BIST 100 index for the period from January 2009 to January 2019. According to the regression analysis, it was concluded that the impact of changes in risk appetite on stock returns is limited. Sarı & Başakın (2021) examined the relationship between the BIST Bank Index, the RISE risk appetite index and VIX index. According to the findings, it was determined that the risk appetite index and VIX index could predict stock returns with acceptable accuracy.

Özkan (2022) investigated the relationships between the RISE risk appetite index and BIST 100, gold, and USD/TRY exchange rate during the Covid-19 pandemic period. A positive relationship was identified between the two-period lagged value of the risk appetite index and the one-period lagged values of the BIST 100 index. This finding seems to be in line with theoretical expectations.

Köycü (2022) examined the relationship between the BIST 100 index and the RISE risk appetite. The causality from the BIST 100 index to the risk appetite index was detected. Yılmaz & Yıldız (2022) examined the relationships between the volatility indices in international markets, including VIX (USA), VXN (USA), V1X1 (Germany), V2TX (Europe), and JNIV (Japan), and the RISE risk appetite index. The findings indicated that the V2TX index was the most influential fear index on the risk appetite index for all investor types.

Gemici et al. (2023) analyzed the effects of four local and five global factors on Turkey's risk appetite using weekly data from 2008 to 2022. The authors employed two nonparametric quantile-based approaches, the causality-in-quantile method proposed by Balcilar et al. (2016) and quantile-on-quantile regressions introduced by Sim & Zhou (2015) The findings unveiled the significant causal relationships between both global and local factors and risk appetite under different market conditions. Among these, local factors, especially CDS spreads, had a stronger causal impact compared to global factors. Besides the uncertainty during the pandemic crisis diminished the explanatory power of most factors. All investor groups generally experienced negative shocks, with the impact being stronger at lower and middle quantiles.

The literature review revealed that there was no study investigating whether the risk appetite could be predicted by machine learning algorithms. So, this study would be the leading one used the machine learning architectures in the prediction of the RISE risk appetite index in Turkey.

4. METHODS and DATASET

Deep learning can be defined as a machine learning method that enables digital systems to learn from vast unstructured and unlabeled data, extracting various patterns and thus making decisions. In its simplest form, it is the application of machine learning methods to big data. We observe the increasing use of deep learning algorithms in various fields such as drug discovery and medicine, natural language processing, signal processing, future prediction, the defense industry, and finance. At the core of this is the considerably successful results of deep learning architectures in these areas compared to other methods used (Doğan & Türkoğlu, 2019).

Deep learning techniques, especially within the finance domain, demonstrate superior effectiveness compared to standard econometric methods when addressing large datasets for predicting asset pricing, optimizing portfolio acquisition, managing risk, and estimating future prices and returns of financial assets. The fundamental reason for this lies in the ability of deep learning methods to detect direct but unobservable data interactions among financial data. One of the deep learning method is LSTM, which is a type of recurrent neural network (RNN) architecture that extends memory. RNN uses short-term past information and therefore has short-term memory.

LSTM, on the other hand, is an improved version of normal RNN with higher memory power, designed to facilitate capturing long-term dependencies in sequential data (Alpay, 2020). LSTM neural network was first proposed by the study of Hochreiter & Schmidhuber (1997). The network is built on the structure by constructing gates on the cell. These gates are nominated as "forget gate", "input gate", and "output gate". These gates are capable of capturing both long-term and short-term memory throughout the time steps and avoid gradient exploding. The operation of an LSTM unit can be expressed as:

$$i_t = \sigma(W_i x_t + U_i h_{t-1} + b_i) \quad (1)$$

$$f_t = \sigma(W_f x_t + U_f h_{t-1} + b_f) \quad (2)$$

$$\tilde{c}_t = tanh(W_c x_t + U_c h_{t-1} + b_c) \quad (3)$$

$$c_t = i_t * \tilde{c}_t + f_t * c_{t-1} \quad (4)$$

$$o_t = \sigma(W_o x_t + U_o h_{t-1} + b_o) \quad (5)$$

$$h_t = o_t * \tanh(c_t) \quad (6)$$

Where,

Input gate, i_t	: Determines which information will be updated in the cell state, c_t
Forget gate, f_t	: Controls which information will be discarded from the previous cell state, c_{t-1}
Candidate cell state, $\tilde{c}_t$	: Created by Tanh to determine the new information to be stored in the cell state.
New cell state, c_t	: Updated using the input gate and the candidate cell state
Output state, o_t	: Determines the output of the LSTM cell
Hidden state, h_t	: The output of the LSTM cell, filtered through the output gate.

Each gate (i_t , f_t and o_t) and state (c_t and h_t) is computed using specific weights (*W* and *U*) and biases (*b*), and the nonlinear activation functions *σ* (sigmoid) and *tanh* (hyperbolic tangent).

Multilayer perceptron (MLP), also known as a multilayered perceptron artificial neural network, is a supervised machine learning algorithm that mimics the working principle of the human brain. The multilayer perceptron artificial neural network consists of three layers: the input layer, hidden layer, and output layer. The training dataset forms the input layer from source nodes, one or more hidden layers with computation nodes, and finally, the output layer of nodes. In practice, the signal from the input nodes propagates through the MLP neural network layer by layer, as illustrated in Figure 3.

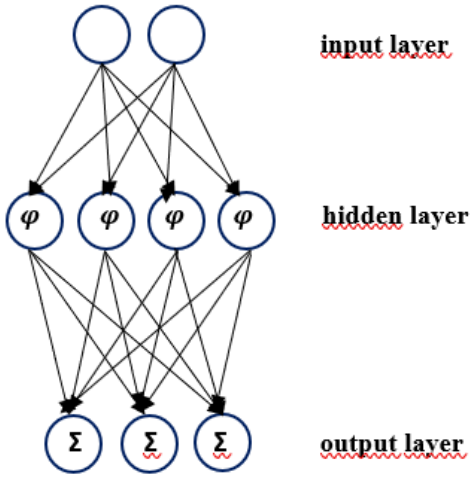

Figure 3. The Signal Flow of Typical MLP Neural Network
Source: Ting & Sim, 2017, p. 2.

MLP consists of simple neurons, called perceptron. As the weights in input nodes are calculated and the output is generated by applying a nonlinear activation function, a linear combination is formed by the perceptron through the computation of an output neuron from multiple real-valued inputs. This computation can be expressed as: (Ting & Sim, 2017)

$$y = \varphi(\sum_{i=1}^{n} w_i \ x_i + b) = \varphi(w^t \ x + b) \quad (7)$$

Where,

x : the vector of inputs

w : the vector of weights,

φ : the activation function

b : the bias

In this study, LSTM and MLP algorithms will be used for the next period price prediction of the RISE risk appetite index time series. The role of machine learning algorithms is the ability to predict the possible outcomes with higher accuracy and provide real-time predictions that allow for quick decision-making in dynamic environments. It means that enables immediate responses to changing situations. These features provide significant advantages for businesses and researchers in making strategic decisions.

Various metrics are used to compare the performance of the machine learning and statistical models. These metrics vary according to the machine learning algorithm selected, the nature of the problem, and the characteristics of the data set. These metrics evaluate the success of the model, and allow for comparison. One of these metrics is RMSE used in this study to determine the prediction performance of the models. RMSE is expressed as follows:

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2} \quad (8)$$

Here, n is the number of data points, y_i is the actual values and $\hat{y}_i$ is the predicted values of the model. The smaller the RMSE value, the closer the model's prediction is to the actual values. When comparing LSTM and MLP models, the smaller the RMSE value indicates the better the prediction performance of the model.

In the literature, there are many activation functions that have been used in network design in neural network model. The model utilises the Rectified Linear Unit (ReLU) as the activation function, which has been chosen for

its ability to introduce non-linearity while mitigating the vanishing gradient problem commonly encountered in deep networks. The network architecture includes 100 nodes per layer, with the intention of achieving a balance between complexity and computational efficiency. The Mean Squared Error (MSE) loss function is employed to quantify the difference between predicted and actual values, serving as a metric to guide the optimisation process. In order to optimise the weights of the network, we implemented the Adam optimiser, which is known for its adaptive learning rate and efficient handling of sparse gradients. The training was conducted over 50 epochs with a batch size of 150, allowing for effective learning through iterative updates and gradient adjustments. Besides, we introduced a set of hyperparameters, which we refer to as "bunker hyperparameters," with the aim of enhancing model stability and preventing overfitting. This novel approach to hyperparameter tuning provides a fortified training environment, ensuring the model's robustness in diverse scenarios.

The dataset for this study was obtained from the Central Securities Depository and Central Registry Agency (MKK). Since the data related to RISE risk appetite is published on a weekly basis, the analysis runs with weekly data. That brings the advantage of having a higher number of observations compared to monthly or yearly data. Therefore, the dataset covers weekly data from the years 2008 to 2023. The model is estimated via Python 3.

5. FINDINGS

The graph of the weekly series for the risk appetite index from 2008 to 2023 is depicted in Figure 3 below.

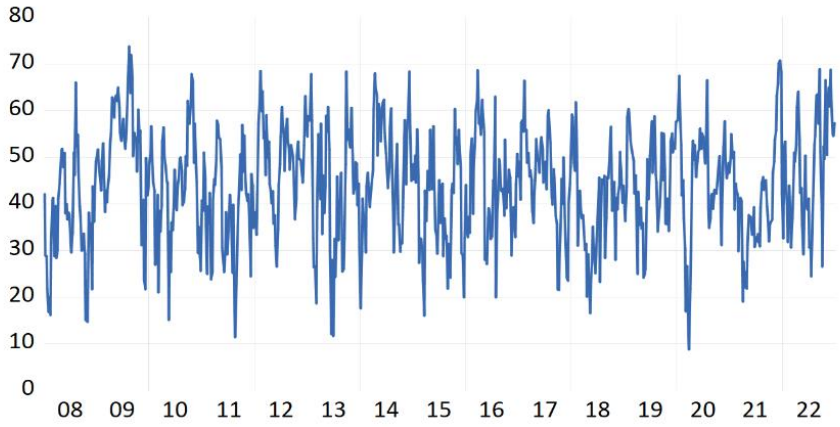

Figure 4. Weekly Chart of RISE Index (2008-2023 Period)

According to Gemici et al., (2023), there is a positive correlation between the risk appetite of investors in Turkey and portfolio flows towards Turkey, while there is a negative correlation between portfolio flows and the risk premium (CDS spreads). However, as of the 2020 pandemic period, the outlook has highly changed. The correlation between risk appetite and portfolio flows turns from positive to negative. Besides, the correlation between the risk appetite and the CDS spread is positive, and it is interpreted that the demand of investors, especially domestic investors, for Turkish stocks may have increased due to searching for a safe haven.

Before proceeding with the prediction of the RISE index, it was checked whether the series inherits unit roots. For this purpose, an ADF (Augmented Dickey-Fuller) unit root test was conducted. The results of the unit root test are presented in Table 1.

Table 1. ADF Unit Root Test and Correlogram Results

		RISE Index
ADF I (0)	**Constant**	-11.2130
	Prob.	0.0000
Test Critical Values	**1% Level**	-3.4384
	5% Level	-2.8650
	10% Level	-2.5686

Table 1 displays the results of the ADF unit root test. According to the result of the ADF unit root test, the RISE index series is found to be stationary at the 1% significance level. Table 2 shows the results of the correlogram.

Table 2. Correlogram Results

Panel B	AC	PAC	Q-Stat	Prob
1	0.7200	0.7200	407.8500	0.0000
2	0.5550	0.0750	650.1800	0.0000
3	0.3930	-0.0650	771.6400	0.0000
4	0.2740	-0.0180	830.7500	0.0000
5	0.1730	-0.0310	854.4900	0.0000
6	0.0900	-0.0390	860.8700	0.0000
7	0.0380	-0.0020	862.0000	0.0000
8	0.0000	-0.0110	862.0000	0.0000
9	-0.0350	-0.0320	862.9600	0.0000
10	-0.0590	-0.0200	865.7200	0.0000

Subsequently, the correlogram of the series was examined and Table 2 displays the correlogram for the series. When examining the correlogram, it can be observed that there is a correlation in the first differences from the partial autocorrelation function (PACF) value. In time series analysis, the PACF gives the partial correlation of a stationary time series with its own lagged values, regressed the values of the time series at all shorter lags. Values at this level cannot be used in statistical methods that involve squared errors. Therefore, it can be asserted that the ADF test might provide misleading results.

The values for the following week of the RISE index were predicted using LSTM and MLP algorithms. In order to determine the prediction success of machine learning algorithms, RMSE values were compared. RMSE is one of the standard ways to measure the error of a model in predicting quantitative data. The lower the RMSE value, the higher the measurement success of the model is considered. Figure 5 displays the error values for MLP and LSTM.

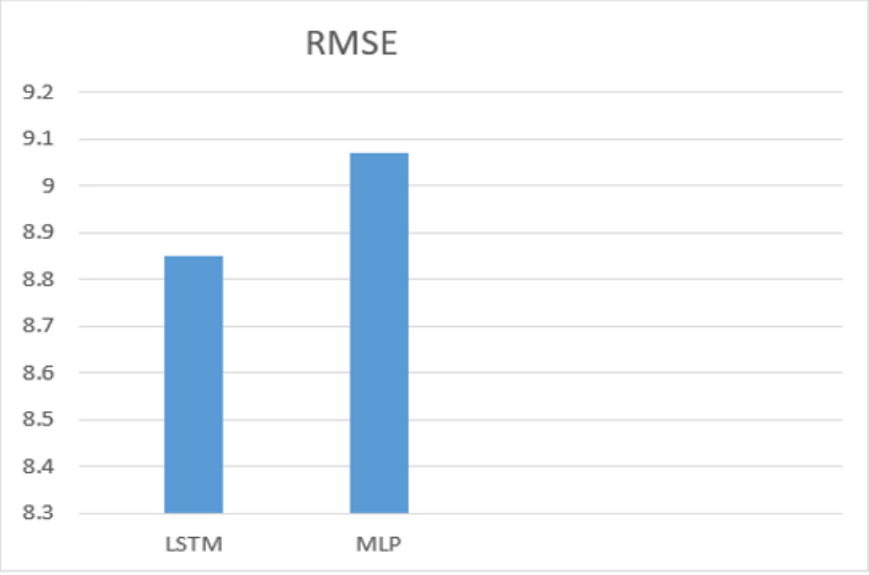

Figure 5. RMSE Values for LSTM and MLP Algorithms

In the prediction using LSTM, the mean squared error value was 8.85, whereas this value was obtained as 9.07 with the artificial neural network as seen as in Figure 5. Therefore, it can be concluded that the long short-term memory architecture provides more successful predictions in forecasting the RISE index.

In the study, there was also curiosity about the relationship between BIST 100 and RISE risk appetite index values. Köycü (2022) found a cointegration relationship between BIST 100 and the RISE index, and Özkan (2022) achieved cointegration between the two by using lagged values of RISE and BIST 100 with a one-period delay. Therefore, the relationships between BIST 100 and the RISE index were examined. Weekly RISE index data for the years 2008-2023 and BIST 100 closing data for the Fridays when the index is published were juxtaposed. By

looking at the weekly changes in both data sets, labeling was done into three categories: "Increase," "Decrease," or "Stable," and movements in the same direction were analyzed.

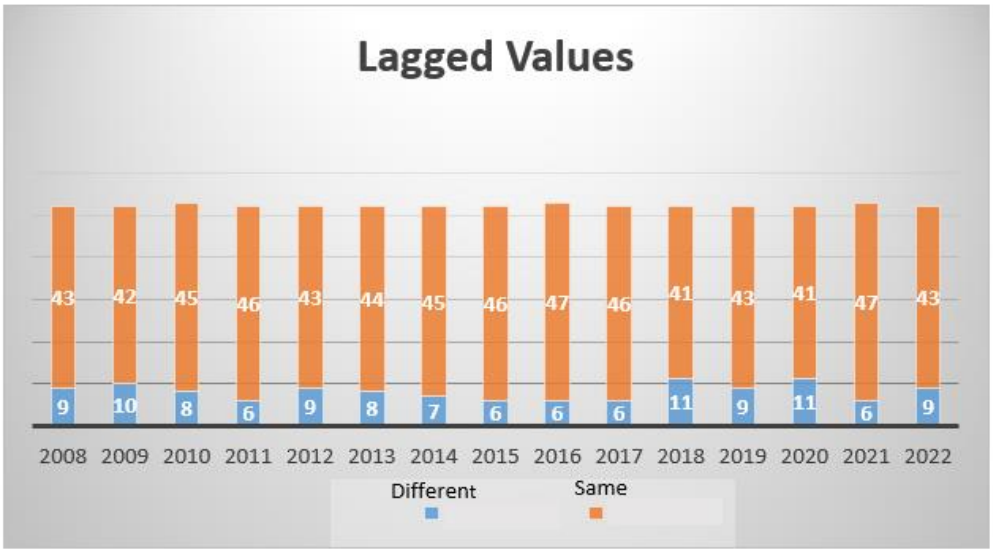

Figure 6. Compliance with the Values of Lagged BIST100 and RISE Index (2008-2023 Period)

Figure 6 shows the compliance with the values of lagged BIST100 index and RISE index. While the compliance of the same week was found to be 48.4%, it was detected at 84.5% when the one-week lagged data of BIST 100 was matched the RISE index. This value could counted as the twice times high. Accordingly, we can assert that lagged values of BIST 100 might better explain the variation on RISE. That provides valuable findings for future studies in forecasting.

5. CONCLUSION

Risk appetite is one of the leading indicators closely monitored by all market participants and institutions, to gain insights and opinions about the state of market. In this study, the predictability of the RISE risk appetite index was attempted using machine learning algorithms instead of econometric models. The weekly values of the RISE risk appetite index, available since 2008, were used until April 2023. The machine learning algorithms were implemented using Python 3 programs.

RISE risk appetite index's next-week value was predicted using two deep learning algorithms, LSTM (Long Short-Term Memory) and MLP (Multilayer Perceptron). To facilitate comparison, Root Mean Square Error (RMSE) was employed. The RMSE value for LSTM was 8.85, while for MLP, it was 9.07. The results indicated that the long short-term memory algorithm had a higher success rate in predicting the RISE risk appetite index's next-week value. In the context of the cointegration relationship between the RISE risk appetite index and BIST 100 index presented by Köycü (2022), and findings on cointegration between lagged values by Özkan (2022), the increase, decrease, and stability of both series were examined. The compliance between the values of the same week was 48.4% while it was obtained 84.5% when used the one-week lagged values of the BIST 100 index and the current value of the RISE index. This result was consistent with Özkan's (2022) finding of cointegration between the variables of two-period lagged values of RISE and one-period lagged values of BIST 100.

In this study, we enrich the existing literature by predicting the RISE risk appetite index employing the machine learning methods. The findings might help to the investors, businesses and researchers for quick investment decision-making in dynamic financial environment. For future studies, researchers are particularly advised to use lagged values related to the BIST 100 index, especially in predicting risk appetite through financial and economic variables. Additionally, it is recommended to reevaluate the predictability of the risk appetite index using different deep learning and machine learning architectures, allowing for the comparison of performance rates.

AUTHORS' DECLARATION:

This paper complies with Research and Publication Ethics, has no conflict of interest to declare, and has received no financial support.

AUTHORS' CONTRIBUTIONS:

Conceptualization, writing-original draft, editing and data collection – **NÖ**, methodology and formal analysis – **NÖY**, Final Approval and Accountability – **NÖ** and **NÖY**.

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Harberger-Laursen-Metzler Hypothesis: An Analysis with ARDL Bounds Test Approach

Harberger-Laursen-Metzler Hipotezi: ARDL Sınır Testi Yaklaşımı ile Bir Analiz

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ABSTRACT

The Harberger, Laursen, and Metzler (HLM) hypothesis posits that a positive (negative) change in terms of trade, ceteris paribus, will lead to positive (negative) movements in the trade balance. When tested on developing countries, the hypothesis yields varying results. Some studies validate the hypothesis, while others suggest it is not applicable. Additionally, causality tests examining long-term relationships also produce different outcomes. Türkiye ranks among the countries with significant trade deficit issues. Therefore, testing the validity of the HLM hypothesis in the context of Türkiye is of great importance. The motivation of this study is to examine the impact of changes in terms of trade on the long-term trade balance in Türkiye from 2013 to 2023. In this context, both the volume and unit value of the terms of trade are considered. According to the findings, there is a positive relationship from terms of trade to the trade balance. Short-term deviations are found to be corrected within approximately three months. The causality test indicates that terms of trade are a Granger cause of the trade balance, and this causality is unidirectional. In this study, Türkiye's terms of trade and trade balance data for the specified periods were meticulously analyzed, and the validity of the HLM hypothesis was carefully tested. The analysis results provide strong evidence supporting the HLM hypothesis. These findings offer significant insights for Türkiye's economy and trade policies.

Anahtar Kelimeler:

Uluslararası Ticaret, Ticaret Hadleri, Ticaret Dengesi, Eşbütünleşme, HLM Hipotezi

Jel Kodları:

F32, F41, E12

ÖZET

Harberger, Laursen ve Metzler (HLM) hipotezi, ticaret hadlerindeki pozitif (negatif) bir değişikliğin, ceteris paribus, ticaret dengesinde pozitif (negatif) hareketlere yol açacağını savunmaktadır. Hipotez, gelişmekte olan ülkeler üzerinde test edildiğinde farklı sonuçlar ortaya koymaktadır. Bazı çalışmalar hipotezi doğrularken, diğerleri geçerli olmadığını öne sürmektedir. Ayrıca, uzun dönemli ilişkileri inceleyen nedensellik testleri de farklı sonuçlar göstermektedir. Türkiye, önemli ticaret açığı sorunları yaşayan ülkeler arasında yer almaktadır. Bu nedenle, hipotezin Türkiye bağlamında geçerliliğinin test edilmesi büyük önem taşımaktadır. Bu çalışmanın motivasyonu, 2013 ile 2023 yılları arasında Türkiye'de ticaret hadlerindeki değişimlerin uzun vadeli ticaret dengesi üzerindeki etkilerini incelemeyi amaçlamaktadır. Bu bağlamda dış ticaret haddi hem miktar hem de birim değer olarak ele alınmıştır. Bulgulara göre, ticaret hadlerinden ticaret dengesine doğru pozitif bir ilişki vardır. Kısa vadeli sapmaların yaklaşık üç ay içinde düzeltildiği tespit edilmiştir. Nedensellik testi, ticaret hadlerinin ticaret dengesinin Granger nedeni olduğunu ve bu nedenselliğin tek yönlü olduğunu göstermektedir. Bu çalışmada, belirtilen dönemler için Türkiye'nin ticaret hadleri ve ticaret dengesi verileri titizlikle analiz edilmiş ve HLM hipotezinin geçerliliği dikkatlice test edilmiştir. Analiz sonuçları, HLM hipotezini destekleyen güçlü kanıtlar sunmaktadır. Bu bulgular, Türkiye ekonomisi ve ticaret politikaları için önemli içgörüler sağlamaktadır.

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1. INTRODUCTION

Many countries, both large and small, have embraced trade liberalization to enhance their economic prosperity, thereby increasing the importance of trade balances in policymaking contexts (Deardorff, 2014). Numerous studies have been conducted to explain changes in trade balances, with the Harberger-Laursen-Metzler (HLM) hypothesis being one of them. The relationship between terms of trade and trade balances constitutes a significant research topic in economic literature. The expectation that positive (negative) changes in the terms of trade of a small open economy will lead, ceteris paribus, to improvements (deteriorations) in its trade balance is known as the HLM hypothesis (Mendoza, 1995). This hypothesis highlights the importance of trade balances in the formulation and implementation of economic policies, as it is believed to have a direct impact on the effectiveness of trade policies. Thus, understanding the effects of changes in terms of trade on trade balances is crucial for successful economic policy formulation.

It is noteworthy that the results of testing the HLM hypothesis in developing countries are varied. Some studies validate the hypothesis, while others conclude that it does not hold. Moreover, causality tests examining long-term relationships have also produced differing results. Türkiye is among the countries facing significant trade deficit issues. Therefore, examining whether the HLM hypothesis is valid in Türkiye is crucial. This study aims to analyze the effects of changes in terms of trade on the long-term trade balance in Türkiye between 2013 and 2023. Sudden changes in a country's trade balance, particularly in countries heavily dependent on foreign exchange from exports, can lead to severe balance of payments issues. For example, an adverse shift in the trade balance may exacerbate the trade deficit and disrupt the current account balance. Such situations can increase the need for external borrowing and potentially lead to currency depreciation due to dwindling foreign reserves.

This study is motivated by the need to analyze trade balances as independent variables, considering both volume and unit value. This approach provides a better understanding of the causes and effects of changes in trade balances. Trade volume represents the total amount of trade, while unit value represents the price level of trade. It is essential to determine whether changes in trade balances are driven by volume or price. By addressing these aspects, this study is expected to make a significant contribution to the literature. Understanding the effects of changes in trade balances on long-term trade balances, particularly in a trade-deficit country like Türkiye, can aid in more effective decision-making in both economic policy and international economic relations management. This study offers a new perspective on analyzing trade balances and may enrich the literature and inspire future research.

Research Questions: In this study, the following research questions are formulated to evaluate the relationships between independent and dependent variables: How do changes in the terms of trade affect the trade balance in Türkiye between 2013 and 2023? Are there significant differences in the impacts of trade volume and trade unit value on the trade balance? What are the short-term and long-term effects of changes in the terms of trade on the trade balance? Does the HLM hypothesis hold true for Türkiye during the study period? What are the policy implications of these findings for managing trade deficits and ensuring economic stability in Türkiye?

Limitations of the Study: Time Frame: The period covered by this study (2013-2023) is marked by specific economic and political events. The impact of these specific events (e.g., the 2018 currency crisis) may limit the generalizability of the results to other periods. Model Assumptions: The ARDL model and other econometric methods used in this study operate under certain assumptions. Violations of these assumptions may undermine the validity of the results. If the model assumptions are not met, the reliability of the findings may be compromised. Macroeconomic Factors: This study focuses on the relationship between terms of trade and the trade balance, excluding other macroeconomic factors (e.g., interest rates, exchange rates, political events). The omission of these factors may affect the analysis. Generalizability: The findings of this study, specific to Türkiye, cannot be directly generalized to other countries. The unique economic, political, and social dynamics of Türkiye limit the applicability of the results to other contexts.

Changes in the real effective exchange rate, which more accurately reflects fluctuations in the purchasing power of the Turkish lira, are considered a critical indicator for understanding Türkiye's foreign trade dynamics. Increases in the real effective exchange rate signify a strengthening of the lira, which leads to higher prices of Turkish goods relative to foreign goods. This directly impacts the country's international trade balance and determines the competitive environment between exports and imports. In Türkiye, the real effective exchange rate has shown a significant downward trend, particularly since 2017. This trend indicates a decrease in the price of Turkish goods compared to foreign goods and a shift in competitive conditions. Data shows that from early 2018 to early 2020, Türkiye's exports increased, but there was no corresponding rise in unit exports (Appendix 6). This suggests that Turkish goods were sold abroad in higher quantities and at more competitive prices. However,

despite the increase in export quantity, the decrease in unit exports suggests that the developments in the foreign trade balance are more complex. This underscores the necessity of addressing both price and quantity dynamics in Türkiye's foreign trade. Testing the validity of the Harberger-Laursen-Metzler (HLM) hypothesis in Türkiye is therefore of great importance. This hypothesis provides a critical framework for understanding the effects of changes in trade balances on the foreign trade balance. This study represents a step toward understanding these significant economic dynamics and shaping Türkiye's foreign trade strategies.

The next section will offer an extensive discussion of the theoretical framework underpinning the study, along with a review of relevant national and international research. Following this, the data sets and analysis methods will be examined in detail, with an explanation of the econometric methods used and a discussion of the results.

2. THEORETICAL FRAMEWORK AND LITERATURE

HLM Hypothesis, which examines the impact of changes in terms of trade on trade balance and the income-consumption relationship, holds a prominent position in economic literature. The foundations of this hypothesis were laid by the works of Harberger (1950) and Laursen & Metzler (1950). Harberger developed a general model to analyze the interaction between price and income mechanisms in the context of a national currency's depreciation (İyibozkurt, 1975). Meanwhile, the hypothesis advocated by Laursen and Metzler is largely based on Keynes' 'Psychological Law of Consumption'. This law posits a stable relationship between real income and consumption. A sudden change in real income necessitates a reassessment of individuals' future consumption plans and lifetime expenditures. Consequently, barring any unforeseen circumstances, future consumption is expected to remain stable (Obstfeld, 1981).

The significance of this hypothesis lies in its ability to elucidate the effects of changes in terms of trade on the trade balance and the income-consumption relationship. The model assumes two countries, where the depreciation of one country's currency against the other's is considered. In such a scenario, it is assumed that the country with the depreciated local currency will experience an increase in imports, while the second country will see a decrease in its imports. The rise in import prices in the country with the depreciated currency will lead to a decrease in real income. Consequently, the proportion of income spent on goods and services, as well as employment, will increase. This increase in income and employment will drive up the demand for imports. Conversely, in the second country where import demand decreases, the proportion of income spent on goods and services will slightly decline, followed by a reduction in production levels and employment, which will, in turn, reduce import demand. As a result, changes in income in the first country will increase imports while decreasing exports. The ultimate outcome of the local currency depreciation will be a trade deficit (Laursen & Metzler, 1950).

According to the Keynesian income-expenditure approach, budget deficits positively impact production and consumption, thereby increasing national income and subsequently boosting demand for imported goods. The rising demand for imports drives up the prices of imported goods, leading to issues in the trade balance (Keynes, 1936: 263). In the 1980s, under President Ronald Reagan, tax cuts and increased public spending led to significant deficits in the current account balance of the United States. This situation, known as "twin deficits," highlights the relationship between the budget balance and the current account balance, providing a different perspective on their interaction. The relationship is articulated through the equations (1), (2), (3), (4), and (5) (Krugman & Obstfeld, 2003: 300-306). In (1), which is the open economy national income equation;

$$Y = C + I + G + EX - IM \tag{1}$$

In equation (1), Y: National income, C: Private consumption expenditures, I: Private investment expenditures, G: Government expenditures, EX: Export, IM: It means import.

CA=EX-IM is obtained when the CA balance between EX and IM of goods and services is called CA. When equation (1) is rearranged according to this equation, equation (2) is obtained.

$$Y - (C + I + G) = CA \tag{2}$$

In a closed economy, investments are equal to savings, that is (S=I). This equation is shown with the help of equations (3) and (4).

$$S = Y - C - G \tag{3}$$

$$I = Y - C - G \quad (4)$$

When the national income identity for open economies is reconsidered, equation (5) is obtained.

$$S = I + CA \quad (5)$$

Savings are examined in two parts as private and public. Private savings are defined as the part of income that is not consumed, that is, accumulated, and is shown in equation (6).

$$S^p = Y - T - C \quad (6)$$

Public savings, on the other hand, consist of the difference between the state's net tax income (T) and expenditure (G) and is expressed by the half of equation (7).

$$S^g = T - G \quad (7)$$

National savings from the sum of private and public savings are included in equation (8).

$$S = Y - C - G = (Y - T - C) + (T - G) = S^p + S^g \quad (8)$$

When this equation is written with the open economy model, the identity number (9) is reached.

$$S^p = I + CA - S^g = I + CA - (T - G) = I + CA + (G - T) \quad (9)$$

When this equation is rearranged for the twin deficit, it is expressed by equation (10).

$$CA = S^p - I - (G - T) \quad (10)$$

In the above equations; S^p: Private savings,S^g: Public savings, S: National savings, T: Taxes.

The channels of transmission mechanism of the terms of trade are expressed with the help of Figure 1 below.

Table 1 below summarizes the studies in the national and international literature.

Table 1. Review of Literature

Author(s)	Timespan	Method	Findings
Otto (2003)	1963 – 1997	SVAR	HLM Hypothesis is valid.
Yamak & Korkmaz (2006)	1991: Q4 – 2003: Q3	Granger Causality – Hsiao Causality	HLM Hypothesis is invalid in the Türkiye.
Mitzal (2010)	1995–2009	VAR	The prevalence of the HLM effect in Poland has been confirmed.
Oktar & Dalyancı (2012)	2004: M01 – 2011: M11	VAR and Cointegration	HLM Hypothesis is valid in the Türkiye.
Aquino & Espino (2013)	1950–2019	VAR	HLM Hypothesis is valid.
Küçükaksoy & Çiftçi (2014)	2003: M1– 2014: M4	Cointegration, Causality and VAR	HLM Hypothesis is valid in the Türkiye.
Lukáčik et al. (2016)	1997: Q1– 2014: Q4	VAR and SVAR	HLM Hypothesis is not valid in the Slovak economy.
Tekgül (2017)	1982: Q1– 2015: Q2	ARDL–Causality	HLM Hypothesis is valid in the Türkiye.
Okyay & Unal (2018)	2005: M1– 2017: M4	Cointegration and Causality	HLM Hypothesis is valid in the Türkiye.
Murshed (2018)	2000 – 2016	Panel Cointegration, VECM and Granger Causality	There is a non-linear relationship between terms of trade and current account movements.
Strojny (2019)	2002 – 2017	VAR	HLM Hypothesis is valid.

Ayad & Belmokaddem (2019)	1990 – 2017	Cointegration and Causality	There is no co-integration or causality.
Hicham (2019)	2000 – 2017	Cointegration and Causality	There is no evidence of HLM effect.
Shafiullah, Islam, & Navaratnam (2020)	1980 – 2015	Cointegration and Granger (non-) causality	HLM Hypothesis is valid.
Akbulut-Bekar (2021)	1987 – 2018	Cointegration and Causality	HLM Hypothesis is valid in the Türkiye.
Khan & Pradhan (2022)	1981– 2018	ARDL	HLM Hypothesis is valid in Bangladesh
Singh (2023)	1950– 2018	ARDL and ECM	The terms of Trade, financial development, trade openness, and domestic investment have positive and significant long-run effects on economic growth.
Trofimov & Aris (2024)	1980–2018	Panel Cointegration, ARDL and VAR	The findings support the positive effects of exports on savings in a specific period and across regions. Therefore, the hypothesis is valid under certain conditions.

Haynes & Stone (1982) revisited the M-S evidence and found that the deterioration in the terms of trade during the period 1955-1974 did not lead to an improvement in the US trade balance. Building on this, subsequent studies by Backus et al. (1994), Mendoza (1995), and Kouassi (1997) attempted to elucidate the Harberger-Laursen-Metzler (HLM) hypothesis, examining how it interacts with the foreign trade structure and technology, regardless of the duration of shocks, be they short-term or sustained.

Research conducted on both developed and developing countries, as demonstrated by Masson et al. (1998), has yielded nuanced findings, suggesting that the relationship between the terms of trade and the balance of trade varies across different national contexts. For instance, Panal VAR analysis conducted by Masson et al. (1998) for industrialized countries spanning the period 1971-1993, and developing countries from 1982 to 1993, revealed that while the HLM hypothesis holds true for industrialized nations, it does not exert a significant influence on the trade dynamics of developing countries.

Adler et al., (2018) made a different contribution to the literature by discussing the periods 1960-2015 in their study published in 2018. The focus of the discussion, which started with the assumption that the rise in exchange rates will create a strong buffer effect, has recently started a discussion on how the fall in commodity prices has created a shock effect on the terms of trade and what effect this effect has on the economy. In their studies, the focus of the study is on the questions that the fluctuation in the terms of trade will cause a noticeable reaction in the current accounts of commodity exporters and importers, but that price differences can be balanced by quantity adjustment and this will bring a limitation in the current account.

According to the empirical findings reached by the use of modern time series techniques, the terms of trade and the balance of trade gave different results in each country.

The literature review summarizes a range of studies analyzing the Harberger-Laursen-Metzler (HLM) hypothesis and its validity across different contexts. Key findings from the literature are:

2.1. Validation of HLM Hypothesis

Several studies confirm the validity of the HLM hypothesis in various countries and contexts, including Türkiye (Oktar & Dalyancı, 2012; Tekgül, 2017; Okyay & Unal, 2018; Akbulut-Bekar, 2021), Bangladesh (Khan & Pradhan, 2022), and Poland (Mitzal, 2010). Contradictions and Limitations: Some studies, such as those by Lukáčik et al. (2016) and Hicham (2019), find the HLM hypothesis invalid in specific economies or contexts, suggesting that its applicability may vary. Effect of Terms of Trade: Other studies highlight a nuanced relationship between terms of trade and economic indicators. For instance, Murshed (2018) identifies a non-linear relationship between terms of trade and current account movements, while Singh (2023) confirms positive long-term effects of terms of trade, financial development, trade openness, and domestic investment on economic growth. Sector-Specific and Regional Insights: Trofimov & Aris (2024) find that exports positively affect savings under certain conditions, pointing to a more conditional validation of the HLM hypothesis. Methodological Approaches:

Various methodologies, including VAR, SVAR, ARDL, and cointegration techniques, are employed to test the HLM hypothesis, with differing results depending on the approach and sample period.

2.2. Differences from Previous Studies and Literature Gaps

Differences from Previous Studies: Contextual Focus: This study specifically examines Türkiye's trade balance from 2013 to 2023, considering both the volume and unit value of terms of trade. This focused approach helps address the significant trade deficit issues faced by Türkiye, providing new insights into how terms of trade impact long-term trade balance. Unidirectional Causality: The study finds that terms of trade are a Granger cause of the trade balance, with short-term deviations corrected within approximately three months. This provides a clearer understanding of the causality direction in Türkiye, which may differ from findings in other countries.

Literature Gaps: Sector-Specific Analysis: Previous studies often provide broad findings or focus on aggregate indices of terms of trade. This study's consideration of both the volume and unit value of terms of trade may address gaps in sector-specific analysis and offer more detailed insights into how these factors influence the trade balance. Long-Term Dynamics: Many studies focus on shorter time periods or specific structural breaks. This study's extended time frame (2013-2023) and focus on Türkiye's trade deficit issues provide valuable long-term insights that are not fully explored in existing literature.

In summary, this study extends the understanding of the HLM hypothesis by focusing on Türkiye's recent economic context, examining the specific impacts of terms of trade on the trade balance, and addressing gaps in sector-specific and long-term analysis.

3. ECONOMETRIC METHOD AND DATA

ARDL model has short-term and long-term dynamics (Moosa, 2017). Pesaran et al. (2001) the ARDL Model consists of 3 stages. Unconstrained ARDL Model Pesaran & Shin (1999) and Pesaran et al. According to (2001) it is as in the following equation.

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{m} \delta_i \Delta X_{t-i} + \varphi_1 Y_{t-1} + \varphi_2 X_{t-1} + u_t \quad (11)$$

In the equation (11), the long-run coefficients are: φ_1, φ_2; short-run coefficients: β_i , δ_i; error (White noise) term: expressed as u_t. Hypotheses for testing the cointegration relationship:

$H_0 = \beta_0 = \beta_1 = 0$ There is no cointegration.

$H_1 \neq \beta_0 \neq \beta_1 \neq 0$ There is cointegration.

If the existence of cointegration is proven as a result of the established ARDL model, long-term analysis can be started for the variables, which is the second stage. Then, the direction and elasticity of the relationship between the variables are determined by estimating the long-term and short-term coefficients. The equation (12) created for the Long-Term Analysis:

$$Y_t = \beta_0 + \sum_{i=1}^{m} \beta_i Y_{t-i} + \sum_{i=0}^{m} \delta_i X_{t-i} + u_t \quad (12)$$

After estimating the long-term coefficients, the next step is to estimate the short-term coefficients.

Short-Term Error Correction Model (EC):

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{m} \delta_i \Delta X_{t-i} + \varphi EC_{t-1} + u_t \quad (13)$$

By finding the ARDL error correction coefficient (φ) CointEq(-1), it will be examined how many of the short-term shocks in the independent variable will stabilize in the long-term. The coefficient is expected to be negative and statistically significant.

If the existence of cointegration is proven, causality analysis is performed to predict the direction of the variables. This confirms that when two or more time series are integrated together, there must be bidirectional or unidirectional Granger causality between them (Awe, 2012).

According to Granger (1969), given the two-time series variables X_t and Y_t, X_t can be compared to Y_t if $Y_t$can be better predicted using the historical values of both X_t and Y_t than using only the past values of Y_t. It is said to

cause. The economic indicators chosen as the subject of the research were modeled as in the equations below using Pairwise-Granger causality analysis as suggested by Granger (1969).

$$Y_t = \sum_{i=1}^{m} a_i Y_{t-i} + \sum_{i=1}^{m} b_i X_{t-i} + u_{1t} \quad (14)$$

$$X_t = \sum_{i=1}^{m} c_i X_{t-i} + \sum_{i=1}^{m} d_i Y_{t-i} + u_{2t} \quad (15)$$

Granger Causality Analysis: a_i, b_i, c_i, d_i: delay coefficients, m: common delay degree for all variables, u_{1t} , u_{2t}: uncorrelated white noise processes (Granger, 1969:431).

The hypotheses tested are listed below:

H_0: Variable DTD is not Granger cause of variable DTH.

H_1: DTH variable is the Granger cause of DTD variable.

The data obtained for analysis are as follows:

Table 2. Explicit and Implicit Representation of Variables

DTH_b	Terms of Trade (Unit Value) 2013:M1-2023:M3	TURKSTAT
DTH_m	Terms of Trade (Volume) 2013:M1-2023:M3	TURKSTAT
DTD	Balance of Trade (Goods Trade Balance) 2013:M1-2023:M3	CBRT, EDVS

Export and import quantity and unit indices were obtained as monthly data from TURKSTAT, adjusted for seasonal and calendar effects. DTH amount as the ratio of export amount (prices) to import amount (prices); DTHm = $(Pxt / Pmt) * 100$ and DTH units; It was obtained as DTHb= $(Pxt / Pmt) * 100$. Balance of Trade: Goods Trade Balance (Million USD)-Level was obtained from EDDS (Electronic Data Distribution System). Eviews 10. The program seasonally adjusted with Tramo/Seats method (seasonal adjust (_SA).

The chosen time frame (2013-2023) was selected due to the significant changes that occurred in the Turkish economy and trade balance during this period. Various economic and political events that influenced Türkiye's trade terms and trade balance took place during this time. The reasons for selecting this time frame are outlined below:

Global Economic Conditions: Changes in global economic conditions after 2013 had significant impacts on the trade balances of developing countries. The global economic fluctuations during this period also affected Türkiye's external trade balance. Another reason for starting the analysis from 2013 is the impact of the Federal Reserve's initiation of the quantitative easing process on exchange rates. Additionally, the effects of the 2008 financial crisis had begun to wane by this period. Changes in the Turkish Economy: The period from 2013 to 2023 saw substantial structural changes and economic policies implemented in the Turkish economy. These changes have been decisive for the trade balance and trade terms. In particular, the currency crises and economic fluctuations starting from 2018 directly impacted Türkiye's external trade balance. Data Access and Timeliness: The accessibility and currency of data from the 2013-2023 period are crucial for the reliability of the analysis. The availability of adequate and current data for this period enhances the accuracy and reliability of the study.

For these reasons, the period from 2013 to 2023 was chosen as a suitable timeframe to examine the effects on Türkiye's trade terms and trade balance. The economic, political, and structural changes during this period will enrich the study's findings and provide more meaningful results.

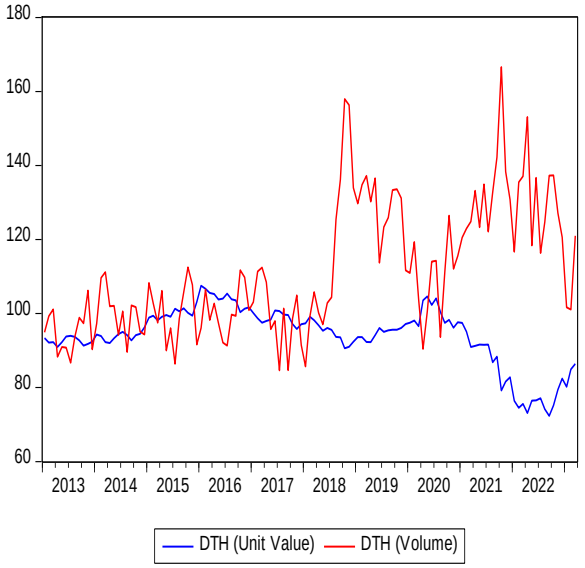

Figure 1. Time Path Chart of Terms of Trade 2013:M1-2023:M3

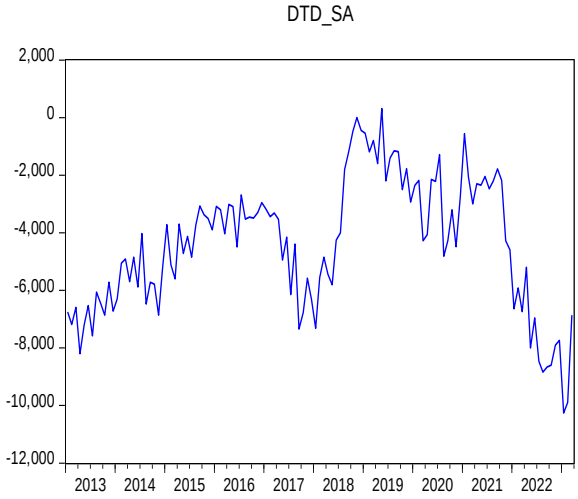

Figure 2. Balance of Trade ((Balance of Goods - Million USD)-Level) Seasonally Adjusted. 2013:M1-2023:M3.

As can be seen much more clearly from Figures 1 and 2, Türkiye exported more goods from the 2nd month of 2018 to the 3rd month of 2020. However, the same increase was not experienced in unit exports, on the contrary, there was a decrease. Later, this gap between the two data continued from the 8th month of 2020 to the 3rd month of 2023. Other conditions being equal, as long as the increase in export prices is less than the increase in import prices, the terms of trade will develop against the country. This difference between the two data means that goods are sold abroad both more and cheaper than before.

The estimated regression model (16) for the analysis is as follows:

Model $$DTD_t = \alpha_0 + \beta_0\, DTHm_t + \beta_1\, DTHb_t + \varepsilon_t \quad (16)$$

In the equation (16), the dependent variable in the Model, DTD_t; balance of trade, $DTHm_t$; terms of trade (volume), $DTHb_t$; terms of trade (unit), α; constant parameter, β; coefficient in front of the independent variables, ε_t; error term, t; shows the time. In the next section, the results of the analysis will be given.

Table 3. Summary Statistics

	DTD	DTHm	DTHb
Mean	-4390.572	111.2103	94.12791
Median	-4257.737	106.1994	95.44824
Maximum	316.4907	166.5848	107.5022
Minimum	-10262.22	84.64206	72.33722
Std. Dev.	2279.247	17.59797	7.882129
Skewness	-0.206849	0.744042	-1.074650
Kurtosis	2.447004	2.964583	3.795103
Jarque-Bera	2.444368	11.35520	26.91487
Probability	0.294586	0.003422	0.000001
Sum	-540040.3	13678.87	11577.73
Sum Sq. Dev.	6.34E+08	37782.00	7579.611
Observations	123	123	123

To summarize Table 3: Balance of Trade (DTH): Mean: The average trade balance is -4390.572, indicating a persistent trade deficit over the period. Median: The median value of -4257.737 is close to the mean, suggesting that the distribution of trade balance values is relatively symmetric around the mean. Maximum/Minimum: The range between the maximum (316.4907) and minimum (-10262.22) values highlights the substantial volatility in the trade balance. Std. Dev.: The standard deviation of 2279.247 indicates significant variability in the trade balance. Skewness: The negative skewness (-0.206849) suggests a slight leftward skew, indicating that extreme

negative values are more common. Kurtosis: The kurtosis value of 2.447004 is close to 3, indicating a distribution with tails that are somewhat heavier than the normal distribution. Jarque-Bera Test: The probability value of 0.294586 suggests that the distribution of trade balance values does not significantly deviate from normality.

Terms of Trade (DTHm): Mean: The average terms of trade is 111.2103, reflecting the average price level of DTHm over the period. Median: The median value of 106.1994 is close to the mean, indicating a relatively symmetric distribution. Maximum/Minimum: The range between the maximum (166.5848) and minimum (84.64206) values shows the variability in import prices. Std. Dev.: The standard deviation of 17.59797 indicates moderate variability in DTHm. Skewness: The positive skewness (0.744042) indicates a rightward skew, suggesting that higher values of terms of trade are more common. Kurtosis: The kurtosis value of 2.964583 is slightly below 3, indicating that the distribution has slightly lighter tails than the normal distribution. Jarque-Bera Test: The probability value of 0.003422 indicates that the distribution of terms of trade significantly deviates from normality.

Terms of Trade (DTHb): Mean: The average export terms of trade is 94.12791, reflecting the average price level of DTHb over the period. Median: The median value of 95.44824 is close to the mean, suggesting a symmetric distribution around the mean. Maximum/Minimum: The range between the maximum (107.5022) and minimum (72.33722) values shows variability in DTHb. Std. Dev.: The standard deviation of 7.882129 indicates relatively low variability in export terms. Skewness: The negative skewness (-1.074650) indicates a leftward skew, suggesting that lower values of terms of trade are more common. Kurtosis: The kurtosis value of 3.795103 indicates heavier tails compared to the normal distribution. Jarque-Bera Test: The probability value of 0.000001 suggests that the distribution of terms of trade significantly deviates from normality.

Overall, the statistics reveal significant volatility and non-normal distributions for the trade balance and terms of trade measures, highlighting the need for further analysis to understand the underlying factors driving these variations.

Table 4. Correlation Matrix

	DTD	**DTHm**	**DTHb**
DTD	1	0.432146540919098	0.4406799816838101
DTHm	0.432146540919098	1	-0.5591462188464253
DTHb	0.4406799816838101	-0.5591462188464253	1

According to Table 4, DTD and DTHm: Correlation Coefficient: 0.4321. There is a moderate positive correlation between the DTD and DTHm. This suggests that as the DTHm increases, the balance of trade tends to improve, indicating a possible relationship where higher trade volumes are associated with better balances of trade.

DTD and DTHb: Correlation Coefficient: 0.4407. There is a moderate positive correlation between the DTD and DTHb. This implies that as the DTHb increases, the DTD also tends to improve. Similar to the previous correlation, this suggests that higher trade volumes (in unit terms) are linked with better trade balances.

Summary from the table, the balance of trade has a positive relationship with both measures of trade volume, indicating that improvements in trade volume are associated with better trade balances. These insights can help understand how changes in trade volume and unit values impact the trade balance and highlight areas for further investigation into the dynamics of trade volumes and their effects on economic indicators.

4. FINDINGS

For the analysis of the effect of terms of trade on the balance of trade for the economy of Türkiye between 2013:M1-2023:M3 periods, ARDL, autoregressive distributed lag, developed by Peseran et al., (2001), was applied. When the F statistical value calculated according to the ARDL Bounds test result is found to be less than the lower limit of the significance levels, H0 cannot be rejected, that is, there is no cointegration relationship; If the calculated F statistical value is greater than the upper limit of the significance levels, the alternative hypothesis is valid and we will have sufficient evidence to reject H0. Hypotheses for testing the cointegration relationship (Peseran et al., 2001):

$H_0 = \beta_1 = \beta_2 = 0$ There is no cointegration.

$H_1 \neq \beta_1 \neq \beta_2 \neq 0$ There is cointegration.

The econometric analysis was first started by performing unit root tests of the series. PP and ADF unit root tests were used for unit root testing. The Schwarz Information Criterion (SIC) was chosen for the test. Unit root results are given in Appendix 1.

According to the PP unit root analysis, the balance of trade is stationary at 10% and the terms of trade (unit) at 5%. The terms of trade (volume), on the other hand, contain a unit root at the level and are nonstationary, since the probability value of the t-statistics value is seen above the critical value of 0.10. When we look at the ADF unit root analysis, the level does not contain a unit root, since only the terms of trade (volume) probability value are seen below the critical value of 1%. Other variables are nonstationary at the level.

For the ARDL Model, the dependent variable must be I(1), and the explanatory variables must be I(0) or I(1). Unit Root Test results show that the data is suitable for the ARDL Model.

Model selection criteria are given in Figure 3 below.

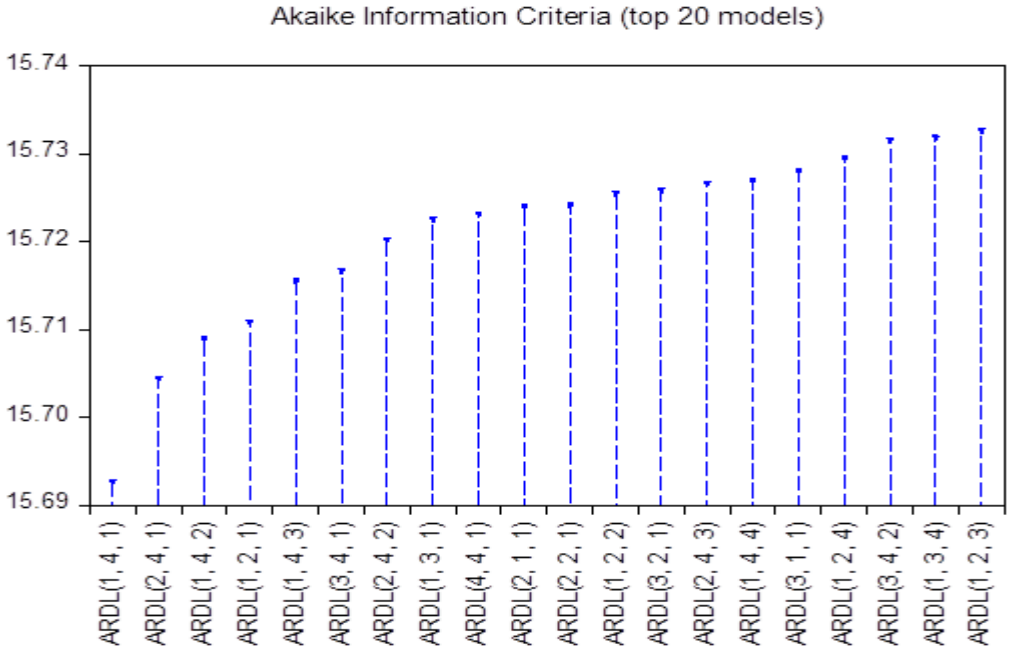

Figure 3. Model Selection Criteria

According to Figure 3, it was decided that the best model was ARDL (1,4,1). If the obtained F-statistic value is greater than the critical upper bound, it provides sufficient evidence for the existence of a co-integration relationship, leading to the rejection of the null hypothesis (H0). Conversely, if the F-statistic value is smaller than the critical lower bound, it indicates insufficient evidence for a co-integration relationship, resulting in the acceptance of the null hypothesis. In such cases, it is necessary to consider additional cointegration tests to verify the accuracy of the results (Peseran et al., 2001). This approach ensures a proper evaluation of the relationship among variables and enhances the reliability of the econometric model. The results of the bounds test related to the analysis are presented in Appendix 2. According to the data obtained from the table, the F-statistic has reached a value greater than the critical upper bound (6.172852). Table 5 provides the long-term coefficients derived from the analysis.

Table 5. ARDL (1,4,1) Model Long-Term Results

Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DTHm	140.9424	13.01868	10.82617	0.0000
DTHb	316.2277	25.32647	12.48605	0.0000
C	-49840.20	3496.521	-14.25422	0.0000
EC = DTD- (140.9424*DTHm + 316.2277*DTHb-49840.1973)				

According to the long-term results of the ARDL model, it has been determined that changes in the terms of trade have a positive and statistically significant effect on the trade balance. A one-unit increase in DTHm results in an average increase of $140,942 in the trade balance. Similarly, a one-unit increase in DTHb results in an average increase of $316,227 in the trade balance. The calculation of terms of trade based on both unit value and volume indicates that these results are based on a more robust and comprehensive analysis. These findings play a crucial role in shaping Türkiye's foreign trade policies and economic objectives.

The error correction model (ECM) is estimated in Table 6.

Table 6. ARDL (1,4,1) Model ECM

Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DTHm)	97.50568	5.469339	17.82769	0.0000
D(DTHm(-1))	-12.83866	5.634399	-2.278622	0.0246
D(DTHm(-2))	0.958215	5.563591	0.172230	0.8636
D(DTHm(-3))	12.84788	5.358170	2.397811	0.0182
D(DTHb)	235.9227	27.91643	8.451033	0.0000
CointEq(-1)*	-0.360766	0.071632	-5.036349	0.0000

*R- squared: 0.773308, Adjusted R-squared: 0.763277, Durbin-Watson stat: 2.116605, BG Serial Correlation LM Test: 0.792586 (F(2.108) probe: 0.4553), JB Normality Test: 0.318397 (0.852827), Heteroskedasticity test: BPG: 0.625389 (F(8,110) probe: 0.7549). * p-value incompatible with t-Bounds distribution.*

Tables summarizing ECM regression and F-Bounds Test and the diagnostic tests are presented in Appendices 3, 4, and 5. According to Appendix 4, there is no evidence of serial autocorrelation in the residuals. Appendix 5 indicates that there is no heteroscedasticity problem in the estimated model (p>0.01).

According to Table 6 above, there is a short-term relationship between the variables. According to CointEq(-1) value, the convergence process of short-term deviations to long-term value: $\frac{1}{\text{CointEq}(-1)} = 2.77$ It takes about three months (period). Therefore, an improvement in the terms of trade in Türkiye during the mentioned period causes an improvement in the balance of trade within three months. CUSUM and CUSUMSQ tests were used to test the stability of the ARDL (1,4,1) model and whether there is a periodic structural break in the variables.

Structural break tests for the ARDL (1,4,1) model:

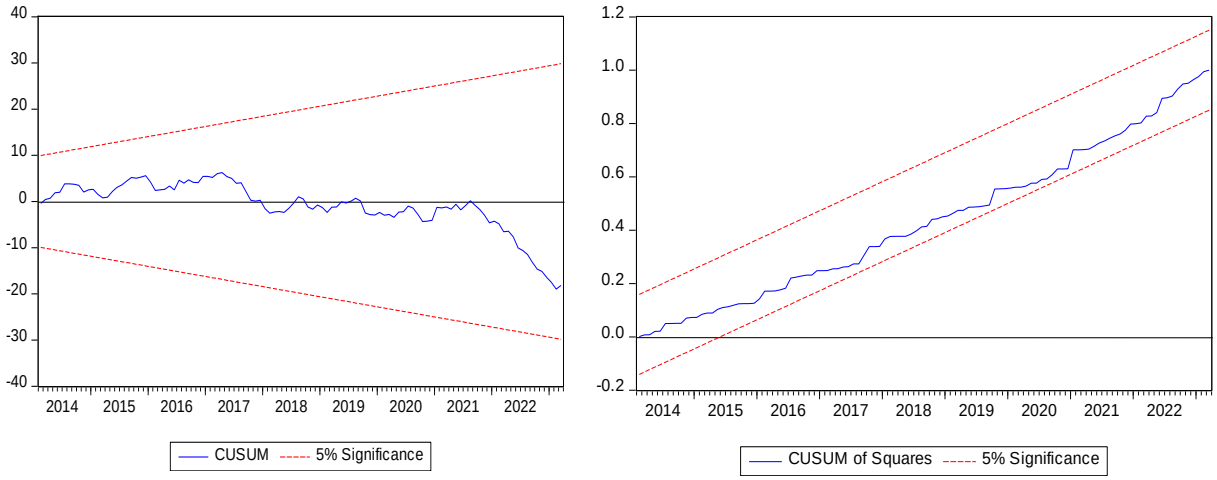

Figure 4. Charts of ARDL (1,4,1) CUSUM and CUSUMSQ

Figure 4. As a result of the CUSUM and CUSUMSQ tests, we cannot talk about the structural break problem as there is no deviation from the 5% range in both graphs except the specified areas. The model has been found to be consistent and statistically significant.

The causality test, which was introduced by Granger (1969) and later developed by Sims (1972), is based on the basic principle that "the use of past values of one variable increases the predictive performance of the other variable". The causality test results are given in Table 7.

Table 7. Pairwise Granger Causality Tests

Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
DTHm does not Granger Cause DTD	122	5.43438	0.0214
DTD does not Granger Cause DTHm		0.03505	0.8518
DTHb does not Granger Cause DTD	122	4.64824	0.0331
DTD does not Granger Cause DTHb		2.27033	0.1345

As a result of the causality test performed to test the causality relationship between the variables, it was understood that the terms of trade were the Granger cause of the balance of trade. Specifically, the analysis unveiled a positive and unidirectional causality, indicating that changes in the terms of trade significantly influenced the balance of

trade DTH→DTD. Thus, our findings furnish compelling evidence to reject the null hypothesis H_0, which posits the absence of a causality effect.

5. CONCLUSION

According to the empirical findings reached by the use of modern time series techniques, the terms of trade and the balance of trade gave different results in each country. The motivation of this study is to consider trade balances as independent variables in terms of both volume and unit value. Because this helps us better understand the causes and effects of changes in trade balances. The aim of the study is to analyze the effect of the changes in the terms of trade in Türkiye between the years 2013-2023 on the long-term balance of trade.

In this study, answers were sought to the following questions: How do changes in the terms of trade affect the trade balance in Türkiye between 2013 and 2023? Are there significant differences in the impacts of trade volume and trade unit value on the trade balance? What are the short-term and long-term effects of changes in the terms of trade on the trade balance? Does the HLM hypothesis hold true for Türkiye during the study period? What are the policy implications of these findings for managing trade deficits and ensuring economic stability in Türkiye?

Time Frame: The period covered by this study (2013-2023) is marked by specific economic and political events. The impact of these specific events (e.g., the 2018 currency crisis) may limit the generalizability of the results to other periods. The reason for starting the analysis from 2013 is the impact of the Federal Reserve's initiation of the quantitative easing process on exchange rates. Additionally, the effects of the 2008 financial crisis have also been ignored. Model Assumptions: The ARDL model and other econometric methods used in this study operate under certain assumptions. Violations of these assumptions may undermine the validity of the results. If the model assumptions are not met, the reliability of the findings may be compromised. Macroeconomic Factors: This study focuses on the relationship between terms of trade and the trade balance, excluding other macroeconomic factors (e.g., interest rates, exchange rates, political events). The omission of these factors may affect the analysis. Generalizability: The findings of this study, specific to Türkiye, cannot be directly generalized to other countries. The unique economic, political, and social dynamics of Türkiye limit the applicability of the results to other contexts.

Except for the terms of trade (volume) series, it has been proven that the other variables are stationary in difference according to the PP and ADF unit root tests. Accordingly, the ARDL model was the most suitable model for the analysis. According to the results of the analysis, the cointegration relationship has been proven. The long-run coefficients show us that a rise in the terms of trade (volume) will lead to a rise of $140,942 on the dependent variable. Similarly, a rise in the terms of trade (unit) will lead to a rise of about $316,227 in the dependent variable. Therefore, an effect of more than twice of DTHm (volume) increase comes from DTHb (unit). Calculating the terms of trade over unit value and volume has been important in this respect. In the economy of Türkiye, more goods were exported from the 2nd month of 2018 to the 3rd month of 2020 compared to the previous data time. However, the same increase was not experienced in unit exports, on the contrary, there was a decrease. Then, according to Figure 1, this gap between the two data continued from the 8th month of 2020 to the 3rd month of 2023. This difference between the two data means that export goods are sold abroad both more and cheaper than in the previous period.

According to the ECM, short-term fluctuations come to equilibrium in the long run. Therefore, the upswing in the terms of trade in the specified periods causes an upswing in the trade balance within three months. As a result of the causality test, it is understood that the terms of trade are the Granger cause of the balance of trade. Causality was found to be positive and unidirectional. There is evidence showing that the HLM hypothesis is accepted in the economy of Türkiye for the periods mentioned in this study. The findings of the study are supported by existing literature. For instance, Otto (2003), Strojny (2019), and Aquino & Espino (2013) provide support for the findings. Additionally, Oktar & Dalyancı (2012), Okyay & Unal (2018), Tekgül, (2017), and Akbulut-Bekar, (2021) indicate the validity of the HLM hypothesis in Türkiye. These results contribute significantly to understanding the dynamics of foreign trade and economic relations in Türkiye.

As a policy recommendation, long-term improvements in the balance of trade can be achieved through the expansion of foreign trade and high-value-added products. In addition, it is of great importance to preserve the value of the Lira and keep inflation under control in order to prevent deteriorations in the balance of trade. Future studies can explore the impact of terms of trade on the trade balance in more detail by examining specific sectors (agriculture, industry, and services). Additionally, more comprehensive time series analyses can be conducted to understand the changing dynamics of this relationship across different periods and under varying economic

conditions. Furthermore, there is a need for in-depth studies that assess the effects of policy recommendations, such as the expansion of foreign trade and the trade of high-value-added products, for policymakers.

AUTHORS' DECLARATION:

This paper complies with Research and Publication Ethics, has no conflict of interest to declare, and has received no financial support.

AUTHORS' CONTRIBUTIONS:

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APPENDİX

Appendix 1. Results of Unit Root

UNIT ROOT TEST TABLE (PP)				
		At Level		
		DTD	DTHb	DTHm
With Constant	t-Statistic	-2.6996	-1.2731	-3.4363
	Prob.	0.0770	0.6405	0.0115
		*	n0	**
With Constant & Trend	t-Statistic	-2.5911	-1.8924	-5.0044
	Prob.	0.2852	0.6524	0.0004
		n0	n0	***
Without Constant & Trend	t-Statistic	-1.0832	-0.4159	0.1407
	Prob.	0.2512	0.5316	0.7250
		n0	n0	n0
		At First Difference		
		d(DTD)	d(DTHb)	d(DTHm)

With Constant	t-Statistic	-16.6082	-11.2496	-23.2831
	Prob.	0.0000	0.0000	0.0000
		***	***	***
With Constant & Trend	t-Statistic	-16.2739	-11.2553	-24.2371
	Prob.	0.0000	0.0000	0.0000
		***	***	***
Without Constant & Trend	t-Statistic	-16.6834	-11.2914	-22.6286
	Prob.	0.0000	0.0000	0.0000
		***	***	***

UNIT ROOT TEST TABLE (ADF)

		At Level		
		DTD	DTHb	DTHm
With Constant	t-Statistic	-1.9380	-1.2965	-3.7730
	Prob.	0.3140	0.6298	0.0041
		n0	n0	***
With Constant & Trend	t-Statistic	-1.7717	-1.8976	-5.1086
	Prob.	0.7125	0.6497	0.0003
		n0	n0	***
Without Constant & Trend	t-Statistic	-0.7926	-0.4102	0.0480
	Prob.	0.3708	0.5338	0.6962
		n0	n0	n0
		At First Difference		
		d(DTD)	d(DTHb)	d(DTHm)
With Constant	t-Statistic	-15.9754	-11.2423	-9.6181
	Prob.	0.0000	0.0000	0.0000
		***	***	***
With Constant & Trend	t-Statistic	-16.0440	-11.2478	-9.5904
	Prob.	0.0000	0.0000	0.0000
		***	***	***
Without Constant & Trend	t-Statistic	-16.0444	-11.2839	-9.6504
	Prob.	0.0000	0.0000	0.0000
		***	***	***

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant

*MacKinnon (1996) one-sided p-values.

Appendix 2. Bounds Test

F-Bounds Test		**Null Hypothesis: No levels relationship**		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	6.172852	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5
Actual Sample Size	119		Finite Sample: n=80	
		10%	2.713	3.453
		5%	3.235	4.053
		1%	4.358	5.393

Appendix 3. ECM Regression and F-Bounds Test

ECM			
R-squared	0.773308	Mean dependent var	11.28261
Adjusted R-squared	0.763277	S.D. dependent var	1209.606
S.E. of regression	588.5233	Akaike info criterion	15.64221
Sum squared resid	39138639	Schwarz criterion	15.78234
Log likelihood	-924.7118	Hannan-Quinn criter.	15.69911
Durbin-Watson stat	2.116605		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.172852	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

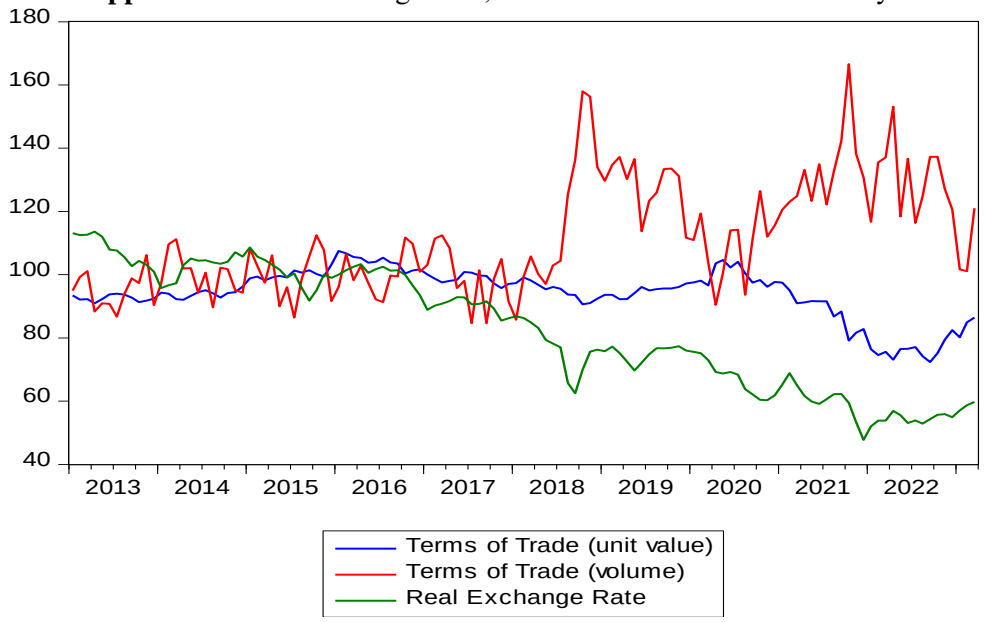
Appendix 4. Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.792586	Prob. F(2,108)	0.4553
Obs*R-squared	1.721360	Prob. Chi-Square(2)	0.4229

Appendix 5. Heteroskedasticity Test: Breusch-Pagan-Godfrey

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.625389	Prob. F(8,110)	0.7549
Obs*R-squared	5.176995	Prob. Chi-Square(8)	0.7385
Scaled explained SS	4.091795	Prob. Chi-Square(8)	0.8487

Appendix 6. Real Exchange Rate, and Terms of Trade in the Türkiye



Source: TURKSTAT, CBRT

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An Investigation of the Predictors of Credit Risk Among Ghanaian Rural and Community Banks

Gana Kırsal ve Topluluk Bankaları Arasındaki Kredi Riskinin Belirleyicilerinin İncelenmesi

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ABSTRACT

Non-performing loans (NPLs) have attracted a lot of academic attention in recent times due to the devastating effects of credit risk on banks. This study investigated the predictors of credit risk in rural and community banks (RCBs), and the effects of rural banking in the Ashanti Region of Ghana. The study examined the correlation between credit risk as the dependent factor and a set of 8 systemic and nonsystemic factors of credit risk as independent variables. The systemic variables were GDP growth rate, interest rate, inflation rate and unemployment rate. The nonsystemic factors analyzed were branch network, total assets, return on assets and capital adequacy ratio. Secondary data was collected from 15 RCBs which were selected through purposive sampling, stratified random sampling and simple random sampling. The dataset ranged from the year 2008 to 2017. The study found that return on assets, branch network and size (total assets) were the significant unsystemic predictors of credit risk whilst interest rate, inflation and unemployment were the significant systemic predictors of credit risk in RCBs in Ghana. Furthermore, the study revealed that RCBs have had a considerable positive impact on the communities where they operated. Managers of RCBs must consider pursuing a strategy of branch expansion and improving the efficiency of staff because of the moderating effects of these factors on credit risk.

Anahtar Kelimeler:

Kredi Riski,

Kırsal ve Topluluk Bankaları,

Şube Ağı

Jel Kodları:

G21, G33

ÖZET

Son dönemde, kredi riskinin bankalar üzerindeki yıkıcı etkileri nedeniyle, geri ödenmeyen krediler (NPL'ler) akademik ilginin odağı haline gelmiştir. Bu çalışma, Gana'nın Ashanti Bölgesi'ndeki kırsal ve topluluk bankalarında kredi riskinin belirleyicilerini ve kırsal bankacılığın etkilerini incelemiştir. Çalışmada, bağımlı değişken olarak kredi riski ile birlikte 8 sistemik ve sistemik olmayan kredi riski faktörü arasındaki ilişki incelenmiştir. Sistemik değişkenler olarak GSYİH büyüme oranı, faiz oranı, enflasyon oranı ve işsizlik oranı ele alınmıştır. Sistemik olmayan faktörler ise şube ağı, toplam varlıklar, varlık getirisi ve sermaye yeterliliği oranı olarak analiz edilmiştir. 2008-2017 yılları arasında, amaçlı örnekleme, tabakalı rastgele örnekleme ve basit rastgele örnekleme yöntemleriyle seçilen 15 RCB'den ikincil veriler toplanmıştır. Çalışmada, varlık getirisi, şube ağı ve büyüklüğün (toplam varlıklar) kredi riskinin önemli sistemik olmayan belirleyicileri olduğu, faiz oranı, enflasyon ve işsizlik oranının ise Gana'daki RCB'lerde kredi riskinin önemli sistemik belirleyicileri olduğu tespit edilmiştir. Ayrıca, RCB'lerin faaliyet gösterdiği topluluklar üzerinde kayda değer olumlu bir etki yarattığı ortaya konmuştur. RCB yöneticileri, bu faktörlerin kredi riski üzerindeki düzenleyici etkileri nedeniyle şube genişletme stratejisini takip etmeyi ve personelin verimliliğini artırmayı düşünmelidir.

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1. INTRODUCTION

Financial institutions across the world play significant roles in financial intermediation which makes credit available from surplus units to deficit units**.** One major consequence of financial intermediation is the granting of credit for which reason the most critical risk faced by banks is credit risk (Mukhtarov et al., 2018) which when mismanaged, could lead to insolvency and collapse of banks of all classifications (Mwinlaaru et al., 2016). Credit (Loan) refers to monetary payments which are enshrined in the contractual agreement in which one party- the borrower- agrees to repay the other party-the lender- at some future date, the principal amount and generally with interest (Owusu-Boateng, 2015). The global financial crises including that of Asia for example have largely been blamed on years of bad lending and excessive risk taken (Tangsupvattana, 2022). According to Amuakwa-Mensah and Boakye-Adjei (2015), credit risk-related bad debts of the world's banking industry got aggravated during the global financial crisis from 2007 to 2008. Indeed, most banking crises for the past two decades were a result of ineffective management of credit risk (Mukhtarov et al., 2018). Though banks face several risks including liquidity risk, operational risk and credit risk (Adusei et al., 2014; Afriyie & Akotey, 2013; Wang, 2013), credit risk has received the most scholarly attention. (Arora, 2014; Berrios, 2013; Jovic, 2017; Nikolaidou & Vogiazas, 2017). This heightened interests in credit risk have several reasons. One reason is that credit risk takes 60% of all risks faced by banks (Bekhet & Eletter, 2014; Garr, 2013; Mpofu & Nikolaidou, 2018; Mukhtarov et al., 2018; Mwinlaaru et al., 2016). As expected, different perspectives of bank credit risk have received reasonable academic attention in the financial literature (Arora, 2014; Han, 2015; Jovic, 2017; Nguyen, 2016; Nguyen, 2014; Nikolaidou & Vogiazas, 2017), including those from Africa and Ghana (Adusei et al., 2014; Afriyie & Akotey, 2013; Appiah, 2015; Garr, 2013; Marouf & Guellil, 2017; Mpofu & Nikolaidou, 2018; Mwinlaaru et al., 2016; Nikolaidou & Vogiazas, 2017; Oheneaku, 2017). Other studies have looked at quality market mechanisms, profitability and uncertainties (Berrios, 2013), the default risks associated with credit (Moges et al., 2013), credit risk measurement (Spuchl'akova et al., 2015), credit risk assessment models (Bekhet & Eletter, 2014), credit risk control (Nguyen, 2014) and the management of credit risk (Han & Bin, 2018).

The likelihood that a borrower will probably not honor the terms of payments as agreed in the loan covenant is termed as credit risk (Adusei et al., 2014; Doung & Houng, 2017; Han & Bin, 2018; Nguyen, 2016). Credit risk is also the possibility that the value of some of the assets of banks, with emphasis on loans will deteriorate and eventually become worthless. This includes the possibility that the expected cash flows from loans, advances and securities in the custody of banks have a lingering likelihood that they may either not be settled at all or they may not be settled in full (Castro, 2013; Garr, 2013). Credit risk or default risk can thus be theorized as a potential loss arising from the inability or failure of the borrower to repay the debt in full in accordance with the agreed terms.

The credit and by implication credit risk has many uses and benefits, though it can also pose considerable threats to banks. Mensah (2019) points out that credit contributes about 85% of the income of banks. In the view of Konovalova et al. (2016), credit risk is used to rate borrowers' credit worthiness, know the acceptable and tolerable level of risk a bank can take, assess the maximum amount of loans a bank can give, assess problematic loans, assist in managing the loan portfolio and prevent recurrence of loan delinquencies. Banks can plan the risk they intend to take in the future depending on the understanding of the portfolio of risks confronting them currently (Owusu-Boateng, 2015).

According to Nguyen (2016), credit risk assists in the classification of loans into performing and non-performing loans (NPLs). As noted by Amoako (2015) non-performing loans generate no revenue within a reasonable length of time, usually 90 days past the due date of settlement. Amoako (2015), again assert that NPLs can further be classified as substandard, other loans especially mentioned (OLEM), doubtful and loss. Such classifications are carried out through effective risk management strategies and proper risk assessment techniques (Afriyie & Akotey, 2013). Kagoyire & Shukla (2016) emphasize the relevance of a well-developed credit risk management system which stabilizes the financial condition of banks and helps enhance the assets and profitability of banks. Attah (2017) assert that banks need to manage risks by identifying, measuring, pricing, monitoring and controlling risk. Clients of rural banks are the most susceptible to co-variant risk, market risk and credit risk; for which reason this process of risk management must be strictly adhered to in rural banks (Attah, 2017).

Owusu-Antwi et al. (2016), define rural banks as single banks owned by indigenes and residence of rural communities through the acquisition of stocks and are accredited to do the business of banking in the communities in which they are established. Similar definitions have been offered by other researchers such as Bannerman & Fu (2018) and Kanthimathinathan (2016) with a common focus on rural development. The focus on rural development has made rural banks an integral part of the financial systems of Ghana and other economies lately. Rural credit in Ghana for instance has been sourced from non-institutional sources such as moneylenders, friends

and relatives. These sources were small and unable to bring any radical development and the desired structural changes in the rural economies. Though institutional credit came from mainstream banks such as the Agricultural Development Bank (ADB), they were inadequate and attracted high interest rates, only a few wealthy individuals had access to the credit. To bridge this gap, rural banks have been established in Ghana since 1976 as unit banks (Akorsu et al., 2015).

The primary functions of rural banks are the mobilization of savings and the extension of credit to rural folks (Owusu-Antwi et al., 2016). Rural banks are also set up to provide cheap credit to small and marginal farmers and artisans, save the rural poor from moneylenders who charge high interest, and ensure the development of entrepreneurial skills in rural dwellers (Bannerman & Fu, 2018). In addition, rural banks serve as catalysts for the inculcation of banking habits in rural dwellers, mobilization of surplus financial resources for rural development and identification of viable enterprises in their catchment areas (Akorsu et al., 2015; Amoako, 2015).

In Ghana, credit risk has received considerable scholarly attention (Adusei et al., 2014; Afriyie & Akotey, 2013; Amuakwa-Mensah & Boakye-Adjei, 2015; Garr, 2013; Oheneaku, 2017; Owusu- Boateng, 2015). Rural banking has also been subjected to significant academic research (Akorsu et al., 2015; Boadi et al., 2016; Boakye, 2015; Manu, 2015; Owusu-Antwi et al., 2016; Owusu-Boateng, 2015). Additionally, researchers such as Adusei et al. (2014), and Amuakwa-Mensah & Boakye-Adjei (2015) have undertaken studies on factors that determine credit risk in mainstream commercial banks in Ghana.

However, these studies present some challenges. Whilst those that studied causes of credit risk tended to concentrate on commercial banks, the rest focused mainly on the management of credit risk in rural banks and were deficient in the identification of factors of credit risk in rural banking (Adusei et al., 2014; Amuakwa-Mensah and Boakye-Agyei, 2015; Boadi et al., 2016; Boakye, 2015; Manu, 2015; Owusu-Boateng, 2015; Oheneaku, 2017). A precise prediction of credit risk has become a difficult venture for rural banks (Kanhukamwe, 2015). The identification of factors of credit risk is critical for any subsequent decision relating to credit risk (Marouf & Guellil, 2017). Additionally, most studies on RCBs in Ghana are generally case studies of few banks since large-scale studies such as this are uncommon (Amoako, 2015). To the best knowledge of the researcher, no study has been undertaken on rural banking in Ghana, that analysed the predictors of credit risk including branch network.

This dearth of scholarly attention has denied the RCBs the opportunity to receive guidance on the factors of credit risk which has resulted in imprudent credit decisions. Consequently, the general capacity to manage credit is impaired resulting in low profitability, low capitalization, low liquidity, poor corporate governance, poor loan recovery, high nonperforming credit portfolios, managerial inefficiencies, decreased staff morale, poor performance, cash flow problems, insolvency, financial distress (Afriyie & Akotey, 2013; Boadi et al., 2016).

As noted by Mukhtarov et al. (2018), NPLs aggravate the liquidity challenges of banks, reduce the net profit of banks, and decrease the image of banks because in the eyes of investors, low profit signifies gross managerial inefficiencies. In 2010, loans and advances in Ghanaian banks grew by 11% from 44.9% in 2008. By the close of 2010, 17.6% of unsettled loans in Ghana were deemed nonperforming and cumulative growth in bad debts reached 77.8% in 2009. The current upsurge in the level of NPLs to 31.1% in April 2018 has led to the collapse of banks and a loss of confidence of the public in the banking sector in Ghana (BOG, 2018).

The Bank of Ghana, (BOG, 2013) indicate that NPLs expressed as a percentage of gross loans for rural banks in Ghana were 11.4%, 18.2%, 16.4% and 13.4% in 2009, 2010, 2011 and 2012 respectively. In April 2017, the share of NPLs in banks was 15.7% (BOG, 2017). Comparing these with the global NPL ratio of 3.2%, Owusu-Boateng, (2015), argues that, the NPL rates associated with rural banking in Ghana are reasonably high and suggestive of ineffective risk management. Collection costs of these bad debts and those related to credit risk management result in high operational costs, making rural banks unprofitable (Boakye, 2015). These costs are usually transferred to clients in the form of high interest rates which make the rural banks unattractive, unprofitable and uncompetitive (Amoako, 2015).

The motivation for this study stems from the critical role that rural and community banks (RCBs) play in promoting financial inclusion and supporting local economies in Ghana. Despite their significance, RCBs often face unique challenges related to credit risk, which can undermine their stability and growth. Understanding the predictors of credit risk specific to RCBs is vital, as it equips these institutions with the knowledge needed to make informed lending decisions, improve risk management practices, and enhance overall financial health. Furthermore, addressing the factors contributing to credit risk can lead to better loan recovery rates, increased profitability, and ultimately, greater confidence among depositors and investors. The study seeks to find out whether an empirical association between branch networks (Branches of Banks) and credit risk in RCBs in Ghana

exists and the extent of this association. Additionally, the study seeks to analyze the applicability of the causes of credit risk in commercial banks to rural banks in Ghana.

The study is structured as follows: after the introduction, we discuss the development of theories and hypotheses. This is followed by sections on research design, methods, data collection and results. The findings from previous research were also reviewed, and concluded with a discussion on the theoretical and practical implications, as well as limitations and directions for future research.

2. THEORETICAL FOUNDATION AND HYPOTHESIS DEVELOPMENT

2.1. The Principal-Agent Theory

The Principal-Agent Theory or the Agency Theory was spearheaded by Stephen Ross and Barry Mitnick in 1960 and 1970 respectively. Whereas Ross originated the economic concept of agency and views the problem as incentive-related, Mitnick concentrated on the institutional theory of agency arguing that the problem emanates from the configuration of institutions, though the underlying assumptions of both studies are similar. The theory analyses the problems that come up in organizations because of the separation of owners from managers (Panda & Leepsa, 2017). According to Appiah, (2015) the theory fundamentally, relies on the theory of information asymmetry and raises the basic problem of self-interested parties in organizations.

The Agency Theory specify that a contract creates a link between principals (owners) and agents (managers) who have competing goals (Mwawurah, 2013). Mwawurah (2013) indicated that agency relation exists between shareholders and managers as well as debt holders and shareholders. In the view of Owusu-Boateng, (2015), credit creates a contractual relationship between lenders (principals) and borrowers (agents) and this relationship is best explained by the Agency Theory. Panda & Leesa, (2017) indicate three ways where the problem exists namely; between Principals or Owners and Agents or Managers, between Majority Owners and Minority Owners, and between Owners and Creditors. Whereas principals expect the maximization of the value of the organization, agents concentrate on self-interest and make decisions detrimental to shareholder expectations. A clash of interests ensues between the goals of shareholders or principals and those of managers or agents (Omwenga & Omar, 2017; Owusu-Boateng, 2015). As noted by Panda and Leesa, (2017) some causes of the agency problem are separation of ownership from control, risk preference, information asymmetry and moral hazard.

As shown by Appiah, (2015), banks are confronted with additional conflicts when screening borrowers for information to detect high-risk borrowers from the onset of the credit application. Some borrowers may provide inadequate information and are likely to conceal relevant information that could aid credit decisions. Banks possess inadequate information and are unable to distinguish between borrowers with differing risk characteristics. Managers may adversely select risky borrowers and pass on the riskiness of borrowers in the form of high lending rates. Adverse selection therefore exposes the bank to reasonable credit risk through high lending rates.

2.2. The Modern Portfolio Theory

The Modern Portfolio Theory (MPT) was developed by Harry Markowitz in 1952. The main thrust of the MPT is that investors attempt to maximize the return to a portfolio of assets and attempt to minimize the risks associated with the portfolio.

The MPT was developed to quantify and measure the trade-off between return-maximization and risk-minimization (Sirucek & Kren, 2015). An investor's focus must thus be on the trade-off between expected return and the risk which is measured by the standard deviation. The MPT used the efficient market frontier to conceptualize this trade-off (Maier-Paape & Zhu, 2018). Sirucek & Kren, (2015) point out that, with a given return to a portfolio of assets, the associated risk could be minimized as long as the blend of assets lies along the efficient market frontier. Any set of assets outside the frontier will not meet the anticipation of the investor and must be eliminated.

A vital factor of the MPT is its ability to assign probabilities to the relation between return and risk under the postulation that, when investors take on higher risk, they must be compensated with higher returns commensurate with the risk taken. Generally, assets with higher risks also have higher returns (Maier-Paape & Zhu, 2018). Markowitz argues that to reduce risk a diversified portfolio should be preferred since this offers an avenue of hedging the total risk of the portfolio. Risk in this instance is the probability of a deviation from the projected return juxtaposed with the realized return. Risk therefore could be conceptualized as a situation where the real

return from an investment could probably be different from an estimated return (Maier-Paape & Zhu, 2018; Mwawurah, 2013; Owusu-Boateng, 2015).

The MPT was later generalized by various researchers between 1964 and 1999 in the Capital Market Theory from which the Capital Asset Pricing Model (CAPM) was developed (Maier-Paape & Zhu, 2018). The CAPM provided an equilibrium view of the trade-off between risk and return in the asset market. The model postulates that, at an equilibrium of investment, the risk of the investment (proxied by the beta coefficient) is directly proportional to the return of the investment. Unlike the MPT, the CAPM adds a risk-free asset (such as Treasury bill) whose rate of return is known to the portfolio so that the combined risk of the portfolio is moderated and reasonably diversified. The total risk of an investment portfolio could thus be segregated into systemic and nonsystemic risk. Systemic risks are non-diversifiable and exhibit substantial responsiveness to the volatilities in asset price movements inherent in the market. Risks that are idiosyncratic to particular assets are unsystemic and are diversifiable (Maier-Paape & Zhu, 2018; Sirucek & Kren, 2015). According to Mwawurah, (2013), in the MPT of investment, the nature of the predictors of credit risk determines whether it could be diversified or not. Whereas determinants of systemic credit risk are non-diversifiable, those of nonsystemic credit risk could be diversified through lending.

2.3. Branch Networks and Credit Risk

Banks with extensive branch networks could spread their loan portfolios across different regions, reducing exposure to local economic downturns or specific industry risks (Han & Bin, 2018). Branch networks could enable banks to gather valuable information on local markets, customer behavior, and economic conditions (Maier-Paape & Zhu, 2018). This data assists in more accurate credit risk assessment, leading to better-informed lending decisions. The relationship between branch networks and credit risk often involves the quality of customer relationships. Several studies suggest that stronger customer relationships built through branches tend to reduce credit risk (Berrios, 2013; Wang, 2013; Mpofu & Nikolaidou, 2018). These relationships facilitate better communication, understanding of customer needs, and early detection of financial distress, thereby aiding risk mitigation. It is therefore hypothesized that;

H_1: There is a relationship between branch networks and credit risk in rural banks.

2.4. Capital and Credit Risk

A well-capitalized bank is better equipped to absorb potential losses arising from loan defaults or credit-related issues. Regulatory frameworks like Basel Accords focus on capital adequacy requirements as a means to ensure banks have enough capital to cover potential credit losses (Wang, 2013). Studies suggest that an optimal capital structure can influence a bank's risk-taking behavior and its ability to manage credit risk effectively (Han & Bin, 2018). The balance between equity and debt financing, as well as the composition of regulatory and economic capital, can impact a bank's risk profile (Amoako, 2015; Appiah, 2015; Castro, 2013). Higher capital buffers in banks could enhance their resilience during economic downturns, reducing the likelihood of systemic crises caused by widespread credit defaults (Badar et al., 2013). The impact of capital regulations, such as risk-based capital standards, on banks' lending behavior, risk assessment, and credit portfolio management is a subject of interest. The market's assessment of a bank's capital adequacy can influence its cost of funding, access to capital markets, and overall financial stability. It is therefore hypothesized that;

H_2: There is a relationship between capital and credit risk in rural banks.

2.5. Total Assets and Credit Risk

While larger banks may have more resources to invest in risk management systems and processes, it doesn't necessarily imply a linear reduction in credit risk as bank size increases. This is because banks have large loan portfolios and are prone to more credit risk. Large banks might employ more sophisticated credit risk models, that have dedicated risk management departments, and utilize advanced technologies for risk assessment compared to smaller banks (Nguyen, 2016). Some studies revealed that larger banks might be more prone to systemic risks due to their interconnectedness with the financial system (Nguyen, 2016; Akorsu et al., 2015). In contrast, smaller banks may struggle to comply with these requirements, potentially exposing them to regulatory scrutiny and financial penalties. Smaller banks may also lack these resources, potentially increasing their vulnerability to credit risk events (Han & Bin, 2018). It is therefore hypothesized that;

H_3: There is a relationship between total assets and credit risk in rural banks.

2.6. Management Efficiency and Credit Risk

Higher management efficiency, reflected in better governance, effective risk management practices, and prudent decision-making, tends to correlate with lower levels of credit risk (Boakye, 2015). Efficient management practices could lead to improved loan origination standards, better monitoring of borrower behavior, and timely risk identification, thus reducing the probability of loan defaults (Castro, 2013; Garr, 2013). Effective governance structures, including competent and independent boards, transparent decision-making processes, and alignment of management incentives with risk management objectives, are associated with lower credit risk. Sound governance practices contribute to better management efficiency and risk oversight, reducing the likelihood of excessive risk-taking (Castro, 2013). Efficient management could tend to make more prudent decisions regarding loan composition, ensuring a balanced mix of low and high-risk assets (Nguyen, 2016; Iqbal et al., 2023). They could also exhibit a better understanding of risk-return trade-offs and avoid over-exposure to risky borrowers or sectors. Efficiently managed banks are more likely to comply with regulatory requirements and standards. It is therefore hypothesized that;

H_4: There is a relationship between management efficiency and credit risk in rural banks.

2.7. Unemployment and Credit Risk

As individuals lose jobs or face reduced income due to unemployment, they may struggle to meet their financial obligations, leading to higher default rates on loans, including mortgages, personal loans. Unemployment is considered a critical macroeconomic factor influencing credit risk. During periods of high unemployment, overall consumer spending tends to decrease, impacting businesses and individuals' ability to repay debts (Owusu-Boateng, 2015). Incorporating employment status and historical unemployment data could enhance risk assessment algorithms, enabling lenders to more accurately evaluate borrowers' creditworthiness. High unemployment rates could lead to a rise in foreclosures and mortgage delinquencies, particularly impacting the housing market and financial institutions holding mortgage-backed securities (Mensah, 2019). Unemployment could tend to correlate with increased delinquency rates on credit cards. Hence it is hypothesized that;

H_5: There is a relationship between unemployment and credit risk in rural banks.

2.8. Inflation and Credit Risk

Doung & Houng, (2017) indicate that inflation may have either a win-win or win-lose relationship with credit risk. When the inflation rate increases, real income levels in the nation drop and weaken the ability of debtors to pay borrowed funds hence credit risk increases. The opposite is that when the inflation rate decreases, real income levels improve and strengthen the ability of borrowers to settle their loans. This is particularly true in countries with flexible interest rate regimes where lenders adjust rates to reflect the current decreases in inflation rates, hence real income of households improves making debt service easier. The effect of inflation on credit risk in this instance is negative. Contrariwise, when inflation rates increase, this is reflected in the adjustments made as household incomes deteriorate making debt serving difficult. Moreover, increases in inflation rates reduce the real value of borrowed funds hence borrowers have smaller amounts to pay all things being equal, for which reason the burden of debt service reduces. Inflation in this instance has an inverse relationship with credit risk (Gila-Gourgoura & Nikolaidou, 2017; Koju et al., 2018; Bhamra et al., 2023). It is therefore hypothesized that;

H_6: There is a relationship between Inflation and credit risk in rural banks.

2.9. Interest Rate and Credit Risk

Interest rate is a key variable of NPLs since it is the cost of funds given out as loans (Mensah, 2019). Higher interest rates could tend to increase borrowing costs, making it more challenging for borrowers to service their debt obligations (Wang, 2013). This situation could elevate the likelihood of defaults, especially among borrowers with variable-rate loans or those highly sensitive to interest rate fluctuations. Research by Curtis et al. (2020) and subsequent scholars emphasized how changes in interest rates impact the probability of default, suggesting that higher rates increase the potential for financial distress and default among borrowers. The term structure of interest rates, especially the yield curve, influences credit risk assessment. Studies such as Chen et al. (2021) and Burova et al. (2021) have analyzed how different segments of the yield curve affect credit spreads and default probabilities. Higher interest rate volatility could often lead to wider credit spreads, reflecting increased uncertainty and perceived credit risk. It is therefore hypothesized that;

H_7: There is a relationship between interest rate and credit risk in rural banks.

2.10. Gross Domestic Product (GDP) and Credit Risk

During periods of economic expansion (higher GDP growth), credit risk tends to decrease as borrowers' ability to repay loans improves due to increased income and employment opportunities. Conversely, during economic downturns or recessions (lower GDP growth), credit risk tends to rise (Afriyie & Akotey, 2013; Boadi et al., 2016). Projections of GDP growth could influence decisions related to lending practices, risk assessment, and loan provisioning. Understanding the relationship between GDP and credit risk helps banks and financial institutions develop risk models and stress tests that consider various economic scenarios, including different levels of GDP growth. A higher GDP per capita shows improvement in the general purchasing power and the capacity of borrowers to pay back credit. However, when GDP decreases, the capacity for individuals, and businesses to hold additional income for debt services deteriorates. Thus, when GDP increases, credit risk reduces and the opposite holds true (Golitsis et al., 2019). It is therefore hypothesized that;

H_8: There is a relationship between Gross Domestic Product (GDP) and credit risk in rural banks.

3. METHODOLOGY

3.1. Research Design

The study employed the quantitative research approach based on similar studies on branch networks (Arora, 2014), and predictors of credit risk in commercial banks (Adusei et al., 2014; Garr, 2013; Jovic, 2017; Kanhukamwe, 2015; Mensah, 2019). The study surveyed RCBs utilizing purposive sampling, stratified sampling and simple random sampling from the population of RCBs in the Ashanti Region of Ghana

3.2. Data Collection

The target population comprised all Rural and Community Banks (RCBs) in Ghana that were licensed and reporting to the Bank of Ghana from 2008 to 2017. By the end of 2017, there were 144 rural banks in Ghana (BOG, 2017). Given their widespread distribution across the country, it was practically impossible to cover every bank. Therefore, the accessible population was defined as all RCBs located and operating in the Ashanti Region of Ghana from 2008 to 2017. At the end of 2017, the Ashanti Region had 29 RCBs (BOG, 2017). From these 29 rural banks, the sample excluded any RCBs established after 2008 and those whose accounts had not been published since 2008. This study excludes the post-2017 period due to data accessibility issues, significant policy reforms during the COVID-19 pandemic, and the desire to maintain focus on stable banking conditions. Additionally, RCBs without branches were excluded from the sample. It was anticipated that at least 24 RCBs would be included in the sample frame, from which 15 RCBs, representing approximately 62.5%, would be included in the study as the sample size.

Purposive sampling, simple random sampling and stratified random sampling were used to select 15 RCBs. The stratification of RCBs was based on the size of the branch network of the banks namely wide branches, average branches and low branches. Stratum 1 RCBs constituted those with 10-12 branches and classified as wide branch network (WIDBRAN). Again, stratum 2 RCBs were banks with an average branch network between 7-9 branches and classified as average branch network (AVEBRAN). Finally, stratum 3 banks were classified as those with low branch network (LOWBRAN) whose branch network ranges from 2-6 (Arora, 2014). Subsequently, a simple random sampling will be used to select five RCBs from each stratum to constitute the sample for the study.

The main data source was secondary financial data from rural and community banks as well as macroeconomic data on Ghana for the ten-year period starting from 2008 to 2017. This data source allows researches to quickly gather the necessary information without the time-consuming process of primary data collection and often accessible through libraries, online databases, government publications, and organizational reports, making it convenient for researchers to obtain (Ajayi, 2017). The data was sourced from the Bank of Ghana (BOG), the World Bank, the Ghana Statistical Service (GSS) and published annual reports submitted to shareholders and the Association of Rural Banks (ARB) during annual general meetings. Despite the challenges with this data collection method, several researchers adopted it (Adusei et al., 2014; Agyei, 2016).

Table 1. Percentage Share of RCBs in the Ashanti Region of Ghana from 2008-2017

Year	RCBs in Ghana	RCBs in Ashanti Region	% of RCBs in Ashanti Region
2008	126	24	19.05
2009	130	25	19.23
2010	132	25	18.94
2011	133	25	18.80
2012	134	26	19.40
2013	137	27	19.71
2014	139	27	19.42
2015	141	27	19.15
2016	142	27	19.01
2017	144	29	20.14

Source: Bank of Ghana, (2008-2017)

From Table 1, as at the end of December 2017, there were 25 rural banks in the Ashanti Region of Ghana, with 192 branches and employing 3759 staff. These banks serve 2,440,265 clients and advanced a gross loan of GHS 468.30 million which is the equivalence of about USD97.20 million (ARB, 2018). The Association of Rural Banks (ARB) has a branch in the Ashanti Region headed by a regional manager. The ARB ensures that periodic reports and other prudential requirements from BOG are complied with by its members. The specie needs of the RCBs are undertaken by the ARB Apex Bank which serves as a mini central bank for the RCBs in the region. Notwithstanding the rural development orientation of RCBs, Akorsu et al. (2015) indicate that all rural banks in the region have the majority of their branches in metropolitan and peri-urban areas especially Kumasi. RCBs are shifting focus to urban areas in the region because of the limited opportunities for diversification, liability management and geographic expansion in the rural areas and, vulnerable segments of the urban population also demand similar banking services just like the rural communities.

4. RESULTS

A correction analysis was undertaken using the STATA software application to identify the relationship between the systemic and nonsystemic variables and credit risk. As can be observed from Table 2 at 95% confidence level, there was a relationship between credit risk as the dependent variable and the nonsystemic predictors which were Size, Capital Adequacy Ratio, Return on Assets and Branch Network, with correlation coefficients (r) of -0.7301, -0.0471, -0.5250 and -0.9186 respectively. By virtue of the magnitude of the resultant coefficients, only CAR had a weak relationship with credit risk with the rest exhibiting strong relationships with credit risk. Each of the nonsystemic factors exhibited an inverse relationship with credit risk. A diagonal observation reveals that the issue of multicollinearity does not exist since the correlation between the predictor variables is not statistically significant.

Table 2. Pearson's Correlation Matrix for Unsystemic Variables

Variable	NPL	CAR	ROA	Total Assets	Branch Networks
NPL	1.0000				
CAR	-0.0471	1.0000			
ROA	-0.5250	0.1673**	1.0000		
Total Assets	-0.7301	0.5184**	0.2088**	1.0000	
Branch Networks	-0.9186	0.0241*	0.3322**	0.3393**	1.0000

*** ~ Correlation is significant at the 0.01 level (2-tailed); * ~ Correlation is significant at the 0.05 level (2-tailed)*
Source: Fieldwork, (2023).

It is inferred from Table 3 that a positive association exists between GDP and credit risk albeit insignificant with a correlation coefficient of 0.1039. This is in contrast with the expectation of this research since it was the expectation that, GDP will be negatively correlated with credit risk. Though the relationship was insignificant, the positive relationship means increases in GDP will trigger increases in NPLs and vice versa. However, Garr, (2013) found a positive relationship between credit risk and GDP per capita. As GDP per capita increases, credit risk also increases and vice versa. Inflation, interest rate and unemployment were found to have a negative association with credit risk.

Table 3. Pearson's Correlation Matrix for Systemic Variables

Variable	NPL	GDP	Inflation	Interest Rate	Unemployment
NPL	1.0000				
GDP	0.1039	1.0000			
Inflation	-0.2114	-0.1383	1.0000		
Interest Rate	-0.6050	-0.2708	0.2984**	1.0000	
Unemployment	-0.4274	-0.3954	-0.0243	0.1294*	1.0000

*** ~ Correlation is significant at the 0.01 level (2-tailed); * ~ Correlation is significant at the 0.05 level (2-tailed)*
Source: Fieldwork, (2023)

A Durbin-Watson test was also conducted to ascertain whether the model's residuals were not autocorrelated because if they were it would invalidate the results of the regression. According to Mwawurah (2013) the Durbin-Watson coefficient (d) should be 2 or more to indicate no autocorrelation from Table 4, the Durbin-Watson statistic was 3.278 which implies that the model's residual was not autocorrelated.

A regression analysis was also undertaken using the STATA software application to identify the causal relationship between the dependent and independent variables. Table 4 displays the result.

Table 4. Regression of Variables

NPL	Coef.	Std. Err.	T	P>|t|
CAR	0.123	0.379	0.33	0.040
ROA	-0.042	2.946	-0.01	0.031
Total Assets	1.548	7.169	0.22	0.005
Branch Networks	2.513	19.001	0.13	0.016
Inflation	-0.324	0.850	-0.38	0.038
Interest Rate	-0.333	0.356	-0.94	0.021
GDP	-0.724	0.898	-0.81	0.046
Unemployment	-2.295	2.273	-1.01	0.017
Cons	1.684	107.597	0.02	0.048

Number of obs	=	10
F (8, 1)	=	0.420
Prob > F	=	0.040
R-squared	=	0.769
Adj R-squared	=	0.461
Root MSE	=	3.313

Durbin Watson Statistic

Source	SS	df	MS
Model	36.522	8	4.565
Residual	10.975	1	10.975
Total	47.497	9	5.277

Durbin-Watson d-statistic (9, 10) = 3.27
Source: Fieldwork, (2023)

5. DISCUSSION OF RESULTS AND THEORETICAL CONTRIBUTION

According to Afriyie and Akotey, (2014), the overall predictive power of a regression model is strong and ensures consistency when the p-value (Prob > F) is between 0.00 and 0.05. From Table 4, the regression model's predictive power is significant at 95% confidence interval with an overall p-value (Prob > F) of 0.04. The coefficient of determination represented by the R-squared (R^2) measures the percentage variations observed in the dependent factor that is explained by the variations in the predictor variables (Owusu-Antwi et al., 2014). From the evidence, the value of R^2 of 0.7689 shows that the predictor variables jointly explain 76.89% of the variations in credit risk in rural banks meaning the model has a high predictive power. The result therefore depicts high reliability for the model and that the model will exhibit consistency in similar studies elsewhere. The finding implies that 23.11% of the vicissitudes in credit risk is from factors other than the factors used in this research. The Adjusted R^2 corrects for any bias in the R-squared due to any addition to the explanatory variables. The evidence shows that the Adjusted R-squared had a coefficient of 0.4608 and signifies that, 46.08% of the differences in the explanatory variables jointly affect credit risk in RCBs.
Empirically, the model yields the following regression line:

$$Y = 1.68+0.12X_1 – 0.04X_2 + 1.54\ X_3+2.51\ X_4 – 0.32\ X_5 – 0.33\ X_6 – 0.72\ X_7 – 2.29\ X_8$$

Where:
Y = Credit Risk
X_1 = Capital Adequacy Ratio
X_2 = Return on Assets (Management Efficiency
X_3 = Total Assets (Size)
X_4 = Branch Network
X_5 = Inflation Rate
X_6 = Interest Rate
X_7 = GDP Growth Rate
X_8 = Unemployment rate

The empirical regression *line* indicates the extent of the variability in credit risk given a change in any of the explanatory variables holding other variables constant (Omwenga & Omar, 2017). The evidence therefore suggests that, holding all predictor variables constant at zero, credit risk in RCBs will be constant at 1.68. This means before RCBs begin to go into operations in their catchment areas, they are already confronted with about 17% credit risk all things being equal. Moreover, as the results indicate when all other terms and variables are held constant at zero, a unit change in CAR, ROA, TA, Branch Network, Inflation rate, Interest rate, GDP growth rate and Unemployment rate, will lead to a change in credit risk of 0.12, 0.04, 1.54, 2.51, 0.32, 0.33, 0.72 and 2.29 respectively.

6. PRACTICAL IMPLICATION

Since branch network had a negative relationship with credit risk, it is recommended to the Board of Directors (BOD) and Managers of RCBs to consider pursuing a strategy of vigorously expanding the branch network of rural banks because of the moderating effect on credit risk. Rural banks with low branch networks are relatively exposed to the damaging effect of credit risk. Such banks especially are to consider the pursuit of a serious branch expansion. The study also showed that management efficiency is a key predictor of credit risk in RCBs. It is therefore recommended to the BOD of RCBs to initiate additional training programs aimed at developing the knowledge, skills and abilities of management and staff of RCBs since this will improve efficient resource utilization and enhance the abilities of management to detect potential delinquent borrowers from the onset of the loan application process. In theory, RCBs in Ghana are unit banks but in practice, all RCBs operate branches.

The study recommends that the Bank of Ghana should reconsider, de-emphasize and officially revoke the original conceptualization of RCBs as unit banks and rather institute a policy that encourages continuous branch expansion in RCBs since this will make institutional credit available to rural communities and also reduce credit delinquencies in RCBs. It is further recommended that the Ministry of Finance and the Bank of Ghana who are policy makers and regulators of the economy should adopt strategies that will enhance the general management of inflation, interest rate and unemployment since these have been proven to exert a considerable impact on the NPLs of RCBs. Managers of the Ghanaian economy should target the implementation of growth-related policies since these could lead to considerable benefits in the rural banking sector such as reducing loan defaults. The Bank of Ghana should not relent in the pursuit of the monetary policy targeting inflation and the general stability of the economy since this will eventually affect the NPL levels in RCBs in Ghana.

The collaboration between the management of rural banks, regulators and policymakers is a continuum. Whereas managers of RCBs handle nonsystemic variables which are idiosyncratic to the RCBs at one end of the continuum, the regulators and policymakers manage systemic factors at the other end. When one end of the continuum is poorly handled, the positive developments at the other end could be eroded. This is because if these key stakeholders act in isolation of each other, the positive effect of managing nonsystemic factors that improve loan repayments could be eroded by poor supervision and poor management of the systemic variables. It is recommended that the predictor variables that were found to be significant should be the target of managers, policymakers and regulators in a collaborative manner. It is further suggested that the BOD, ARB Apex Bank and the Bank of Ghana as well as the managers of the macroeconomic landscape of Ghana should team-up to deal with both systemic and unsystemic variables in other to enhance the efficient management of credit risk in RCBs.

7. CONCLUSION

This study empirically investigated the predictors of credit risk in rural and community banks (RCBs) in the Ashanti Region of Ghana. Specifically, the study investigated the correlation between credit risk as the dependent variable which was proxied by the NPL ratio and a set of 4 systemic factors and 4 unsystemic factors of credit risk as independent variables from 2008 to 2017. The systemic variables used were GDP growth rate, interest rate, inflation rate and unemployment rate. The unsystemic factors analyzed were branch network, total assets (size), return on assets (management efficiency) and capital (capital adequacy ratio).

The study adopted the quantitative research method using secondary data. The secondary data were extracted from the annual reports of RCBs as well as periodic prudential reports submitted to the Association of Rural Bank, Ashanti Regional Branch. The RCBs were selected through purposive sampling, stratified random sampling and simple random sampling. The data collected were analyzed with the help of Microsoft Excel and STATA and presented with tables and percentages. Three sets of analyses namely, descriptive statistical analysis correlation analysis and regression analysis were undertaken. The framework of the analyses was aimed at answering and testing 8 hypotheses.

The study concludes that return on assets, branch network and size are the significant unsystemic predictors of credit risk whilst interest rate, inflation and unemployment and GDP are the significant systemic predictors of credit risk in RCBs in Ghana. This means that predictors of credit risk in commercial banks in Ghana are generally applicable to the rural banking sector as well. These findings lead to the conclusion that any deterioration in the macroeconomic landscape of Ghana and poor management of RCBs could lead to increasing levels of NPLs in the rural banking sector in Ghana Since the paper is a pioneer study on the causes of credit risk in RCBs in Ghana, it has provided fresh insights on credit risk in rural banking and contributed to the literature on credit risk especially the relevance of branch network as a predictor of credit risk in rural banking.

8. LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

The capacity of the research to generalize the results of the study was limited because it concentrated on a specific population in a specific region and did not take into consideration the local dynamics of rural banking from the other regions of Ghana. Studying all RCBs in Ghana would have been ideal for effective generalization. Hence the study was limited by small scope, small sample size, small constructs and scope of analyses. The study revealed that the predictor variables only explain about 76% of the variations in credit risk. Further studies need to be conducted to ascertain the additional determinants of credit risk in rural banking. Factors such as board size and the exchange rate could be modeled alongside other variables. The study showed that capital and GDP were significant predictors of credit risk in rural banking which runs contrary to most literature. Additional research needs to be conducted to find out why this is so in rural banking. Again, further studies need to be conducted on the relevance of branch network in the era of dynamic technological advancements and to determine the impact of technology on the banking habits of rural dwellers. Since this is the only study that has analyzed branch network as a predictor of credit risk in rural banking, it is recommended that this study is extended to mainstream commercial banks and ascertain the relevance of branch network as a predictor of credit risk in commercial banks in Ghana.

AUTHORS' DECLARATION:

This paper complies with Research and Publication Ethics, has no conflict of interest to declare, and has received no financial support.

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The entire research is written by the author.

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The Impact of Middle East Conflict on Crypto-Market Study Case Palestine-Israel War and Bitcoin

Orta Doğu Çatışmasının Kripto Piyasasına Etkisi: Filistin-İsrail Savaşı ve Bitcoin Üzerine Bir Çalışma

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ABSTRACT

The objective of this research is to determine the impact of geopolitical developments on Bitcoin's value. It focuses on the events that occurred from October 7, 2023 including the attack on Israel by the militant group Hamas, the tension between Iran and Israel, and the conflict between Palestine and the US. Through a comprehensive event study, we can analyze the returns generated by these events. The results of the study Srevealed that Bitcoin performed well during the adjustment and anticipation periods, which showed that it could be a safe-haven asset. On the other hand, the negative AAR during the event day reflected the market's first reaction. The study also highlighted Bitcoin's dual nature as a speculative asset and a safe-haven asset providing investors with a deeper understanding of the risks that affect the cryptocurrency market.

Anahtar Kelimeler:
Jeopolitik Olaylar, Kripto Piyasaları, Hamas'ın Saldırısı, Bitcoin
Jel Kodları:
G12, G14, G15

ÖZET

Bu çalışmanın amacı, jeopolitik olayların Bitcoin'in performansı üzerindeki etkilerini analiz etmektir. Çalışma, militan grup Hamas'ın İsrail'e saldırısı, İran ile İsrail arasındaki gerilim ve Filistin ile ABD arasındaki çatışma da dahil olmak üzere 7 Ekim 2023'ten itibaren yaşanan dönemi incelemektedir. Olay çalışması yönteminin kullanıldığı Çalışmanın sonuçları, Bitcoin'in ayarlama ve tahmin dönemlerinde iyi performans gösterdiğine dair kanıtlar sunmakta ve bu da onun güvenli bir liman varlığı olabileceğini göstermektedir. Ayrıca, olay günündeki negatif Aritmetik Ortalama Getiri (AAR), piyasanın ilk tepkisini yansıtmaktadır Çalışma yatırımcılara kripto para piyasasını etkileyen riskler hakkında daha derin bir anlayış sağlarken aynı zamanda Bitcoin'in spekülatif bir varlık ve güvenli bir liman varlığı olarak ikili yapısını da vurgulamaktadır.

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1. INTRODUCTION

Over the past decade, Bitcoin, a virtual currency, has evolved into a significant asset within the financial sector, exhibiting distinct behavioral characteristics that differentiate it from traditional assets. This study aims to systematically examine the impact of geopolitical developments in the Middle East on the cryptocurrency market, with a specific focus on Bitcoin. The Middle East has long been a region plagued by conflicts such as the Iran-Iraq War, the Arab-Israeli War, and various uprisings and terrorist activities, which have influenced global economic stability. The ongoing conflict between Palestine and Israel, characterized by frequent ceasefires and escalations, continues to impact markets. The recent attack by Hamas on Israel on October 7, 2023, further exacerbated concerns about political and military instability in the region.

In times of heightened geopolitical uncertainty, investors typically seek out safe-haven assets such as gold and government bonds to hedge their risks. However, the emergence of digital currencies like Bitcoin has introduced a new alternative. Bitcoin's decentralized and independent nature makes it an increasingly popular asset among investors looking to mitigate geopolitical risk. This study evaluates the performance of Bitcoin, focusing on its cumulative average and abnormal returns following the Gaza attack and other political developments in 2024. By analyzing Bitcoin’s price movements during this period, the research explores broader implications for both policymakers and investors.

The motivation for this research is rooted in the growing need to understand whether Bitcoin can reliably function as a safe-haven asset during geopolitical crises. While traditional assets have long been studied in this context, Bitcoin’s unique characteristics—such as high volatility, decentralization, and speculative nature—present both opportunities and risks that require deeper exploration. Understanding the interplay between political developments and cryptocurrencies is crucial for investors seeking to navigate these uncertain times, as well as for policymakers who need to consider the financial stability risks posed by the growing role of cryptocurrencies. The potential contributions of this research are twofold. First, it adds to the limited body of literature by specifically examining the impact of the Palestine-Israel conflict on Bitcoin, a subject that has seen only minimal academic inquiry. Second, it provides a comprehensive analysis of Bitcoin's role as both a speculative asset and a safe-haven alternative during times of geopolitical instability, offering practical insights for investors and valuable implications for policymakers. The findings of this study could guide future decisions on risk management, portfolio diversification, and regulatory frameworks, enhancing both theoretical understanding and practical application within the financial sector.

2. LITERATURE

The Middle East has long been a central issue of geopolitical conflicts and tensions, which have affected global markets. This literature review looks into key events and developments, including the conflict between Israel and Palestine, Iran's political situation, and recent attacks, like the one carried out by Hamas on October 7, 2023. Smith, (2013) published a book detailing the history of the conflict between Israel, Palestine, and Arabs. It explores how these conflicts have affected global financial markets. The first Arab- Israeli war was fought in 1948. This book presents a historical overview of the conflict, which has affected global economies. Berti & Guzansky, (2014) discussed Israel and the Arab Spring, which looked into how these developments have affected economic stability and investor confidence. Grinin & Korotayev (2022) published a book that looked into the Arab Spring and the subsequent conflicts. It revealed how these developments have affected the financial markets. The research provided a framework for evaluating how the cryptocurrency market might be affected by similar events currently taking place.

The study conducted by Smith & Jones (2023) analyzed how the attack by Hamas on Israel on October 7, 2023, affected the financial markets. It noted that the incident caused panic and increased volatility in the cryptocurrency market. Bitcoin, which is often considered a safe haven asset, also experienced a spike in trading volume. Bitcoin's price immediately rose after the incident, as investors sought to take advantage of its perceived safety. The sudden increase in volatility was triggered by the market's reaction to the geopolitical situation. The sudden death of key political figures in Iran has raised concerns about the country's political stability. This issue is analyzed in a study conducted by Yan et al. (2022) who noted that Bitcoin could be a safe haven asset. During times like these, investors tend to increase their exposure to Bitcoin. Although Baur & Lucey, (2010) mainly focused on gold, it also looked into the various asset classes that can be considered as safe havens, such as stocks, bonds, and gold. It found that when faced with crises, assets perceived as autonomous from the conventional financial systems become more appealing.

Analyzing the volatility of the cryptocurrency market, Corbet, Lucey & Yarovaya, (2019) looked into how investors react to global crises. They also analyzed Bitcoin's price movements and trading volume during the incident. The findings of this study provide a basis for understanding how the market reacts to geopolitical events. In 2016, a study conducted by Dyhrberg compared Bitcoin's hedging capabilities with those of gold. It found that Bitcoin enjoys the same characteristics as gold when it comes to geopolitical uncertainty. It is therefore a preferred asset for investors during such situations. In 2018, Klein et al. (2018) compared Bitcoin's performance to that of traditional safe-haven assets. It noted that Bitcoin's volatility and correlation with the market are different from those of gold.

Bitcoin's behavior is different from that of traditional markets, as it tends to react more quickly to geopolitical events. Kumar (2023) discussed the impact of cryptocurrencies on scholarly interest and discussions. People are always looking to protect their assets whenever there is conflict, and global political events such as elections can have an effect on the market. Due to the current situation in the Middle East, people are also searching for ways to safeguard their financial assets. The objective of Khalfaoui (2023) was to analyze how the war affected the stock returns of the industrialized nations. They looked into the link between the war and the crypto market. They found that although the conflict had a negative effect on cryptocurrencies, it was only during normal market conditions.

The geopolitical events in 2023 were able to positively impact the crypto markets as they occurred during a period of rising market sentiment. For their study, the researchers focused on Bitcoin, Ethereum, Bitcoin, Litecoin, and Ripple They noted that during the Ukraine-Russian crisis, the stock market had been bullish, but cryptocurrencies, as well as G7 stocks, were regarded as safe haven assets. The effects of the conflict on the stock and crypto markets depend on the time horizon of investors. For instance, the war's negative impact on the stock returns of G7 nations can be attributed to the lack of attention. However, the long-term consequences of the conflict in Ukraine can also have a negative impact on the crypto market.

According to Houben (2020) cryptocurrencies should be regarded as different types of assets. They also think that cryptography is the main factor that drives the development of these assets. They claim that the term cryptocurrencies do not only refer to physical assets. It doesn't just contain digital assets. They believe that these are all based on cryptography. In response to Russia's invasion of Ukraine, the Western Nations imposed sanctions on the country. This was the kind of reaction they took after they seized Crimea in 2014.

All individuals who are citizens of one of the European Union's member states or reside there are affected by the sanctions. Companies operating within the EU are also subject to these regulations. These include foreign and local firms. These regulations also cover the activities of companies in the cryptocurrency industry. All of these entities are subject to the sanctions, and those operating in Russia are not affected.

These regulations are aimed at punishing the country’s vital business and economic activities. Since the cryptocurrency market is fairly unregulated, it's not yet clear how they would affect the activities of individuals and companies operating in this sector. In response, Russia has issued regulations that prevent people who aren't Russian citizens from providing services to others. It is also not feasible to fully implement these regulations since there is a lack of a definition for cryptocurrencies. For instance, during the war in Ukraine, the exchange rate between the Russian ruble and Bitcoin became volatile. Another factor that contributed to the volatility of the exchange rate was the depreciation of the Russian currency.

Qin (2021) Explores how the interaction between the global economy and Bitcoin affects its price. They used a rolling-window method to analyse the link between the uncertainty of the global economy and the price of bitcoin. They discovered that the market's information can help predict the likely future state of the global economy. According to the researchers, this information can help improve the Bitcoin price's prediction capabilities. In addition, various studies have shown that political events can interact with Bitcoin. The research on cryptocurrency's potential role in the financial sector is being conducted by a number of academic institutions.

In Bouoiyour & Selmi (2017), the authors explaine how the sharp increase in Bitcoin’s value following Donald Trump’s election led them to question whether the cryptocurrency could serve as a safe haven investment for the U.S. stock market. However, their research concluded that Bitcoin is a weak haven asset. Umar (2021) reached similar conclusions and looked into the link between political and economic uncertainties in the US and bitcoin when the situation was at its peak. They discovered that its relationship could change as uncertainty grows. Bitcoin also has various important events that are linked to it.

In 2021, Qin noted that when various uncertainties, such as the UK's exit from the European Union and the debt crises in Cyprus and Turkey, occur, the price of bitcoin will increase. In another study, Wustenfeld & Geldner

(2022) explained that economic shocks can have an effect on the activities and trading volumes of bitcoin. Almaqableh's group in 2022 noted that attacks by terrorists affected how people used bitcoin. Although other studies have shown that economic and political factors can affect the price of bitcoin, this finding is not supported by the available data.

A study conducted in 2022 identified Bitcoin and other assets as not considered safe havens during the Ukraine war. The research, which utilized a statistical method known as the Distributed Consensus Gathering Algorithm (DCC-GARCH), analyzed the daily data of various cryptocurrencies from November 1, 2021 to March 15, 2022. Halousková, (2022) The researchers used a statistical model, the researchers were able to determine how attention indicators affect stock price changes. They found that the predictability of the performance of the market was influenced by the amount of media attention that 36 nations paid to the conflict in Syria before, during, and after it happened. They also discovered that the economic openness of these countries was linked to media attention to Russia.

The study conducted by Aslanidis in (2022) used the Google Trends Indicator to analyze the daily changes in the sentiment toward various cryptocurrencies from 2015 to 2021. They discovered that the sentiment toward these digital currencies is more closely related to the market-specific indicator than the general uncertainty index. Moreover, the returns from these currencies have a longer time frame compared to those from other assets.

Based on the research of Jankovič (2024) It is believed that the conflict involving Ukraine occurred before March 23, 2022. Doing this would allow us to determine if the market was affected by the war. The null hypothesis states that the market did not experience any impact. The analysis was performed using a time frame that spans from June 19, 2021 to January 23, 2022. For the event window, it was used from February 17, 2022 to March 24, 2022. Although it's hard to tell exactly how the war affected the market, it can be observed how various cryptocurrencies changed their prices, volumes, and liquidity. A quick review of the data allows us to compare its findings with a larger time frame, offering a deeper comprehension of the factors that impacted the market. Furthermore, we should take into account other global events happening at present.

3.DATA AND METHODOLOGY

Here in this research to understand the complex relationship between crypto and war attacks we will use Top crypto BTC to represent the entire crypto market. According to Usatoday.com top cryptocurrency of 2024 is Bitcoin as shown in the list below of the Table1 with full name, codes, and market capitalization. Data of BTC are retrieved from The investing.com. All the data covers period from, 07.07.2023 to 17.10.2023 Israel-Palestine conflict.

Table 1. Bitcoin

Full name	Codes	Market Capitalization
Bitcoin	BTC	756,020,936,523

This section explores the concept of Event study, which is a statistical analysis of the effects of certain types of events on financial markets. It aims to determine if the market reaction is statistically significant. Through the event study, we can analyze the movements of Bitcoin exchange rate. It determines the presence or absence of significant market reactions to past events that are relevant to a company's stock price.

The event study's foundation is based on the Efficient Market Hypothesis (EMH), which was developed by Fisher, Fama, Brown, and Warner in 1985. The main goal of the research is to find out if the market's reaction differs from what it would be in the event of no event. The standard event study method can also be used to analyze the effects of stock splits.

According to MacKinlay & Lo, in 2004, the event study has been regarded as the most successful method for analyzing corporate finance. Fama & Brown were also acknowledged for their seminal work on the subject in 1969. Their study examined how news or economic events affected share prices.

The event study can analyze how certain types of news or events affected share prices. It can also identify abnormal performance. There are a variety of methods that can be utilized to determine abnormal returns. One of the most popular methods used by the event study to analyze abnormal returns is the Market model, which is a risk adjusted returns model. It can be used to measure the multiple measures that affect share prices during the event window. For the expected returns of Bitcoin, a benchmark index is needed to be established. The Crypto

Currency Index 30 (CCI30) is a 30-day market cap-weighted index created on January 1, 2017. It is used to measure the overall increase and daily changes in the market. Daily values of the CCI30 index are retrieved from The cci30.com. All the data covers the period the war and conflicts going on at the moment between Palestine and Israel. After all the required data has been collected, the logarithmic returns of each cryptocurrency and CCI30 index are calculated with the following equation:

Step a: Daily returns for BTC

The daily return for each sample company is computed for the estimation window and for the event window using:

$$Rit = log(P\,it - P\,i(t-1)) \quad (1)$$

Where, Pit and Pi (t–1) are respective daily closing share prices for the company (i) at day t and t-1, Rit is the actual return for company i at day t.

In equation (1), Ri,t represents the logarithmic return of BTC i

On day t, Pi,t is the closing price of BTC i on day t, and Pi,t-1 is the closing price of BTC i on the previous day. In this study, event study approach to calculate the impact of a conflict on the returns of the sample firms. They determined that the day of the conflict, which is the day when Hamas attacked Israel, has the most significant impact on the returns. They also specified the period wherein the events were analyzed, and the event window, which is used to evaluate their effects.

Step b: Daily returns for market

The daily returns for the market are computed using daily values of CCI30 for the same period using:

$$Rmt = log(Iit - Ii(t-1)) \quad (2)$$

Where, Iit and I i (t–1) are respective daily index values at time t and t–1 respectively, Rmt is the Return of Market portfolio for the period.

Step c: Abnormal returns calculation

Abnormal return is defined as actual return (Rit) minus normal return (NRit).

$$ARit = Rit - NRit \quad (3)$$

After taking into account the expected returns, the researchers computed the abnormal returns of Bitcoin using equation 3. They subtracted the expected return from the event that was not taken into account.

Normal Return is calculated using the market model which is –

$$Rit = \alpha i + \beta i\ Rmt + \epsilon it$$
$$\text{And, , } NRit = \hat{\alpha}_i + \hat{\beta}_i\ Rmt \quad (4)$$

Rmt is the return on the market index for day t.αi measures mean returns not explained by the market. *Bi* measures the sensitivity of return (company i) to the market return and εit is the statistical error whose expectation is assumed to be zero.

Using Eq. (3) and Eq. (4), abnormal returns are defined as residuals or prediction errors of the model which is as under:

$$ARit = Rit - NRit = Rit - (\hat{\alpha}i + \hat{\beta}i\ Rmt) \quad (5)$$

Where, $\hat{\alpha}\ and\ \hat{\beta}$

are OLS estimators of the regression coefficient estimated over the estimation window.

Step d: Average Abnormal returns (AARs)

To eliminate the effect of any one or group of shares on ARs, ARs (Abnormal returns)are aggregated and averaged for each day in the event window. The un-weighted cross-sectional AARs in period t are calculated using:

$$NAARit = \sum_{i=1} ARit / N \quad (6) \quad (6)$$

Where, N is the number of shares for which ARs are present on day‘t’ in the event window.

the common response of BTC to the world conflict is examined by utilizing this formula to determine the average abnormal returns (AARs) for each day:

In equation (6), the AARs are computed for each day by dividing the ARs of each BTC by the total number. The last step in the analysis is to determine if the anomalous returns of cryptocurrencies during the period were statistically significant. They added in the adjustment period, the anticipation period, the event day, and the total event window to arrive at the CAARs. The results of the study are then analyzed by using statistical methods and Microsoft Excel. Previously computed AARs are added together to determine the CAARs over the anticipation period (-10, 0), adjustment period (0, +10), event day (0, 0), and total event window (-10, +10). The statistical significance of the results is assessed by using t statistics and Microsoft Office Excel is used for all calculations. All the data covers the period from 07.07.2023 to 17.10.2023 Israel-Palestine conflict.

4. EMPIRICAL FINDINGS

Table 2 shows the descriptive data of the collected information. During the period, there were 122 observations for Bitcoin.

Table 2. Descriptive Statistics

Name	Mean	Max	Min	Std.Dev	Obs
BTC	-2,453E-	0,0310099	-0,0444032	0,00937467	122

Note: The mean indicates that the returns were generally negative during the period. The minimum indicates that there were significant losses, while the positive maximum shows that there were periods of gains. The standard deviation indicates that returns can fluctuate both positively and negatively. Second, the abnormal returns (ARs) for BTC are calculated, the results are shown in Table 3.

Table 3. Abnormal Returns of BTC

Day	BTC
t-10	0,006262806
t-9	-0,007097375
t-8	-0,001551707
t-7	0,015278263
t-6	0,001460974
t-5	-0,004275395
t-4	0,012070597
t-3	-0,006063385
t-2	0,006964526
t-1	0,003080581
0	0,001095516
t+01	0,006678314
t+02	-0,004487195
t+03	-0,012616192
t+04	0,002698085
t+05	-0,002406446
t+06	-0,002726729
t+07	0,006627384
t+08	0,028815474
t+09	0,004370338
t+10	-0,293802278

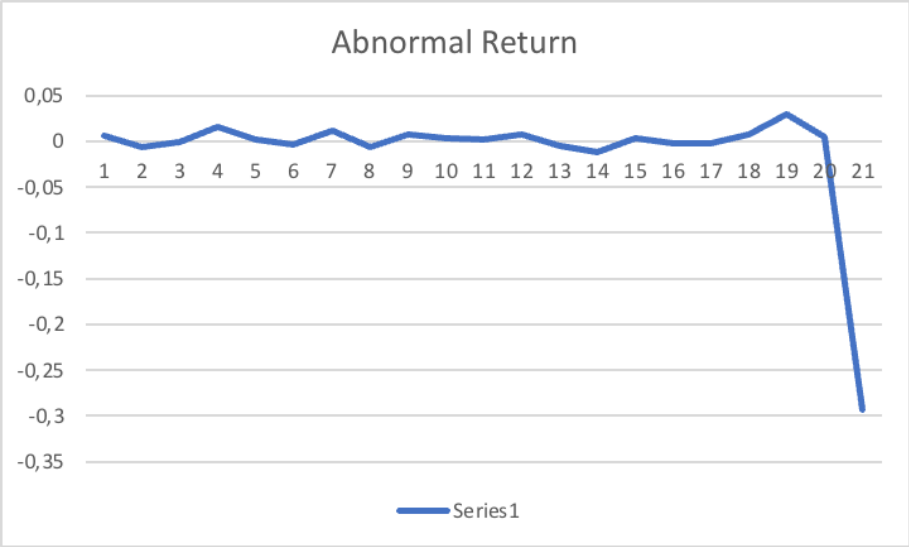

Figure 1. Abnormal Returns Over Event Period

Since it is difficult to evaluate overall patterns with the individual abnormal returns, in the third step, the cumulative market reactions (CARs) of BTC are evaluated for the anticipation period (-10, 0), adjustment period (0, +10), event day (0, 0) and total event window (-10, +10), and the results are presented in Table 4.
According to the results, we didn't find a statistically significant difference in the cumulative abnormal returns of Bitcoin during the period. The returns were also positively affected by the events.

Table 4. Cumulative Abnormal Returns of BTC

Code	AnticipationPeriod (-10, 0)	Event Day(0,0)	Adjustment Period (0, +10)	Total Period(-10, +10)
BTC	0,02613	0,001096	-0,26575	-0,23962

Note: The main results showed that during the Anticipation Period (-10, 0), EventDay (0, 0), the cumulative average abnormal returns were not statistically significant. The Adjustment Period (0, +10), and Total Period (- 10, +10), the cumulative average abnormal returns were statistically significant.

This indicates that the Israel-Palestine war on October 7, 2023, may have a significant impact on Bitcoin's market performance.

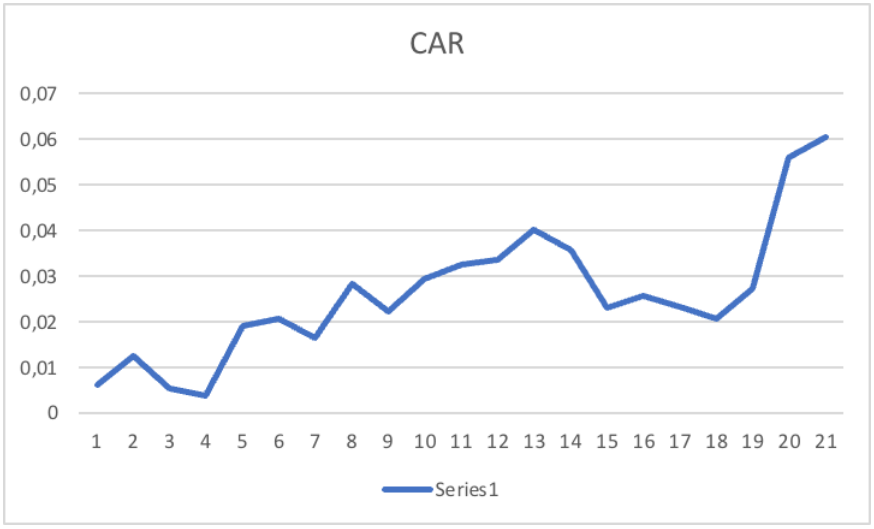

Figure 2. Cumulative Abnormal Returns (CAR) Over Event Period

In the next step, the average abnormal returns (AARs) for each day, For BTC, are computed to depict the entire reaction of BTC to an event. The results are shown in Table 5 and the market seems not affected by the event.
The next step is to analyze the daily average abnormal returns (ARs) for Bitcoin (BTC) to determine the total reaction of the market to an event. The results show that the market doesn't seem affected by the event. On the fourth day before the event, there is a positive and statistically significant AR.

Table 5. Average Abnormal Returns of BTC

	Day	AARs	t-test	Significant
Anticipation Period (Pre-event)	t-10	0,00395909	0,675416774	NO
	t-9	-0,000417284	-0,765416774	NO
	t-8	0,004324541	-0,167344956	NO
	t-7	0,006863278	1,647695149	NO
	t-6	0,008369619	0,157559766	NO
	t-5	-0,001407211	-0,461083006	NO
	t-4	0,003897601	1,301762101	NO
	t-3	0,003003606	-0,65391007	NO
	t-2	0,00045057	0,751094203	NO
	t-1	0,005022553	0,332227448	NO
	0	0,002088048	0,118146656	NO
Adjustment Period (post-event)	t+1	0,003886915	0,720227534	NO
	t+2	0,00109556	-0,483924676	NO
	t+3	-0,008551693	-1,360602184	NO
	t+4	-0,004959053	0,290976909	NO
	t+5	0,00014582	-0,259524873	NO
	t+6	-0,002566588	-0,294066063	NO
	t+7	0,001950327	0,714734967	NO
	t+8	0,017721429	3,107625234	Yes
	t+9	0,016592906	0,471322164	NO
	t+10	-0,14471597	-31,68531495	Yes

Note: If your t-statistics are more extreme (e.g., greater than 3 or less than -30), the p-values will be very small, typically indicating strong evidence against the null hypothesis and suggesting that the observed abnormal returns are highly significant. The results shown in table 5 demonstrate that t+9 and t+8 are significant statistically.

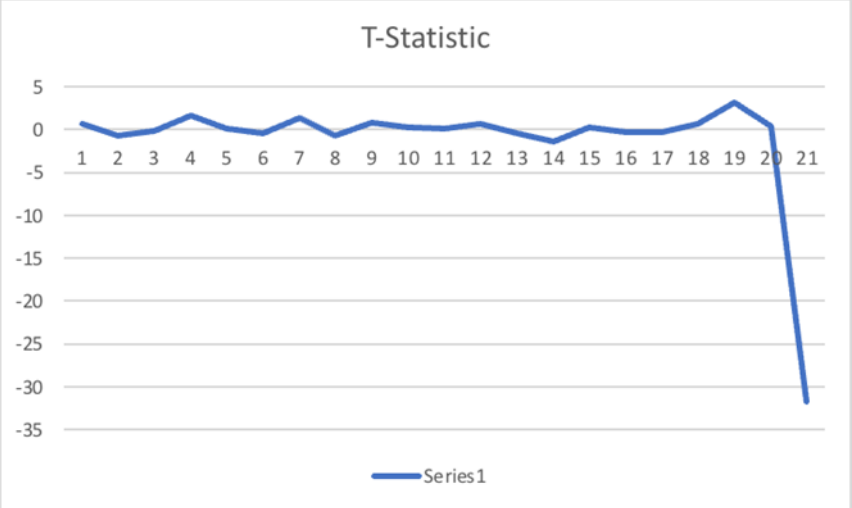

Figure 3. T-Statistic Over Event Period

Since the AARs can't capture the overall performance of the market, cumulative average CAARs are used to analyze the various periods and days of the cryptocurrency market. Table 6 shows the results of the analysis, which are none of them statistically significant. It is concluded that all the conflicts and wars have an impact on certain cryptocurrencies, but the overall performance of the market seems unaffected.

Table 6. Cumulative Average Abnormal Returns of BTC

Statistics	Anticipation period (- 10,0)	Event day (0,0)	Adjustmentperiod (0,+10)	Total Period (-10,+10)
CAAR	0,02613	0,001096	-0,26575	-0,23962
t-stats	2,818	0,118115	-28,6604	-25,8424

Note: for the Anticipation period (-10,0) and the Event day(0,0) The p-value is greater than 0.05, so the result is not statistically significant. For the Adjustment period (0,+10) and the Total period (-10,+10) The p-value is below 0.05, The p-value is extremely small, indicating very strong statistical significance.

5. CONCLUSION

This study analyzed the impact of recent geopolitical events, particularly the Israel-Palestine conflict on October 7, 2023, on the cryptocurrency market, with a focus on Bitcoin. By examining Bitcoin's price movements and abnormal returns during this period, the research sheds light on its role in the global economy as both a speculative and safe-haven asset. While our findings indicate that the immediate market reaction to the conflict was not significant, Bitcoin did exhibit resilience during the adjustment period, recovering from initial negative abnormal returns. This highlights Bitcoin's dual nature, where it can both react to geopolitical shocks and later stabilize as a hedge against further risks.

Comparing our findings with existing literature, we observe similarities and differences. Prior research, such as studies by Dyhrberg (2016) and Klein et al. (2018), supports the view of Bitcoin acting as a safe-haven asset during crises, while others like Raza et al. (2022) have found that Bitcoin and other cryptocurrencies may not always provide refuge during conflicts. Their results show that Bitcoin's reaction to geopolitical instability involves initial volatility followed by a stabilization period. The volatility observed in the aligns with Corbet, Lucey & Yarovaya (2019), although their findings suggest more sustained volatility than what we observed.

Our study also emphasizes the importance of investor behavior in the cryptocurrency market. Although geopolitical events like the Gaza conflict may not lead to dramatic immediate shifts in Bitcoin's returns, investors should remain cautious about future crises, as Bitcoin's volatility can lead to both significant gains and losses. This suggests a high-risk investment environment, reinforcing the need for effective risk management strategies.

6. RECOMMENDATIONS FOR FUTURE RESEARCH

Broader Cryptocurrency Market Analysis: While Bitcoin was the primary focus of this study, future research should explore the effects of geopolitical events on other cryptocurrencies, such as Ethereum, Ripple, and Litecoin. This will allow for a more comprehensive understanding of how the broader cryptocurrency market behaves during geopolitical crises.

Long-Term Geopolitical Event Analysis: Our study was limited to the short-term impact of the conflict. Future studies should investigate the long-term effects of sustained geopolitical instability on cryptocurrency markets, as this would provide deeper insights into how digital assets respond over extended periods.

Impact of Global Regulatory Changes: Given the decentralized nature of cryptocurrencies, global regulatory changes can significantly influence market behavior. Future research should examine how upcoming or existing regulatory frameworks affect cryptocurrencies, especially during times of geopolitical uncertainty.

Incorporating Macroeconomic Factors: Further research should also explore how macroeconomic variables, such as inflation, interest rates, and global trade patterns, interact with cryptocurrencies during geopolitical events. This could provide a more nuanced understanding of market dynamics.

Advanced Methodological Approaches: To enhance the accuracy of future analyses, researchers could use more advanced econometric techniques, such as vector autoregression (VAR) or GARCH models, to better capture the complexities of market volatility and interdependencies between assets during periods of crisis.

Our findings suggest that Bitcoin has the potential to act as both a speculative and a safe-haven asset during geopolitical events. Policymakers should consider this when crafting regulations for cryptocurrencies, particularly in terms of financial stability and risk management. Introducing transparent and comprehensive reporting requirements for the cryptocurrency market would help mitigate risks. Moreover, investors should be advised to include cryptocurrencies in their portfolios to hedge against geopolitical risks, while also implementing stop-loss

orders and portfolio recalibration strategies to manage potential losses due to the inherent volatility of digital assets.

In conclusion, while Bitcoin displayed resilience and recovery after the initial shock of the October 7, 2023, Hamas attack, the market's reaction was mixed, demonstrating both volatility and stabilization. The findings highlight Bitcoin's unique characteristics as both a speculative and a safe-haven asset, depending on market conditions. Future research should expand upon these results by studying other cryptocurrencies, integrating macroeconomic factors, and using more advanced methodologies to better understand the full scope of how geopolitical events influence the cryptocurrency market. Through these insights, policymakers, investors, and academics can better navigate the growing role of cryptocurrencies in the global financial system.

AUTHORS' DECLARATION:

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Conceptualization, writing-original draft, editing **– ME** and **AK**, data collection, methodology, formal analysis **– ME**, Final Approval and Accountability **– ME** and **AK**

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The Effect of Perceived Service Quality on Brand Loyalty: The Case of 5 Star Hotels in Tourism Sector

Algılanan Hizmet Kalitesinin Marka Sadakati Üzerine Etkisi: Turizm Sektörü 5 Yıldızlı Oteller Örneği

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ABSTRACT

This study aims to examine the attitudes towards brand loyalty based on the perceived service quality of guests staying in 5-star hotels in the tourism sector. The sample consists of 204 male and female participants who stayed in a 5-star hotel in Istanbul. The study evaluates how the dimensions of perceived service quality-namely tangibility, reliability, responsiveness, assurance, and empathy-affect brand loyalty among hotel guests. Quantitative methods were used to measure perceived service quality and brand loyalty using questionnaires. Statistical analyses including descriptive statistics, exploratory factor analysis and structural equation modeling were conducted to evaluate the data. The findings reveal that there is a significant positive correlation between perceived service quality and brand loyalty. Specifically, higher perceived service quality increases customer satisfaction, which in turn improves brand loyalty. The results emphasize the importance for hotel management to focus on improving service quality to ensure stronger customer loyalty. This study contributes to the literature by providing insights into the relationship between service quality and brand loyalty in the context of the luxury hotel industry in Istanbul and offers practical implications for hotel managers aiming to increase customer retention and loyalty.

Keywords:

Perceived Service Quality,
Brand Loyalty,
Tourism Industry,
5-Star Hotels,
Customer Satisfaction

Jel Codes:
L15, M31, M30. M00

ÖZET

Bu çalışma, turizm sektöründe 5 yıldızlı otellerde konaklayan misafirlerin algıladıkları hizmet kalitesine dayalı olarak marka sadakatine yönelik tutumlarını incelemeyi amaçlamaktadır. Örneklem, İstanbul'da bir 5 yıldızlı otelde konaklayan 204 erkek ve kadın katılımcıdan oluşmaktadır. Çalışma, algılanan hizmet kalitesinin boyutları olan fiziki unsurlar, güvenilirlik, yanıt verebilirlik, güvence ve empati unsurlarının otel misafirleri arasındaki marka sadakatini nasıl etkilediğini değerlendirmektedir. Anketler kullanılarak algılanan hizmet kalitesi ve marka sadakati ölçülmüş ve nicel yöntemler kullanılmıştır. Verilerin değerlendirilmesinde betimleyici istatistikler, keşifsel faktör analizi ve yapısal eşitlik modellemesi gibi istatistiksel analizler yapılmıştır. Bulgular, algılanan hizmet kalitesi ile marka sadakati arasında anlamlı bir pozitif korelasyon olduğunu ortaya koymaktadır. Özellikle, daha yüksek algılanan hizmet kalitesi müşteri memnuniyetini artırmakta ve bu da marka sadakatini geliştirmektedir. Sonuçlar, otel yönetimlerinin müşteri sadakatini güçlendirmek için hizmet kalitesini iyileştirmeye odaklanmasının önemini vurgulamaktadır. Bu çalışma, İstanbul'daki lüks otelcilik sektöründe hizmet kalitesi ile marka sadakati arasındaki ilişkiye dair literatüre katkı sağlamakta ve otel yöneticilerine müşteri bağlılığını ve sadakatini artırmaya yönelik pratik öneriler sunmaktadır.

Anahtar Kelimeler:

Algılanan Hizmet Kalitesi,
Marka Sadakati,
Turizm Sektörü,
5 Yıldızlı Oteller,
Müşteri Memnuniyeti

Jel Kodları:
L15, M31, M30, M00

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1. INTRODUCTION

Services are a set of values, usually intangible, offered to consumers and constitute an important part of economic activities. They are produced and delivered by individuals or organizations to meet customer needs. Services, unlike physical goods, cannot be stored and are often produced at the time of consumption, making them unique in terms of quality assessment. Perceived service quality is the process by which customers evaluate the extent to which a service meets their expectations. This concept is based on customers' experiences with, expectations of and perceived benefits from the service. Service quality is more difficult to measure than tangible products because subjective judgments and individual expectations play a major role.

Loyalty refers to the tendency of individuals to show a continuous commitment to a particular brand, product or service. This tendency manifests itself as repeatedly preferring the same brand, not switching brands and giving positive recommendations. Brand loyalty, on the other hand, is the continuity of consumers' tendency to repurchase and positively recommend a brand. This concept is not only limited to repurchase behaviors, but also includes consumers' commitment to a brand and their intention to prefer that brand.

The relationship between perceived service quality and brand loyalty has been extensively studied in the academic literature and there are many studies showing a strong link between these two concepts. High perceived service quality increases customer satisfaction, which in turn strengthens brand loyalty. When customers experience service quality that exceeds their expectations, they have experiences that reinforce their loyalty and increase their commitment to the brand. On the other hand, low service quality negatively affects customer satisfaction and thus brand loyalty. Therefore, businesses need to pay special attention to service quality in order to gain a competitive advantage and achieve sustainable success in the market. Moreover, it should be kept in mind that beyond perceived service quality, customers' emotional ties and personal relationships with the brand are also important in the process of creating loyalty.

This study aims to evaluate the relationship between perceived service quality and brand loyalty through the example of five-star hotels operating in the tourism sector. The increasingly settled view of researchers is that customer experience is generated through a longer process of company–customer interaction across multiple channels, and is generated through both functional and emotional clues. Research with practitioners indicates that most firms use customer satisfaction, or its derivative the Net Promoter Score, to assess their customers' experiences (Klaus & Maklan: 2013).

2. PERCEIVED SERVICE QUALITY

Service is a concept that is defined in many different ways. In the literature, there is no consensus on a specific definition of service and this situation reveals that there are different definitions of the concept of service. In general terms, service is accepted as "a set of non-material activities that respond to needs" (Sarıyer, 1996: 2). In another definition, service is defined as "abstract efforts that can be determined in a way to meet the demands of the consumer as the main goal or factor of any activity" (Üner, 1994: 3).

Service is an abstract product that transfers value to the buyer upon its production (Konya, 1998: 78) and the most distinctive feature of the service concept is that it is abstract. However, service is a concept that emerged due to the needs of people. The economic fulfillment of people's needs necessitates the existence of a service. In other words, where there is an economic need, there is a service. In order to fully understand the concept of service, the characteristics of service should be known (Erkut, 1995).

Service has been defined in various ways in the historical process. Davis and Goetsch defined service as "doing work for someone else" and according to Dibb, it refers to the abstract products produced by humans and machines (Koçbek, 2005: 23). Based on these definitions, it is possible to say that service is a set of abstract activities that are offered for sale at a certain price to meet the needs of individuals or groups, cannot be standardized, and provide satisfaction and benefit (Sevimli, 2006: 2).

Society's quality expectations are rising continuously due to factors such as globalization, increasing and difficult competition conditions, intense public control, increasing economic freedom and education level. These changes in customers' perception of service and quality cause the quality level of the services provided in the service sector to become more important. What is expressed by service quality is the extent to which the needs of the consumer can be satisfied based on the relationship between the sector providing the service and the person who is the recipient of the service (Bakan et al., 2011: 3). Service quality is the feeling that the service creates in the person

who buys it and shows the degree of satisfaction of the buyer. The way quality is perceived by customers is very important for service businesses. For this reason, the concept of service can also be defined as the qualities that the service should have in line with the expectations and needs of the buyer and the degree to which the service offered has these qualities (Çiçek & Doğan, 2009: 203).

According to Parasuraman, Zeithaml and Berry's definition, service quality is the indicator of the harmony of customers' perceptions of the performance in service delivery and their expectations from the service. In cases where the quality perception of the sector providing the service and the customer who is the recipient of the service are similar, disagreements and incompatibilities are minimized. The customer evaluates the service according to his/her own perception of quality. Accordingly, if the customer obtains the performance he/she expects from the service he/she receives, he/she will consider the service as "high quality", and if the service he/she receives is below his/her expectations, he/she will consider the service as "poor quality". For this reason, it is very important to analyze the quality perception of the customer base in the service sector in order to determine the level of service to be provided. Vincet K. Omachonu defines quality in health services from a synthesizing perspective with its technical and artistic aspects. This approach argues that quality in healthcare is determined by the art of treatment and technical quality. While compliance with scientific norms and standards refers to technical quality, responding to customer requests and expectations refers to the art of treatment (Kavuncubaşı, 2000: 270).

Perceived quality is defined as an attitude formed as a result of the comparison of customer expectations and service performance (Kang, 2006: 8). Customers have certain expectations about a service before using it. After using the service, customers perform an evaluation process by comparing their expectations with the realization of the service they have received. If the service quality perceived by the customer does not adequately meet the expected level of quality, the customer feels dissatisfied. On the contrary, if the service quality meets or exceeds the customer's expectations, the customer experiences satisfaction (Dalgıç, 2013; Uzunçakmak, 2021). Perceived service quality emerges as a result of customer expectations and experiences. When customer expectations are not met, perceived service quality is generally considered low, even if the experienced service quality is measured objectively (Grönroos, 2015: 98). Fundamentally, customer satisfaction depends on the perceived level of quality. A consumer with positive perceptions of service quality will be more inclined to report higher levels of satisfaction (Cronin & Taylor, 1994; Kouthouris & Alexandris, 2005; Pappu & Quester, 2006; de Barros & Gonçalves, 2009).

3. BRAND LOYALTY

The concept of brand loyalty refers to the degree of passion and commitment of users towards a brand. Brand loyalty is of critical importance for companies. David Aaker emphasizes that thanks to brand loyalty, budgets allocated to marketing activities can be reduced, new customers can be acquired more easily and commercial gains can be increased (Devrani Korkmaz, 2009: 408). Brand loyalty enhances the predictability of sales and revenue by establishing a stable base of loyal customers. If a brand does not have a loyal customer base, it weakens its defenses in the market and only offers the possibility of building a potential loyal customer base. Brand loyalty provides a distinct advantage in the effective use of marketing resources. Maintaining an existing customer base is far more cost-effective than spending on new customer acquisition. A common mistake companies make is to ignore existing customers and focus solely on acquiring new ones. Customer loyalty creates a barrier to entry for competitors and it is costly to switch a customer from one brand to another (Aaker, 2009: 35; Devrani Korkmaz, 2009: 408). Aaker defines brand loyalty as an indicator of consistency in a person's tendency to repurchase a particular brand. According to Oliver, brand loyalty is the user's tendency to choose the same brand again, despite all situational factors and marketing efforts of rival brands. According to Palumbo and Herbig, brand loyalty is the tendency of users to choose a particular brand again despite lower price policies and promotional activities of competitors (Çilingir & Yıldız, 2010: 82). The concept of brand loyalty is particularly important in fast-moving consumer goods and packaged goods. Research shows that users can be loyal to more than one brand in fast moving consumer goods. This refers to the fact that consumers choose among more than one brand that they find acceptable and prefer. There have been many studies on the definition and measurement of brand loyalty. The generally accepted definition by Jacoby and Chestnut (1978) explains brand loyalty as a prejudiced/qualified, behavioral response, continuous over time, as a result of decision-making processes, as a choice between multiple alternatives. As a result of the decision-making and evaluation process, users develop a commitment to the brand to which they are loyal. Brand loyalty refers to a commitment to a brand, as opposed to a tendency to repurchase. Dick and Basu (1994) define brand loyalty as "a behavioral response sustained consistently over time by a decision-making unit". Onkvisit & Shaw (1989) explain brand loyalty as a consistent preference after the act of purchase, expressed as attitudes and behaviors towards a brand. Hallberg (2004), on the other hand, defines

consumer loyalty as the act of repeatedly preferring and continuously purchasing the same brand by establishing an emotional bond with the brand. In particular, experiential service brands are of interest that are characterised by higher levels of employee contact, customisationdirected toward people, and with a strong people orientation (Ismail et al., 2011). While some authors claim that it affects brand loyalty directly, others have found that it is a dependent variable, which, alone does not have any immediate effect on brand loyalty (Maheshwari & Lodorfos: 2014a).

4. THE EFFECT OF PERCEIVED SERVICE QUALITY ON BRAND LOYALTY

In both developed and developing economies, the growth rate of the service sector is increasing and this sector represents a significant portion of the global domestic product; in fact, it is known that this sector accounts for approximately two-thirds of the global domestic product. The competitive conditions triggered by the globalization process and the increasing importance of services in parallel with economic and industrial developments require businesses to provide high quality services in order to survive (Koparal, 1997: 324; Okumuş & Duygun, 2008: 20). In recent years, the rapid evolution of the service sector and the intensification of competition in expanding markets have increased the sensitivity and awareness of the society towards quality, which has led service businesses to give more importance to quality. Service quality perceived by customers is a critical factor impacting brand loyalty in the service sector (Zeithaml et al., 1996: 33; Sivadas & Baker-Prewitt, 2000: 73). According to the study conducted by Zeithaml et al. (1996), perceived service quality directly affects brand loyalty, while Taylor & Baker (1994) stated that this effect can also occur indirectly, especially customer satisfaction plays an important mediating role in this process (Taylor & Baker, 1994: 174-176; Brady et al., 2002: 27). Expectations are prominent in perceived quality; what consumers expect from a five-star hotel in terms of service quality differs from what they expect from a simple guesthouse. Just as the concepts of good and beautiful are relative, the concept of perceived quality is also relative (Erdoğan, 2014: 22).

In competitive environments, perceived service quality, customer satisfaction and brand loyalty are recognized as key elements of success for both manufacturers and service providers (Wang et al., 2004: 325). Cronin & Taylor (1992: 55) found positive causal relationships between customer satisfaction and service quality in the banking and fast food sectors. In their study on the travel behavior of university students, Gallarza & Saura (2006: 437) revealed that perceived service quality is an important factor affecting consumer behavior. The study conducted by Price et al. (1995) in the tourism industry indicated that there is a positive relationship between perceived service quality and customer satisfaction and that if this relationship is repeated, the link between satisfaction and loyalty will be strengthened.

Perceived service quality is a relative concept that can vary depending on individual experiences and expectations. Studies by Nguyen & Leblanc (1998), Bloemer et al. (1999), and Snoj et al. (2004) have shown that perceived service quality can have an impact on loyalty through satisfaction as well as directly on loyalty. Customers' positive and negative perceptions of products or services affect their level of satisfaction. In order to ensure customer loyalty, it is important to understand customers' satisfaction with products or services and the perceptions that affect this satisfaction (Yılmaz & Çatalbaş, 2007: 85). Nadiri & Tümer (2007: 304) stated that high quality perception will have a positive effect on customers' future recommendation and behavior intentions.

Tangible elements encompass the concrete characteristics and amenities of a service environment, including the visual appearance of equipment, facilities, staff, and communication materials. By providing a visible feature that customers can readily evaluate, these factors enhance the customer's view of the total service quality. The tangible dimension, as identified by Zeithaml, Parasuraman, & Berry (1988), plays a crucial role in guiding clients to develop expectations about the service, particularly during the pre-purchase phase. Recent research has underscored the importance of tangible factors in influencing customer views, especially in industries where the physical environment is a major component of the service experience (Chua et al., 2018; Nguyen et al., 2021). Specifically, in the hotel sector, the level of cleanliness in rooms, the professional demeanor of staff, and the layout of the lobby play a crucial role in determining the overall happiness of guests (Ali et al., 2022). Reliability was defined as the service provider's capacity to consistently and precisely deliver the promised service. It is widely recognized that this dimension is a key determinant of customer satisfaction, since it directly affects the reliability and credibility of the service provider (Parasuraman et al., 1985). The concept of reliability encompasses elements such as punctual delivery of services, adherence to commitments, and the preservation of accurate records. Contemporary studies have demonstrated that dependability continues to be a crucial factor in determining the quality of service in several sectors, such as healthcare, banking, and telecommunications (Lee et

al., 2017; An et al., 2019). Deploying a consistent and dependable service delivery system cultivates consumer confidence, resulting in increased customer loyalty and favorable word-of-mouth (Bolton & Mattila, 2015). Explicit enthusiasm indicates the level of preparedness and eagerness of the service staff to assist clients and deliver timely services. Although excitement is sometimes used interchangeably with responsiveness, it has been recognized as a separate factor that influences consumers' evaluation of service quality (Parasuraman et al., 1988).

The presence of enthusiastic personnel exudes a palpable vitality and optimism, therefore augmenting the whole client experience. Kumar & Shah (2018) argue that employees who actively demonstrate enthusiasm not only enhance their ability to meet client demands more efficiently but also establish an emotional bond with the consumer, which is crucial for cultivating loyalty. The level of enthusiasm shown by employees in service sectors such as hospitality and retail has been shown to have a substantial influence on customer satisfaction and their likelihood to experience repeat business (Bharwani & Jauhari, 2017; Chiang & Wu, 2020). Trust, within the SERVQUAL paradigm, pertains to the service provider's capacity to instill confidence and give clients with assurance regarding the dependability and safety of the service. This dimension encompasses elements like as proficiency, politeness, and safety, guaranteeing that clients experience a sense of security in their engagements with the service provider. Parasuraman et al. (1988) recognized trust as a pivotal element in the establishment of enduring client relationships, particularly in services characterized by significant levels of risk, such as financial services or healthcare. Recent studies have emphasized the significance of trust in establishing robust customer connections, especially in the digital age, when customers are growing more preoccupied with the protection of their data and privacy (Crosby & Johnson, 2019; Hollebeek et al., 2021). Establishing trust through open and honest communication and maintaining high standards of quality has been shown to greatly improve customer satisfaction and loyalty (Morgan & Hunt, 1994; Ranaweera & Sigala, 2015). Empathy encompasses the level of concern and personalized involvement that the service provider extends to its clients. It encompasses comprehending the particular requirements of clients, giving accessible assistance, and delivering tailored services. Effective empathy is essential for establishing a customer-centric culture in service organisations (Zeithaml et al., 1990). Previous research has indicated that when service providers exhibit empathy, clients are more inclined to perceive themselves as being appreciated and comprehended, resulting in increased levels of pleasure and loyalty (Yoon & Uysal, 2005; Lee & Hyun, 2016). Within the healthcare and education industries, empathy has been recognized as a crucial indicator of favorable experiences for patients and students (Mercer & Reynolds, 2002; Ali & Raza, 2017). As a result, studies show that loyalty increases with increasing service quality, which leads to a decrease in the tendency to switch and complain (Parasuraman et al., 1996: 42).

5. METHODOLOGY

A questionnaire-based survey was employed in the study to gather data from participants. The SERVPERF scale, created by Cronin & Taylor (1994), was used to construct the questionnaire for assessing individuals' perception of service quality. The selection of the SERVPERF scale was based on its ability to directly assess the performance as viewed by the customer, as opposed to the SERVQUAL model which estimates the gap between customers' expectations and perceptions. Furthermore, the survey included items pertaining to recommendation intents and repurchase behavior to evaluate brand loyalty, based on the scale developed by Zeithaml et al. (1996). The survey had elements that corresponded to the five fundamental aspects of perceived service quality: Tangible Elements, Reliability, Enthusiasm, Trust, and Empathy. All items were evaluated using a 5-point Likert scale, which included responses ranging from "strongly disagree" to "strongly agree." This facilitated participants in articulating their degree of agreement with different statements pertaining to their experiences and views on service quality and brand loyalty.

The survey focused on clientele residing in luxury hotels with a five-star rating in Istanbul. A sample size of 204 individuals was established, including both male and female attendees. In order to guarantee a sample that accurately represents the population, participants were chosen based on their recent accommodation in a luxury hotel. The sampling technique employed was purposeful and convenient, specifically targeting visitors who had recently encountered the service quality of luxury hotels. This selection was made to ensure that the potential influence of perceived service quality on brand loyalty could be effectively evaluated.

In order to have a thorough picture of the sample, demographic factors including age, gender, marital status, education level, income, and employment position were documented. Prospective participants were approached and requested to complete the questionnaire on a voluntary basis. The acquired data were further examined using a range of statistical techniques, including as descriptive statistics, exploratory factor analysis, and structural equation modeling, in order to assess the correlation between perceived service quality and brand loyalty.

This study was evaluated at the Ethics Committee meeting of İstanbul Nişantaşı University, on 07.03.2024, with the number 2024/03, and it was unanimously decided that the study complies with ethical standards. The decision number is 20240307/15.

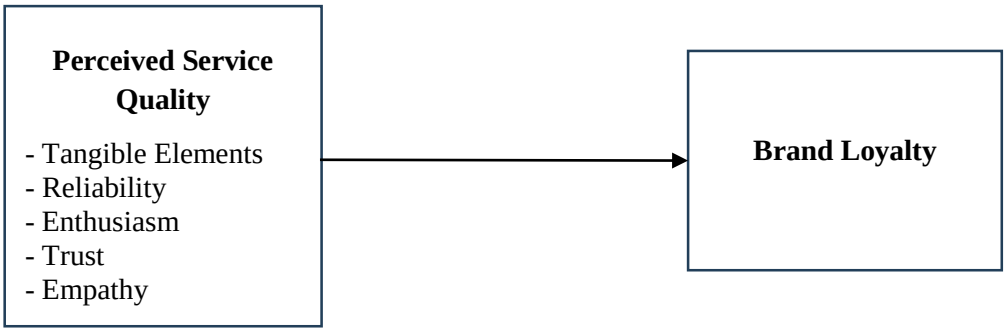

Figure 1. The Model of the Study

The hypotheses were formed as follows:

H_1: Perceived service quality has an impact on brand loyalty.

H_{1a}: Perceived quality of tangible elements has a positive effect on brand loyalty.

H_{1b}: Reliability of service has a positive effect on brand loyalty.

H_{1c}: Staff's enthusiasm in service delivery has a positive effect on brand loyalty.

H_{1d}: The reassurance capacity of service providers has a positive effect on brand loyalty.

H_{1e}: Service providers' capacity to show empathy has a positive effect on brand loyalty.

SPSS 24.0 program was used for statistical analysis. Descriptive statistical methods, explanatory factor analysis and confirmatory factor analysis were used to evaluate the study data. Structural equation modelling was used for effect analysis. Significance was evaluated at $p<0.01$ and $p<0.05$ levels.

5.1. Distribution of Demographic Characteristics

Table 1 provides a detailed analysis results of the participants' demographic characteristics and hotel stay experiences. As shown in Table 1, data on participants' gender, age, marital status, education level, income, employment status, reasons for hotel stays, frequency of stays at the same hotel, and stays at other hotels are analyzed. Of the participants, 52% (n=106) were female and 48% (n=98) were male. In terms of age distribution, 14.7% (n=30) were between the ages of 18-28, 31.9% (n=65) were between the ages of 29-38, 34.9% (n=71) were between the ages of 39-48 and 18.6% (n=38) were 49 years and older. In terms of marital status, 53.9% (n=110) of the participants were single and 46.1% (n=94) were married. In terms of educational level, 21.7% (n=44) were high school graduates, 14.2% (n=29) were associate degree graduates, 51.5% (n=105) were bachelor's degree graduates and 12.7% (n=26) were postgraduate graduates. According to income level, 14.7% (n=30) had an income of 17,002-25,000 TL, 12.3% (n=25) 25,001-35,000 TL, 13.7% (n=28) 35,001-45,000 TL, 22.8% (n=47) 45,001-55,000 TL and 36.8% (n=75) 55,001 TL and above. According to the organization, 30.4% (n=62) were self-employed and 54.9% (n=112) worked in the private sector. According to the purpose of hotel stay, 80.4% (n=164) stayed for vacation and 19.6% (n=40) for business purposes. According to the length of previous stay in the same hotel, 28.8% (n=58) had never stayed, 48.5% (n=98) had stayed 1-3 times, and 22.5% (n=46) had stayed more than 3 times. According to the length of stay in another hotel, 41.2% (n=83) stayed 1-3 times, 53.4% (n=107) more than 3 times and 5.4% (n=11) never.

Table 1. Demographic Information

		n	%
Age	18-28	30	14,7
	29-38	65	31,9
	39-48	71	34,8
	49 and above	38	18,6
Gender	Male	98	48,0
	Woman	106	52,0

Marital status	Single	110	53,9
	Married	94	46,1
Education Status	Bachelor's Degree	105	51,5
	Graduate Graduate	26	12,7
	High School Graduate	44	21,6
	Associate Degree Graduate	29	14,2
Income Level	17,002-25,000 TL	30	14,7
	25,001- 35,000 TL	25	12,3
	35,001-45,000 TL	28	13,7
	45,001-55,000 TL	46	22,5
	55,001 TL and above	75	36,8
Employed Institution	Public	30	14,7
	Own Business	62	30,4
	Special	112	54,9
Purpose of Hotel Accommodation	Work	40	19,6
	Holiday	164	80,4
Previous stay in the same hotel	1-3 times	100	49,0
	3-above	46	22,5
	Nothing	58	28,4
Duration of Stay at Another Hotel	1-3 times	84	41,2
	3-above	109	53,4
	Nothing	11	5,4

5.2. Results of Exploratory Factor Analysis

The Kaiser-Meyer-Olkin (KMO) adequacy measure and Bartlett's Sphericity test were used to measure the applicability of the factor analysis. The closer the (KMO) measure is to 1, the more appropriate it is to perform factor analysis on the available data group (Živadinović; 2004). In the analysis, it was calculated as 0.835 in the brand loyalty scale and 0.947 in the perceived service quality scale. As a result of the data obtained, it was deemed appropriate to analyze the data group.

Table 2. KMO and Bartlett's Test Results of Perceived Service Quality and Brand Loyalty Scales

	Brand Loyalty Scale	**Perceived Service Quality Scale**
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0,835	0,947
Chi-Square	1340,499	3341,658
Df	15	231
Sig.	<0.000	<0.000
Explained Variance Ratio	89,340	72,589

According to the results of the exploratory factor analysis, the total variance explanation rate of the brand loyalty scale was calculated as 89.340% and the total variance explanation rate of the perceived service quality scale was calculated as 72.589%. It is accepted that the larger the variance ratios obtained as a result of the analysis, the stronger the factor structure is and that it is sufficient for this value to be between 40% and 60% in social areas (Karagöz, 2017). In order to be able to say that an item measures a construct or factor well, the value of this factor loading is expected to be 0.30 or higher (Stevens, 2002). The results of the research support these findings and all values were found within the range specified in the literature.

5.3. Normality Distributions and Cronbach Alpha Results

Skewness and kurtosis values are taken into account to decide whether a distribution shows a normal distribution. At this point, the cut-off points (limits) of kurtosis and skewness values should not be above 3 in absolute value for skewness and above 10 in absolute value for kurtosis (Kline, 2011). Since all values found in our study were within the specified limit ranges, they are suitable for normal distribution.

Cronbach Alpha values of the scales between 0.70 and 0.99 indicate that they are reliable (Tavakol & Dennick, 2011). Since all the values found in our study are within the specified limit ranges, our scales are reliable.

Table 3. Scale Mean Scores, Normality Distributions and Cronbach's Alpha Values

	Avr+SS	Min-Max (Medyan)	Skewness	Kurtosis	Cronbach's Alpha
Tangible Elements	4,16±0,58	2,25-5 (4)	-0,346	-0,040	0,791
Reliability	4,19±0,58	2,8-5 (4)	0,000	-0,978	0,920
Enthusiasm	4,07±0,59	2,6-5 (4)	0,043	-0,681	0,867
Trust	4,16±0,55	2,5-5 (4)	0,118	-0,493	0,839
Empathy	3,96±0,64	2,5-5 (4)	0,041	-0,574	0,819
Total Perceived Service	4,11±0,52	2,83-5 (4)	0,204	-0,662	0,958
Recommending to Others	4±0,81	1-5 (4)	-0,974	1,867	0,938
Repurchase	4,2±0,61	1,67-5 (4)	-0,476	1,038	0,926
Total Brand Loyalty	4,1±0,66	1,33-5 (4)	-0,630	1,464	0,939

5.4. Confirmatory Factor Analysis Results

Confirmatory Factor Analysis (CFA) was applied to determine the construct validity of the scales used in the study and the fit values obtained are shown in Table 4.

Table 4. Fit Values

Compliance Criteria	$\chi 2$	P	χ 2/df	RMSEA	SRMR	NFI	CFI	NNFI
Total Perceived Service Scale	16,44	0,000	3,28	0,091	0,084	0,98	0,97	0,97
Brand Loyalty Scale	2874,90	0,000	4,77	0,096	0,077	0,93	0,95	0,95

Table 5. Compliance Index Criteria

Compliance Measures	Good Fit	Acceptable Compliance
$\chi 2$/df	≤ 3	$\leq 4 - 5$
GFI	≥ 0.90	0.89 - 0.85
CFI	≥ 0.97	≥ 0.90
RMSEA	≤ 0.05	0.06 - 0.08
NFI	≥ 0.95	0.94 – 0.80

As a result of the analysis, RMSEA, SRMS, NFI, CFI and GFI measurements are within the fit values. Accordingly, it shows that the research data have an acceptable and good fit and that our confirmatory factor analysis is statistically significant and valid (Erkorkmaz et al. 2013). Figure 2 shows the standardised regression values and goodness of fit indices of the model related to the total perceived service scale.

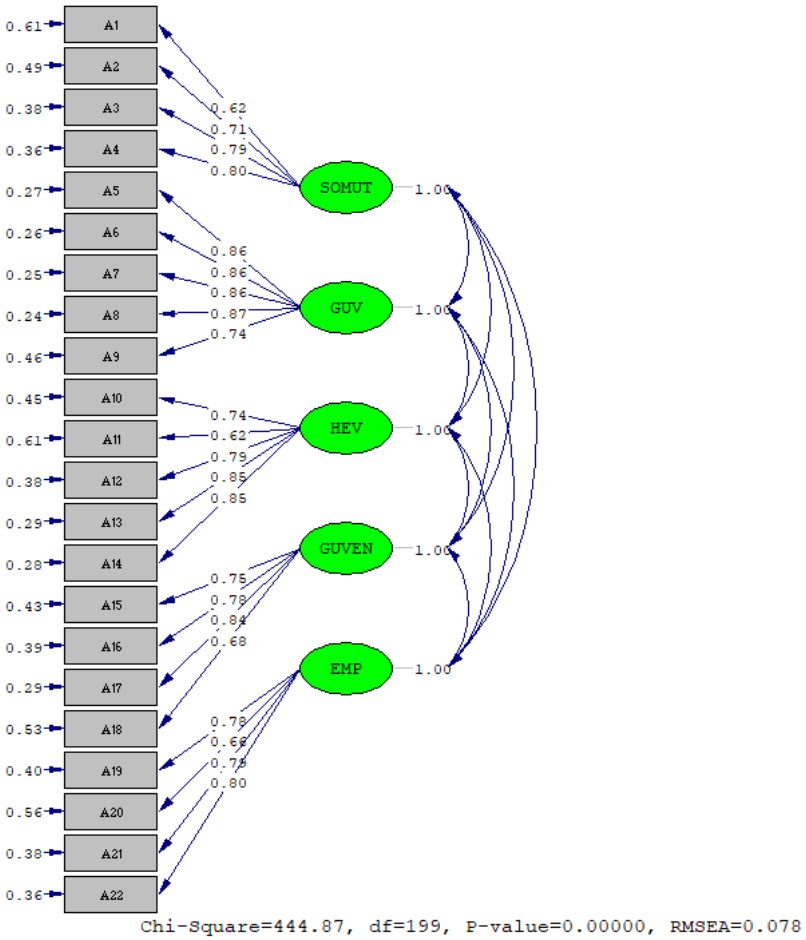

Figure 2. Total Perceived Service Scale Standardized Model Outputs

The goodness of fit index values obtained according to the model in Figure 1 are within acceptable limits (X2/df=2.23, RMSEA=0.078, p<0.05). Standardised regression coefficients vary between 0.62 and 0.86. The model and the regression coefficients obtained are statistically significant (p<0.05).

Figure 3 shows the standardised regression values and goodness of fit indices of the model related to the brand loyalty scale.

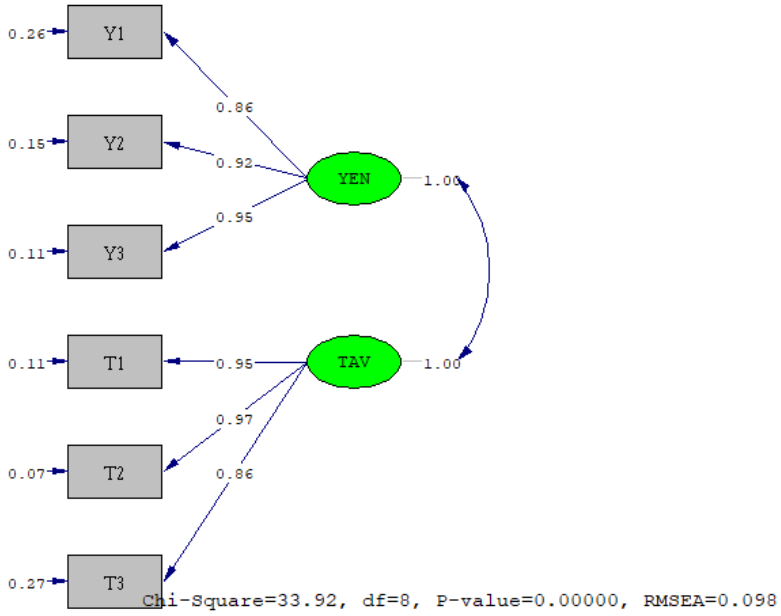

Figure 3. Brand Loyalty Scale Standardized Model Outputs

The goodness of fit index values obtained according to the model in Figure 2 are within acceptable limits (X2/df=4.24, RMSEA=0.098, p<0.05). Standardised regression coefficients vary between 0.86 and 0.97. The model and the regression coefficients obtained are statistically significant (p<0.05).

5.5. Results of Hypothesis

Structural equation modeling was used to determine the effect of perceived service quality on brand loyalty. Our model outputs were found to be between acceptable fit and perfect fit. In addition to these criteria, if the {χ2 / df} value is less than 3, it means that there is an acceptable fit. For this model, χ2/df =1066.29/336=3.17. This means that the model is statistically significant (Erkorkmaz et al. 2013). The goodness of fit values and limits for the structural model given in Figure 3 are given in Table 6.

Table 6. Structural Model Limits

Limits	Good Fit	Acceptable Fit	Model
RMSEA	0 ≤ RMSEA ≤ 0.05	0.05 < RMSEA ≤ 0.10	0.098
NFI	0.95 ≤ NFI ≤ 1	0.90 < NFI < 0.95	0.94
NNFI	0.97 ≤ NNFI ≤ 1	0.95 ≤ NNFI < 0.97	0.95
CFI	0.97 ≤ CFI ≤ 1	0.95 ≤ CFI < 0.97	0.95
SRMR	0 ≤ SRMR < 0.05	0.05 ≤ SRMR < 0.10	0.066

Figure 4 shows that Tangible has a positive effect on brand loyalty with a coefficient of 0.26. Reliability has a negative effect on brand loyalty with a coefficient of 0.18. Enthusiasm has a positive effect on brand loyalty with a coefficient of 0.03. Trust has a positive effect on brand loyalty with a coefficient of 0.51. Empathy has a positive effect on brand loyalty with a coefficient of 0.25.

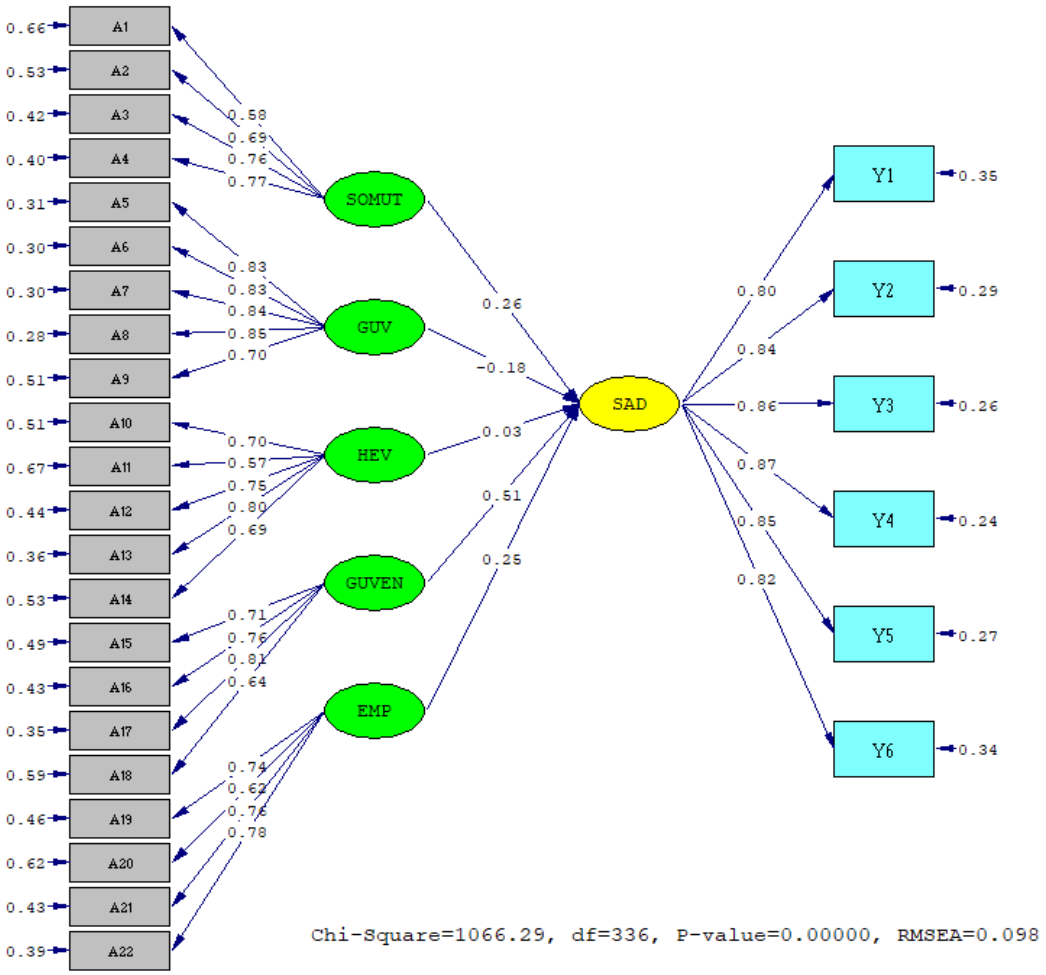

Figure 4. Structural Equation Model

Table 7. Hypothesis Results

Hypothesis		Acceptance/ Rejection
H_1	Perceived service quality has an impact on brand loyalty.	Accepted
H_{1a}	Perceived quality of tangible elements has a positive effect on brand loyalty.	Accepted
H_{1b}	Reliability of service has a positive effect on brand loyalty.	Rejected
H_{1c}	Staff's enthusiasm in service delivery has a positive effect on brand loyalty.	Accepted
H_{1d}	The reassurance capacity of service providers has a positive effect on brand loyalty.	Accepted
H_{1e}	Service providers' capacity to show empathy has a positive effect on brand loyalty.	Accepted

As shown in the table based on the analysis, the reliability factor (H1b) had a negative impact on brand loyalty, resulting in its rejection. Other hypotheses (H_1, H_{1a}, H_{1c}, H_{1d}, and H_{1e}) were accepted, indicating a positive effect of the respective factors on customer brand loyalty.

6. CONCLUSION

This research examined the effects of perceived service quality on brand loyalty and the findings revealed the important role of various dimensions of service quality on customer behavior. The analysis showed that the reliability factor has a negative impact on brand loyalty with -0.18. This emphasizes that the lack of consistent and reliable service has a negative impact on customer loyalty and how critical it is to meet customers' expectations of reliable service.

On the other hand, the factors of tangibility (0.26), enthusiasm (0.03), trust (0.51) and empathy (0.25) were found to have positive effects on brand loyalty. The embodiment shows that the physical elements of the service have an important place in customer perception and that the elements that make the quality of the service tangible increase customer loyalty. Enthusiasm indicates that the interest and enthusiasm shown by service personnel towards customers have a positive effect on loyalty. The trust factor reveals that customers' trust in the service provider is one of the strongest factors in increasing loyalty. Finally, empathy shows that understanding and being sensitive to customers' needs and emotions positively affects customer loyalty.

In our age, the similarity of products poses a serious problem. In this situation, it may be insufficient for businesses to rely solely on traditional marketing techniques or advertising strategies for their long-term success. If businesses want to achieve sustainable success, they need to approach the issue from a broader perspective. For this reason, businesses aiming to increase their competitive advantage by offering personalized customer experiences in order to get to know their customers and establish an emotional bond with them, apply various innovative marketing techniques. Brand experience, as an interactive and personalized marketing approach that symbolizes the products and services offered by the brand, meets people's emotional and psychological needs. In this context, consumers attach much more importance to the emotional and value-laden experiences offered by a brand than simply defining a brand by price or quality (Zhang, 2019: 556-557).

Recently, academics and marketing professionals have emphasized the critical importance of managing customer experiences in the value creation process (Berry et al., 2002; Iglesias et al., 2011). In this context, the marketing strategies of businesses represent a shift in focus from product attributes and quality to the quality, accuracy, and effectiveness of experiences (Klaus & Maklan, 2013). For businesses aiming to gain a competitive advantage in the market, clearly defining and developing the brand experience has gained great importance (Ismail et al., 2011; Maheshwari & Lodorfos, 2014b). Recent studies have further validated this focus, demonstrating that a well-designed customer experience significantly influences emotional attachment and brand loyalty, thereby driving customer retention and advocacy (Lemon & Verhoef, 2016; Khan et al., 2021). Especially in the service sector, the concept of experience has become an integral part of service delivery, and in this context, improving the experience and service quality is seen as one of the most important success factors in building customer loyalty. Service-dominant logic emphasizes that value is co-created with customers through their experiences, making the quality of these interactions crucial for fostering strong customer-brand relationships (Vargo & Lusch, 2016; McColl-Kennedy et al., 2019). Additionally, digital transformation in recent years has amplified the need for businesses to deliver seamless and engaging experiences across multiple touchpoints, further highlighting the role of customer experience in the contemporary marketplace (Bolton et al., 2018; Verhoef et al., 2021).

Geçen (2011) examined the effect of service quality on brand choice and customer loyalty in low-cost airlines. According to the results of the study, perceived service quality directly affects customer satisfaction. At the same time, passengers' satisfaction with their previous travel experiences was found to be linked to their likelihood of choosing the same airline in the future. This finding aligns with more recent studies that highlight the role of perceived service quality in shaping customer perceptions and behaviors in various service sectors, including aviation (Ali et al., 2022; Park et al., 2021). Erdoğan (2014) conducted a field study on the impact of brand equity on customer loyalty through the example of Starbucks. Quantitative analyses revealed that perceived quality increases customer loyalty, but brand awareness has no significant effect on this loyalty. The study also indicated that loyalty cards strengthen customer loyalty. Recent research has supported these conclusions, emphasizing that loyalty programs can enhance customer retention by offering tangible rewards, thereby creating an emotional connection with the brand (Kumar & Shah, 2020; Yang & Rahman, 2022). Furthermore, while brand awareness alone may not significantly drive loyalty, the combination of perceived quality, customer satisfaction, and loyalty programs has been shown to form a more holistic approach to cultivating long-term customer loyalty (Mende et al., 2019).

Karadeniz and Demirkan (2015) evaluated the relationship between service quality and brand loyalty in the retail sector in the case of Migros stores. The results showed that service quality reinforces brand loyalty. These findings are consistent with more recent research in the retail sector, which indicates that high service quality not only enhances customer satisfaction but also leads to increased trust and loyalty towards the brand (Hameed et al., 2022; Chen et al., 2020). Service quality has been identified as a critical factor in differentiating brands, especially in highly competitive markets, and it plays a vital role in fostering customer retention and advocacy (Gopalakrishnan et al., 2021). Kaya (2015) analyzed the relationship between brand loyalty, brand image, and perceived quality in the white goods sector. The findings revealed that perceived quality positively affects both brand image and brand loyalty, while brand image positively contributes to brand loyalty. This relationship has been further substantiated by recent studies, which suggest that a strong brand image can act as a mediator between perceived quality and customer loyalty, enhancing the overall customer experience and emotional attachment to the brand (Liu & Brock, 2019; Le & Shao, 2023). Moreover, perceived quality's influence on brand loyalty extends beyond functional aspects, encompassing emotional and symbolic associations that drive long-term customer commitment (Wang et al., 2022).

It has been observed that the results of the research and previous studies in the literature contain similar and compatible results. The findings reveal the existence of a significant and strong relationship between perceived service quality and brand loyalty. This relationship shows that consumers' loyalty to a brand is directly influenced by the quality of the services offered and that this quality increases customer satisfaction and reinforces loyalty. In this context, it is understood that service quality is a key factor that positively affects not only immediate customer satisfaction but also long-term customer loyalty. Therefore, for businesses, improving perceived service quality should be central to their customer relationship management strategies. These strategies are one of the basic building blocks for brands to gain a sustainable advantage in the competitive market. To summarize, the research once again confirms that the dynamic interaction between service quality and brand loyalty is a critical issue frequently emphasized in brand management literature.

The research results reveal that the perceived quality of service has a strong and direct impact on brand loyalty. It is observed that dimensions of service quality such as reliability, tangibility, enthusiasm, trust, and empathy shape customer behavior. While the inability to provide reliable service negatively affects loyalty, factors like trust, physical elements, and empathy strengthen it. These findings emphasize the critical role of improving service quality in customer relationship management strategies for businesses to maintain a sustainable competitive advantage. Therefore, offering personalized experiences that create emotional connections with customers and continuously enhancing service quality emerge as key elements in increasing brand loyalty.

AUTHORS' DECLARATION

This paper complies with Research and Publication Ethics, has no conflict of interest to declare, and has received no financial support. This study was evaluated at the Ethics Committee meeting of İstanbul Nişantaşı University, on 07.03.2024, with the number 2024/03, and it was unanimously decided that the study complies with ethical standards. The decision number is 20240307/15.

AUTHORS' CONTRIBUTIONS

Conceptualization, writing-original draft, editing – **AÖ, BP** and **AE**, data collection, methodology, analysis – **BP** and **AÖ**, Final Approval and Accountability – **AÖ** and **AE.**

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