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An Analysis of the Relationship Between Investor Risk Appetite and CDS Premiums in Turkey Using Asymmetric Methods

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Abstract

In this study, the asymmetric relationship between the Risk Tendency Indices calculated for each investor type and Turkey's CDS premium is investigated. The data set of the study consists of weekly frequency data covering the period April 2010-December 2023. Nonlinear ARDL (NARDL) method and Hatemi-J and Roca (2014) asymmetric causality test was used in the empirical analysis of the study. The findings show that in the long run, positive changes in the CDS premium have a greater impact on REKS Domestic and REKS Qualified indices than negative changes, while negative changes in the CDS premium have a greater impact on REKS Domestic Real, REKS Domestic Corporate and REKS Domestic Funds indices than positive changes. These findings reveal that the effects of market risks and uncertainties on investor groups are asymmetric.

Keywords: The Propensity to Risk Taking, Asymmetric ARDL, Asymmetric Causality.

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1. INTRODUCTION

Although the structure, characteristics, functioning, asset price formation, and the relationship between risk and return in financial markets can be theoretically and systematically explained, the volatilities and fluctuations in asset prices in financial markets can lead to significant differences in portfolio returns. Changes and developments in financial asset prices reflect shifts in investors' willingness to assume different types of risks. An increase in the overall demand for risky assets (risk appetite or inclination) leads to a rise in the demand for these assets, consequently driving up their prices. One of the most crucial determinants of asset prices is the investor's risk-taking propensity. Risk-taking propensity can be defined as the willingness of investors to assume financial risk with the expectation of achieving potential returns. Conceptually, risk-taking propensity differs from risk aversion and risk itself. Risk aversion is a highly specific concept related to investors' preferences to eliminate the likelihood of loss, including the utility function. Risk, on the other hand, refers to the loss or damage that may occur in the event of an occurrence. Risk-taking propensity or risk appetite reflects market participants' subjective assessments regarding potential developments in risks or investment opportunities and threats. Several factors influence investors' risk-taking propensity, including financial stability, market liquidity, and asset prices. Particularly in foreign exchange markets, which arguably come closest to a perfect competition market structure and never close globally, the predictability of asset returns associated with investor risk-taking propensity has been explained through hypotheses related to investor behavior or expectations (Fama, 1984, pp. 520-525). Fama and Bliss (1987, pp. 689-690) emphasize that investor expectations and systematic and unsystematic risks influence the difficulty in predicting returns. In this context, during periods of financial instability, deteriorating economic expectations, increasing macroeconomic problems such as inflation and current account deficits, narrowing market liquidity, and falling asset prices, increases in risk premiums are observed. Changes in CDS premiums are associated with market expectations and investor perceptions.

When the risk-taking propensity is high, it is expected that the portfolio will yield positive returns. In contrast, if the risk-taking propensity weakens, the portfolio's returns are likely to be negative. Consequently, when risk-taking is high, investors tend to replace less risky assets in their portfolios with riskier ones. Conversely, when the risk-taking propensity decreases, or in other words, when investors' risk aversion increases, investors prefer to sell their riskiest assets and replace them with risk-free assets such as government bonds.

As the Central Securities Depository of Turkish Capital Markets, Merkezi Kayıt Kuruluşu A.Ş. (MKK) and Özyeğin University calculate the Risk Appetite Index (REKS) separately for all investors, as well as for domestic investors (segmented into domestic individual and institutional investors), foreign investors, qualified investors, and domestic investment funds. These indices serve as indicators to measure the risk perception of investors in financial markets. They are used to determine the risk-taking tendencies (risk aversion or risk appetite) of market participants and investors. The REKS index values, which explain investor risk appetite, along with the Credit Default Swap (CDS) premiums that secure against the default or insolvency risk of states or corporate entities issuing financial assets, can be used to monitor the risk perception in financial markets, determine investment strategies, gain insights into the state of the economy or financial structure, and for portfolio diversification.

The Credit Default Swap (CDS), standardized by the International Swaps and Derivatives Association (ISDA) and defined as a "credit default swap," is an insurance mechanism that protects the buyer or investor against risks arising from the inability of a country or company issuing securities in international markets to repay its debt. Therefore, it is also used as an indicator in financial markets for investors' financial decisions and in determining country or company risk (Fettahoğlu, 2019, pp. 268-269). CDS contracts can be bought and sold in credit derivative markets and are priced according to countries and businesses' creditworthiness and repayment risk. Consequently, CDS premiums are also considered a credit risk indicator reflecting investors' views on foreign economies and financial markets (Kılcı, 2017, p. 145).

After the 1980s, when the process of financial globalization and liberalization began, financial markets encountered various financial risk elements, primarily exchange rates and interest rates. Systematic and unsystematic risks increased extreme volatility and uncertainties in financial markets. Following financial crises in many economies, some states or companies faced the risk of being unable to pay their debts on time due to poor risk management, and some even fell into bankruptcy. CDS products, designed to hedge against the default or bankruptcy risk of countries or companies, have gradually become indicators of country risk and economic and financial stability (Yapraklı & Güngör, 2007, p. 212). The CDS premiums of countries or firms are influenced by various factors such as the credit risk of the debtor entity, economic and financial structure, market conditions, interest rates on the relevant debt instrument, and liquidity. Therefore, instead of examining numerous macroeconomic indicators individually for every financial decision, investors can guide their investments by evaluating developments in investor risk appetite or CDS indicators.

This study aims to empirically examine the asymmetric relationship between the Risk Appetite Indices (REKS), calculated separately for different investor types by the Central Securities Depository (MKK), and Turkey's CDS premium. Using weekly data from April 9, 2010, to December 31, 2023, the analysis employs the nonlinear ARDL (NARDL) method by Shin, Yu, and Greenwood-Nimmo (2014) and the asymmetric causality test by Hatemi-J and Roca (2014). The NARDL method allows for the decomposition of positive and negative changes in the independent variable to measure their asymmetric effects on the dependent variable. Additionally, the Hatemi-J and Roca (2014) asymmetric causality test, used to detect asymmetric causality relationships between variables, separates shocks in the variables into positive and negative and considers their potential impacts separately. As a critical indicator of country risk, the CDS premium is closely monitored by investors to evaluate a country's risk perception. Continuously fluctuating based on market conditions, the CDS premium encompasses all risk factors that may influence financial markets and reflects current market dynamics daily. Changes in CDS premiums—whether increases or decreases—can significantly influence financial markets, resulting in price fluctuations of financial assets. Country-specific favorable or unfavorable developments play a pivotal role in shaping CDS premiums. An increase in CDS premiums is often interpreted as a signal that financial market participants may face heightened risks. Within this framework, this study employs asymmetric methods to estimate the effects of changes in CDS premiums on the Risk Appetite Indices (REKS), which are calculated separately for different types of investors by the Central Securities Depository (MKK). The main objective of this study is to analyze the asymmetric relationship between CDS premiums and risk appetite indices in Turkey and to make an original contribution to the existing literature. This study contributes significantly to the literature by encompassing an extensive data set period, starting from the initial calculation of risk appetite indices for different investor types. Furthermore, the use of up-to-date econometric techniques in the analyses distinguishes this study from existing literature and provides a methodologically innovative approach. Due to these contributions, the work is anticipated to have a distinctive position in literature. The study is structured as follows: introduction, a review of the empirical literature related to the research topic, the data set, the econometric methodology, the empirical findings, and finally, the conclusion.

2. INVESTOR RISK APPETITE AND CREDIT DEFAULT SWAPS: A THEORETICAL FRAMEWORK

The Efficient Market Hypothesis (EMH) asserts that financial asset prices promptly and fully reflect all available information, and that investors make rational decisions. According to this hypothesis, market participants cannot achieve returns beyond market averages, known as abnormal returns, by utilizing newly accessible information. Nonetheless, these assumptions have been criticized from the perspective of behavioral finance. Behavioral finance emphasizes that individuals often do not act as rational agents and examines the impact of irrational behaviors on financial asset pricing. It argues that psychological biases, emotional responses, and decision-making errors can lead to deviations from the principles of the Efficient Market Hypothesis. The Efficient Market Hypothesis (EMH) posits that financial markets fully incorporate all available information, suggesting that variations in CDS premiums should respond promptly and precisely to shifts in market risk appetite or credit risk perceptions. However, behavioral finance challenges the assumptions of EMH by highlighting factors that influence investor behavior, such as psychological biases like overconfidence and loss aversion. These biases can cause investors to deviate from rational decision-making processes, leading to market inefficiencies and anomalies in CDS pricing.

Market participants closely monitor investors' risk-taking propensity (risk appetite or willingness to take risks) as it is associated with fluctuations in financial markets or changes in asset prices. Various indicators are developed globally and in Turkey to determine investors' risk-taking tendencies, and studies are conducted to identify the determinants of investor risk perception.

Investor risk-taking propensity is sometimes referred to as "risk appetite," "investor confidence," or "investor sentiment" (ECB, 2007). Despite the different terminologies, the aim is to measure the risk-taking propensity of investors. The first index to determine risk appetite or risk propensity globally was created by Hamilton (1989) using the Markov Switching Model.

Today, various indices developed to measure investor risk propensity are generally prepared using two different approaches. In the market-based approach, investor risk propensity is measured using indices created by statistical methods based on data obtained from market prices. In this approach, the price volatilities or price differences of fixed-income or variable-income financial assets are differentiated according to the type of financial instrument or market structure to determine investor risk propensity. The most important risk perception (appetite) indicators calculated using this method include the Chicago Board Options Exchange's VIX volatility index, JP Morgan's Risk Tolerance indices, UBS's FX Risk Index, and Bank of America's Risk Appetite Monitor.

The second approach used to measuring risk propensity involves structured indicators prepared based on the correlation between volatilities and returns, using a financial or economic model applied to a single financial market. The Bank of England Index, the Goldman Sachs Risk Aversion Index, and the Credit Suisse Global Risk Appetite Index are examples of risk perception scales created using this approach (ECB, 2007, pp. 168-169).

One of the most important indicators prepared and announced to measure investor risk perception in Turkey is the Risk Appetite Index (REKS) calculated by the Central Securities Depository (MKK). The REKS indices are calculated based on investor portfolio changes. To determine the investor portfolio threshold value, the natural logarithm of factors such as the "USD exchange rate," "unemployment," "USD-based annual GDP growth rate," and "average portfolio values in Turkish Lira" is taken. The hypothesis that these factors have no effect on the threshold value is tested using linear regression methodology. The data of investors exceeding the defined threshold value are then examined to identify the factors affecting risk appetite. The REKS index calculates the change in investors' risk appetite by considering the number of stocks and stock umbrella funds held by investors as of the calculation date and their past data, adjusting for market returns.

A Credit Default Swap (CDS) is an insurance contract typically involving two parties, a buyer and a seller, where the buyer is protected against losses resulting from a credit event related to the underlying reference entity (Amato, 2005, p. 56). In a CDS contract, the buyer pays a premium to the seller in exchange for protection against adverse events such as the default or bankruptcy of the debtor associated with a specific debt instrument (bonds, stocks, etc.) or entity (a company or government).

CDSs are primarily used by investors to protect against the risk of non-payment of principal or interest at maturity of a financial asset or the risk of a firm's bankruptcy. Investors, especially those investing in public or private sector bonds, prefer to purchase CDSs to cover potential losses in case the issuing institution defaults. CDSs can be used as a tool for diversifying portfolios, protecting against specific risks, and for speculation. As such, CDSs are one of the most important instruments traded in derivative markets, used for gaining profit from price fluctuations or hedging against risk. Moreover, CDSs are closely monitored in financial markets as they are considered an important indicator reflecting a company of country's the creditworthiness or bankruptcy risk.

Interest rate risk and economic uncertainty significantly impact CDSs and risk appetite. Since CDS premiums are also evaluated as an indicator of market perception regarding a country's creditworthiness, an increase in CDS premiums indicates a deterioration in investors' perception of the country's credit risk. Therefore, governments and policymakers monitor CDS prices to gauge market sentiment and assess the effectiveness of economic policies. Increases in a country's CDS premiums are considered early warning signals of potential financial crises or macroeconomic vulnerabilities, supporting the implementation of preventive policies by economic management. Lastly, as CDS premiums indicate investor confidence and financial stability, they facilitate or hinder countries' ability to raise funds in international money and capital markets by affecting the cost of borrowing.

The relationship between CDS premiums and risk appetite is important because it provides valuable information, primarily for foreign investors making investment decisions in another country and for policymakers implementing economic policies related to liquidity conditions in a financial market.

3. LITERATURE REVIEW

Internationally, various instruments are used to measure risk appetite and some major investment banks developed their own risk appetite indices. However, the most widely used risk appetite indicator in the world is the Chicago Board Options Exchange Volatility Index (VIX), which is derived from S&P options, while in Turkey, the REKS indices prepared by the Central Registry Agency stand out in this field. In the literature, studies that measure risk appetite, analyze the determinants of risk appetite or CDS premiums, or examine the relationship between different risk appetite indicators and CDS premiums fall into three main categories. The first category includes studies that examine the determinants of risk appetite or CDS premia, while the second category focuses on the relationship between risk appetite and asset returns or CDS premia and asset returns. The third category analyzes the interactions between various risk appetite indicators and country risk or CDS premia.

Numerous studies focus on the causal relationship between CDS premiums and various variables, such as financial markets, asset prices, stock prices, interest rates, exchange rates, volatility indices, country credit ratings, national income, current account deficits, portfolio investments, and investor risk perception, in Turkey and around the world. Table 1 below summarizes some selected studies from the national and international literature in this field, providing information on their scope, models, data sets, findings, and other relevant details.

Risk-taking or risk-aversion propensity is an unobservable phenomenon that can change over time. Risk-taking propensity increases with the returns on risky assets but decreases with equity volatility. Since the risk-taking or risk-aversion propensity of investors can vary according to the type of assets and markets, it is impossible to create a single index with the same structure on a global scale. Therefore, results obtained from studies using different economic tests based on different countries, investor groups, or different assets provide a framework supporting the development of this subject.

The increasing trends of globalization and financial liberalization following the implementation of neo-liberal economic policies since 1980, along with the rapid development of communication technologies, have brought financial markets closer globally. As a result, the savers or investors of one country have started allocating resources to cross-border investments. This situation has necessitated the consideration of various market-driven, economic, or political risk factors, primarily interest rate and exchange rate risks, in such investment decisions. However, the production of indicator indices based on different variables by many public and private sector financial institutions, both domestically and internationally, has become an important tool for investors in making investment decisions (Gemici et al., 2023, p. 2).

As mentioned in the second section above, numerous indices have been created as indicators of market fluctuations and asset or country risks related to investor risk propensity. In recent years, many studies have been conducted, both nationally and internationally, to investigate the determinants of these indices and financial indicators and their relationships with other macroeconomic variables.

Studies in this field have examined the determinants of investor risk appetite created by various financial institutions or organizations, ant the determinants of derivative instruments like CDSs that insure against country or security default risks. They have also investigated the effects of macroeconomic variables such as GDP growth rate, inflation, stock prices, exchange rates, interest rates, current account balance, central bank foreign exchange reserves, money supply, oil prices, and more on investor risk propensity or CDS premiums. Below, some important similar studies are listed, detailing the variables used, data sets, models applied, and empirical findings.

The literature summarized below indicates that studies generally focus on the macroeconomic or financial determinants of CDS premiums and risk appetite indicators. Research on CDS premiums (Hull & White, 2000; Tang & Yan, 2009; Kargı, 2014; Galil et al., 2014; Jopp, 2023) identifies a negative relationship between macroeconomic variables, such as GDP and interest rates, and CDS premiums. Studies investigating the macroeconomic variables influencing risk appetite (Gai & Vaus, 2005; Cipollini et al., 2018) reveal that interest rates and exchange rates negatively affect risk appetite. In the Turkish context, studies analyzing the relationship between CDS premiums and the MKK risk appetite index (REKS) (Çelik, Dönmez, & Acar, 2017; Fettahoğlu, 2019; Çiftçi & Reis, 2020; Alptürk et al., 2021; Kaya et al., 2024) report a significant relationship between investors' risk appetite indicators and CDS premiums. Furthermore, the analyses demonstrate that the CDS premium and risk index are crucial indicators for understanding investor behavior and measuring investor sentiment, highlighting a close relationship between these two measures.

Table 1. Literature Summary

Author(s)	Scope, Period, Model Variables	Model, Findings, Conclusion, and Recommendation
Hull & White (2000)	This study assumes that the amount bondholders would claim in case of default depends on the difference between the post-default market value of the bond and its nominal value.	One of the first studies on CDS premiums. This study examines the risk-neutral default probabilities obtained from market prices for a series of bonds from the same issuer, under the assumption that debtor's default risk is zero and that the risk is on the CDS issuing institution, along with swap values and the shape of the yield curve.
Gai & Vause (2005)	The concepts of risk appetite, risk aversion, and risk premium are explained. A a new risk appetite measurement model is proposed by relating the risk premium expected by investors to the returns for taking that risk.	The model assesses the risk-neutral probabilities of future returns, differentiates risk appetite from risk aversion, and shows that risk appetite fluctuates within a narrow range during 'normal' times but drops sharply during crises.
Tang & Yan (2010)	The impact of macroeconomic variables on countries' CDS premiums was investigated.	A negative relationship was found between GDP and a country's CDS premiums, and it was determined that market-level investor sentiment is the most important determinant of credit spreads.
Kargı (2014)	The causality relationship between CDS premiums, GDP, and interest rates was determined using data from the period 2005:01–2013:03 and five different tests.	The research concluded that there is a bidirectional causality between CDS and market interest rates. Although there is a long-term relationship with GDP, it does not exist in the short term. CDS spreads in the Turkish economy are mostly affected by market interest rates.
Galil, et al., (2014)	The study proposes four different models for analyzing the determinants of CDS premiums and premium changes using data from 718 US firms, including stock returns, volatility, and rating scores, covering 2002-2013.	The findings suggest that market variables have explanatory power for CDS premiums, all three variables perform well, the models can be improved with additional variables. Credit rating scores are statistically insufficient in explaining CDS spreads.
Kaya, et al., (2014)	The relationship between the BIST 100 index and political risk (International Country Risk Guide (ICRG) "Political Risk Index") was analyzed using data from the period 1998-2012.	The findings indicate a long-term relationship between the political risk index and the BIST 100 index, with political risk fluctuations affecting the stock index. A negative relationship was found between the two variables.
Gatumel & Lelpo (2015)	A new measure of risk appetite based on the cross-sectional behavior of extreme returns in financial markets is proposed.	Empirical tests using different data sets and models suggest that a data set consisting of asset allocation and related assets provides reliable measurement and predictions of risk aversion among various alternatives.
Çelik, et al., (2017)	The macroeconomic factors determining the MKK risk appetite index were investigated using data from the period 2008-2017 and time series regression analysis.	The analysis concluded that increases in interest rates and exchange rates negatively affect the MKK indices determining investor risk appetite in Turkey. In contrast, increases in money supply and CBRT foreign exchange reserves have a positive impact. GDP and current account balance data have no impact on investor risk appetite.

(Table 1 cont.)

Cipollini, et al., (2018)	The interconnectedness of risk aversion, vulnerability, and systemic risk aversion among five European countries was examined using variance risk premia over the period 2000–2013. The analyses were performed using a FIVAR model for long-term memory and a VAR model for short-term memory.	A long-memory VAR model is found to produce more accurate linkage estimates than short-memory models. It is found that risk aversion indices peaked during the collapse of Lehman Brothers and the 2010-2011 European debt crisis, with Germany contributing the least to systemic risk aversion and the Netherlands and the United Kingdom contributing the most. In addition, the Netherlands was found to be the least exposed country to systemic risk, while Switzerland was the most exposed country.
Fettahoğlu (2019)	The relationship between Turkey's 5-year CDS premiums for the period November 2013-February 2018 and the Risk Appetite Index calculated by MKK was examined. Control variables include EUR/TRY and USD/TRY exchange rates, the BIST 100 Index, and 2040 Eurobond prices.	The study found that the risk appetite indicators of both foreign and domestic investors were significant in explaining CDS premiums. There was a negative and significant correlation between CDS premiums and the risk appetite index for all groups of foreign, domestic, and institutional investors. CDS premiums decrease as investor risk appetite increases.
İskenderoğlu & Balat (2019)	The causality relationship between MKK risk appetite index and oil prices, exchange rates, gold prices, and interest rates was investigated using weekly data from the period 2008-2015 and Granger and Breitung-Candelon Frequency Causality Tests.	The results of the analysis indicate a long-term relationship from oil prices to MKK risk appetite index, a short, medium, and long-term relationship from exchange rates to risk appetite, and a short-term unidirectional causality relationship from changes in gold prices and interest rates.
Çifçi & Reis (2020)	The relationship between the risk perceptions of investors investing in Borsa Istanbul and capital market liquidity was investigated using Toda-Yamamoto causality analysis. Risk appetite was measured with the MKK Risk Appetite Index, and Borsa Istanbul market index liquidity was measured with the Amihud illiquidity ratio.	The causality analysis concluded a unidirectional relationship between market liquidity to the MKK investor risk appetite index.
Kaya (2021)	The correlation between the Risk Appetite Indices created by MKK for different investor types was examined using weekly data from the period 04.01.2008-07.08.2020.	The VAR models analysis found that MKK Risk Appetite Indices move together in the long term, have mutual causality, and all investor types are approximately 80% influenced by foreign investor risk appetite.
Köycü (2021)	The relationship between the Risk Appetite (RISE) Index and the BIST 100 index was investigated using weekly data from the periods before (15.03.2019-13.03.2020) and after (13.03.2020-13.03.2021) COVID-19.	The study concluded that there is an equilibrium relationship between Risk Appetite and the BIST 100 index before and after COVID-19, investor risk appetite is affected by the BIST 100 index value, and investor risk appetite increases during periods when the BIST 100 index is in an upward trend.

(Table 1 cont.)

Alptürk, et al., (2021)	The relationship between geopolitical risk and CDS premium in Turkey was investigated using data from the period 2010-2020, examining the existence of causality.	It was found that increases or decreases in Turkey's geopolitical risk index affect CDS premiums, but CDS premiums do not have an impact on Turkey's geopolitical risk index.
Dai &Chang (2021)	The predictability of time-varying risk aversion on U.S. stock return volatility was investigated using intraday close price data of the S&P 500 index over the period 1986–2019, employing the risk aversion measure developed by Bekaert et al. (2019).	The findings indicate that time-varying risk aversion significantly impacts the volatility of stock returns. Out-of-sample forecasting results show that incorporating this measure into the baseline model enhances prediction accuracy while maintaining robustness across various lag structures and evaluation periods. Furthermore, this new predictor significantly improves forecasting performance for the volatility of other stock indices and crude oil types. These results underscore the importance of volatility risk in asset pricing processes, emphasizing its relevance for financial market participants.
Gemici, et al., (2023)	The predictability of risk appetite in Turkey, represented by the MKK Risk Appetite Indices, was investigated using weekly data from the period 2008-2022, with 4 local variables (2-year government bond yields, 5-year government CDS spreads, USD/TRY exchange rate, and TRY gold prices) and 5 global variables (global geopolitical risk index (GPR), CBOE crude oil volatility index (OVX), financial stress index from emerging markets (FSI), CBOE volatility index (VIX), and safe haven index).	The analysis concluded that both local and global factors significantly impact the risk appetite indices under various market conditions. However, local factors are the primary drivers of these indices. Changes in bond yields, CDS spreads, FSI, GPR, and VIX indices were the most effective factors in terms of causality. It was highlighted that monitoring fluctuations in local factors is crucial when measuring investors' preferences regarding various market conditions.
Jopp (2023)	The relationship between the CDS spreads of 131 businesses operating in Europe and the credit risk premium is investigated using data for the period 2012-2021 using panel data analysis. This study incorporates risk appetite into the model as a factor of the credit risk premium, which is determined based on the risk premium itself.	The study indicates that risk appetite escalated during periods of near-zero interest rates in the Euro Area and the implementation of expansionary fiscal policies. However, no significant effect was observed in periods when the ECB announced its purchase program due to the pandemic. On the other hand, there is a positive relationship between credit risk premiums and the risk-free interest rate.
Kaya, et al., (2024)	The relationship between MKK domestic and foreign investor risk appetite indices and Turkey's 5-year CDS premium, representing country risk, was examined using Hatemi-J cointegration and Hatemi-J asymmetric causality tests.	The analysis found that CDS premiums affect both domestic and foreign investor risk appetite. There is a cointegration between CDS and the risk appetite variables of domestic and foreign investors. Positive causality from increases in investor risk appetite to CDS premiums and negative or positive causality from decreases were determined.

4. METHODOLOGY

4.1. Data Set of the Research

In this study, the asymmetric relationship between the Risk Appetite Indices (REKS), calculated separately for different types of investors by the Central Registry Agency (CRA) Data Analysis Platform (DAP), and Turkey's CDS premium was investigated using weekly frequency data covering the period from 09.04.2010 to 31.12.2023. The information regarding the variables used in the empirical analyses of the study is presented in Table 2.

Table 2. Information on Variables

Variable	Definition	Data Source	Frequency	Period
CDS	Turkey Credit Default Swap	Bloomberg HT	Weekly	2010:04-2023:12
REKS All	All Investors Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12
REKS Foreign	Foreign Investors Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12
REKS Domestic	Domestic Investors Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12
REKS Domestic Individual	Domestic Individual Investors Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12
REKS Domestic Corporate	Domestic Corporate Investors Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12
REKS Domestic Funds	Domestic Funds Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12
REKS Qualified	Qualified Investors Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12

Source: Turkey's CDS data were provided by Bloomberg HT, and the weekly data for the Risk Appetite Index were obtained by the authors from the Central Registry Agency's data platforms.

In the study, descriptive statistics of the series were first examined, and the results are presented in Table 3.

Table 3. Descriptive Statistics of Variables (2010-2023)

	CDS	***REKS All***	***REKS Foreign***	***REKS Domestic***	***REKS Domestic Individual***	***REKS Domestic Corporate***	***REKS Domestic Funds***	***REKS Qualified***
Average	309.39	53.16	51.88	65.53	66.96	62.07	72.76	57.12
Median	258.68	53.13	53.41	64.99	66.80	61.23	72.65	56.02
Maximum	874.40	64.84	72.93	88.39	90.25	92.44	103.14	75.30
Minimum	111.62	45.13	30.29	50.26	45.61	38.94	42.44	40.47
Std. Deviation	155.56	3.25	6.82	7.57	7.92	9.48	13.19	6.41
Skewness	1.194	0.38	-0.80	0.72	0.36	0.53	-0.10	0.52
Kurtosis	3.957	3.77	4.44	3.90	3.67	3.65	2.39	3.64
Jarque-Bera	197.99 (0.000)	35.96 (0.000)	139.22 (0.000)	86.28 (0.000)	29.30 (0.000)	46.84 (0.000)	12.22 (0.000)	44.91 (0.000)
Number of Observations	717	717	717	717	717	717	717	717

Source: Created by the authors.

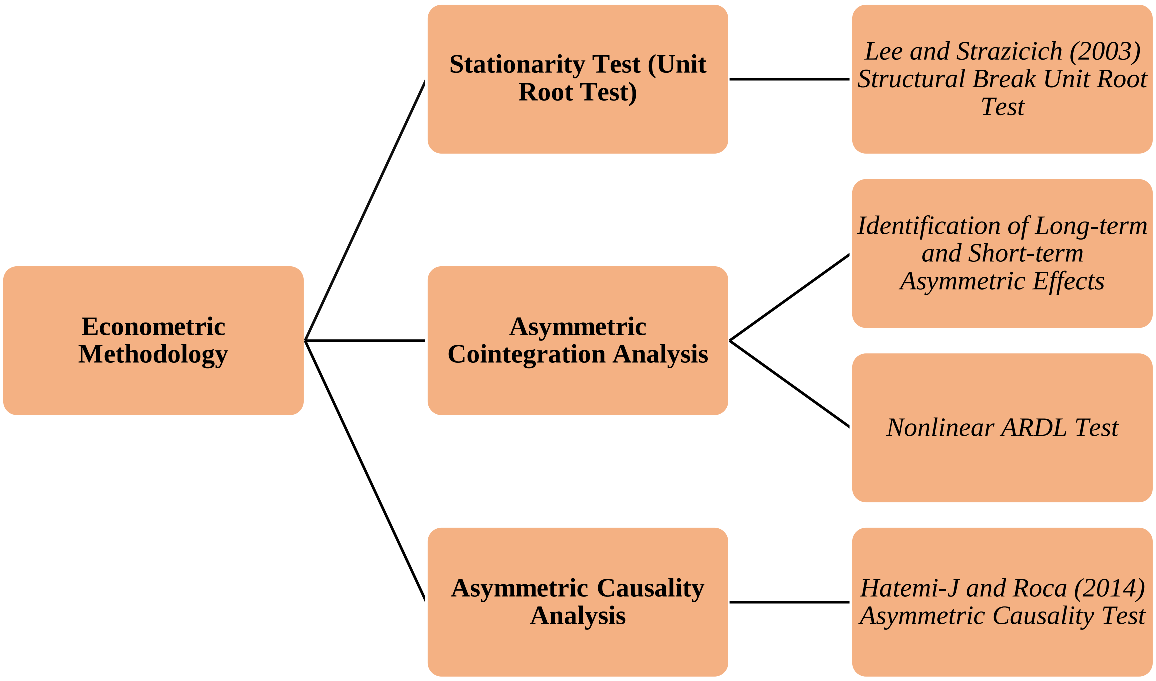
When examining the standard deviation values presented in Table 3, it is observed that the series with the highest variability are the CDS premium, REKS Domestic Funds, and REKS Domestic Corporate Investors Risk Appetite Indices, respectively. Conversely, the series with the lowest standard deviations are the REKS All Investors, REKS Qualified Investors, and REKS Foreign Investors Risk Appetite Indices. Regarding the maximum and minimum values within the Investor Risk Appetite Index categories, the highest (lowest) values are attributed to the REKS Domestic Funds variable. The statistically significant Jarque-Bera test statistics indicate that the series do not conform to a standard normal distribution.

4.2 Econometric Methodology and Empirical Findings

In this study, the cointegration relationship between Turkey's CDS premium and the REKS indices, calculated separately for different types of investors, was investigated using nonlinear ARDL models. In the first stage of the analyses, the stationarity levels of the series were tested using the unit root test allowing for two endogenous breaks introduced to the literature by Lee and Strazicich (2003).

After determining the stationarity levels of the series, the second stage of the analyses examined the existence of a long-term cointegration relationship between the series using the nonlinear ARDL test of Shin et al. (2014), one of the nonlinear cointegration tests. The causality relationship between the series was investigated using the asymmetric causality test of Hatemi-J and Roca (2014). The econometric methodology of the study is presented in Figure 1.

Figure 1: Econometric Methodology



Source: Created by the authors.

4.2.1. Lee and Strazicich (2003) Unit Root Test

The traditional unit root tests of the Dickey-Fuller type are known for their weakness due failure to reject the null hypothesis when structural breaks are not considered during the testing processes. In this context, a time series with structural breaks may be incorrectly identified as following a unit root process due to the use of conventional unit root tests (Hepsağ, 2022, p. 19). To achieve statistically significant relationships in the econometric analyses of this study, the Lee and Strazicich (2003) LM unit root test, which accounts for potential structural breaks in the series, was employed to determine the stationarity levels of the series.

The Lagrange Multiplier (LM) unit root test developed by Lee and Strazicich (2003) is based on the LM test developed by Schmidt and Phillips (1992). In the Lee-Strazicich unit root test, the data generation process considers the three structural break models (Model A, B, and C) described by Perron (1989) as follows (Lee & Strazicich, 2003, pp. 1082-1083).

$$y_t = \delta' Z_t + e_t, \tag{1}$$

$e_t = \beta e_{t-1} + \varepsilon_t,$ (2)

In Equation (1), Z_t is a vector of exogenous variables, allowing for two breaks in level for Model AA:

$Z_t = [1, t, D_{1t}, D_{2t}]$ (3)

For $t \geq T_{BJ} + 1, j = 1, 2, D_{jt} = 1;\ otherwise, it\ takes\ the\ value\ of\ 0$.

To obtain the dummy variable that takes the value of zero, Z_t should be replaced with $[1, t, D_t, DT_t]'$. For Model CC, which allows for two breaks in both level and trend:

$Z_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]$ (4)

For $t \geq T_{BJ} + 1, j = 1, 2, D_{jt} = t - T_{Bj};\ otherwise, it\ takes\ the\ value\ of\ 0$

The data generation process under the null hypothesis includes breaks $(\beta = 1)$, while the alternative hypothesis is $(\beta < 1)$. The LM unit root test statistic is calculated using the regression specified in Equation (5):

$\Delta y_t = \delta' \Delta Z_t + \emptyset \tilde{S}_{t-1} + u_t$ (5)

In the equation, $\tilde{S}_{t-1} = y_t - \tilde{\psi}_x - Z_t \tilde{S}_{t-1}$, for t = 2, ..., T; $\tilde{\delta}$ are the coefficients of the regression of Δy_t of ΔZ_t. $\tilde{\psi}_x$ is obtained as $y_1 - Z_1 \delta$ (Yılancı, 2009, p. 330).

The unit root null hypothesis is defined as $\phi = 0$ and the LM test statistics are obtained as $\tilde{\rho} = T\tilde{\phi}$. The test statistic obtained from the calculations is compared with the critical values. If the calculated test statistic exceeds the critical values, the null hypothesis of a unit root with structural breaks will be rejected. In the LM unit root test with two breaks, the breakpoints (T_{Bj}) are determined endogenously, and the points where the $\tilde{\tau}$ test statistic is minimized are selected to identify the break times (Lee & Strazicich, 2003, p. 1083).

$LM_p = inf \tilde{\rho}(\lambda),$ (6)

$LM_\tau = inf \tilde{\tau}(\lambda).$ (7)

In the study, the Lee and Strazicich (2003) unit root test with structural breaks was applied to the level values and first difference values of all series to determine whether they contain a unit root. The results are reported in Table 4.

Table 4. Lee-Strazicich Unit Root Test Results

Variable	Model AA			
	Test Statistic	**Result**	**TB1**	**TB2**
CDS	-3.245	I(1)	2018M07	2022M08
REKS All	-2.903	I(1)	2020M08	2022M06
REKS Foreign	-2.139	I(1)	2020M11	2022M06
REKS Domestic	-3.078	I(1)	2018M06	2020M11
REKS Domestic Individual	-3.139	I(1)	2012M03	2018M06
REKS Domestic Corporate	-3.067	I(1)	2018M01	2020M11
REKS Domestic Funds	-3.013	I(1)	2016M03	2019M03
REKS Qualified	-3.066	I(1)	2018M01	2020M08
ΔCDS	-10.818*	I(0)		
ΔREKS All	-11.538*	I(0)		
ΔREKS Foreign	-9.855*	I(0)		
ΔREKS Domestic	-8.205*	I(0)		
ΔREKS Domestic Individual	-7.888*	I(0)		
ΔREKS Domestic Corporate	-8.973*	I(0)		
ΔREKS Domestic Funds	-7.750*	I(0)		
ΔREKS Qualified	-8.904*	I(0)		
Critical Values ***1%***			***-3.9977***	
5%			***-3.4044***	
10%			***-3.1155***	

Note: Δ denotes the first difference operator. The symbols *, **, and *** indicate that the null hypothesis of the series containing a unit root is rejected at the 1%, 5%, and 10% significance levels, respectively. TB1 and TB2 denote the break dates.

According to the results of the unit root test with structural breaks presented in Table 4, the calculated test statistics are, in absolute terms, smaller than the critical value at the 5% significance level. Consequently, the null hypothesis that the series contains a unit root cannot be rejected. Based on this result, the series is not stationary. However, the unit root test results for the first differences of the series indicate that the series are stationary. Therefore, it can be concluded that the series are integrated of order one.

4.2.2. Nonlinear ARDL (NARDL) Model

The asymmetric ARDL method developed by Shin et al., (2014) is known in the literature as the Nonlinear ARDL (NARDL) method. The linear ARDL approach, developed by Pesaran et al., (2001), is based on the assumes that explanatory variables symmetrically affect the dependent variable when testing for the existence of a long-term relationship through a cointegration test (Berke, 2023, p. 413). The method introduced by Shin et al., (2014) extends the traditional ARDL method and bounds testing by considering the decomposed positive and negative changes of the independent variable. This proposed method allows for the measurement of the asymmetric effect of the independent variable on the dependent variable by decomposing it into positive and negative changes (Hepsağ, 2022, p. 99). The asymmetric long-term model proposed by Shin, Yu, and Greenwood-Nimmo (2014) is calculated using the regression in Equation (8) (Shin et al., 2014, pp. 285-293):

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + u_t, \quad (8)$$

$$\Delta x_t = v_t, \quad (9)$$

In the long-term model formulated in Equation (8), it is assumed that the variables y_t and x_t are stationary of the first order I(1). β^+ and β^- represent the asymmetric long-term parameters. The variables x_t^+ and x_t^- in the equation represent the partial sums of the positive and negative changes of the independent variable, respectively, and are obtained as follows:

$$x_t^+ = \sum_{j=1}^{t} \Delta x_j^+ = \sum_{j=1}^{t} max\left(\Delta x_j, 0\right), \quad x_t^- = \sum_{j=1}^{t} \Delta x_j^- = \sum_{j=1}^{t} min\left(\Delta x_j, 0\right). \quad (10)$$

The partial sums of the positive and negative changes of the independent variable are obtained cumulatively. Similar to the traditional ARDL method, the asymmetric ARDL model also includes an unrestricted error correction model (UECM) formulated in Equation (11) (Hepsağ, 2022, pp. 99-100):

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{p-1} \alpha_{1i} \Delta y_{t-i} + \sum_{i=0}^{q-1} (\omega_i^+ \Delta x_{t-i}^+ + \omega_i^- \Delta x_{t-i}^-) + \alpha_3 y_{t-1} + \alpha_4 x_{t-1}^+ + \alpha_5 x_{t-1}^- + \varepsilon_t \quad (11)$$

In Equation (11), the unrestricted error correction model is estimated using the ordinary least squares method. Before testing for cointegration with the unrestricted error correction model, it is necessary to test for long-term and short-term asymmetry. To test for long-term asymmetric effects, the null hypothesis, which states that there is a long-term symmetric effect, is tested against the alternative hypothesis, which indicates the presence of long-term asymmetric effects.

$$H_0: (-\alpha_4/\alpha_3) = (-\alpha_5/\alpha_3) \rightarrow The\ long - term\ symmetric\ relationship$$

$$H_1: (-\alpha_4/\alpha_3) \neq (-\alpha_5/\alpha_3) \rightarrow The\ long - term\ asymmetric\ relationship$$

In this test, which follows a χ^2 distribution, if the calculated χ^2 test statistic is greater than the χ^2 table value with 1 degree of freedom, the null hypothesis is rejected, indicating the presence of a long-term asymmetric relationship. On the other hand, to test for short-term asymmetric effects, the null hypothesis, which states that there is a short-term symmetric effect, is tested against the alternative hypothesis, which indicates the presence of short-term asymmetric effects.

$$H_0: \omega_i^+ = \omega_i^- \rightarrow \text{The short} - \text{term symmetric relationship}$$

$$H_1: \omega_i^+ \neq \omega_i^- \rightarrow \text{The short} - \text{term asymmetric relationship}$$

Similar to testing for long-term asymmetry, the test for short-term asymmetry also follows a χ^2 distribution. If the calculated χ^2 test statistic is greater than the χ^2 table value with 1 degree of freedom, the null hypothesis is rejected, indicating the presence of a short-term asymmetric relationship.

After identifying at least one of the long-run or short-run asymmetric effects, the null hypothesis of no cointegrated relationship is tested against the alternative hypothesis of the existence of a cointegrated relationship using the unrestricted error correction model in Equation (11):

$$H_0: \alpha_3 = \alpha_4 = \alpha_5 = 0 \rightarrow No\ cointegration$$

$H_1: \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq 0 \rightarrow Cointegration\ exists$

In testing for the existence of a cointegrated relationship, the F_{PSS} test statistic is calculated using the bounds testing approach developed by Pesaran et al., (2001) as follows:

$$F_{PSS} = \frac{(ESS_R - ESS_{UR})/3}{ESS_{UR}/(n-k)} \quad (12)$$

In Equation (12), ESS_R represents the sum of squared residuals for the restricted model, ESS_{UR} represents the sum of squared residuals for the unrestricted model, *n* denotes the number of observations, and *k* denotes the number of parameters in the unrestricted model. After estimating the unrestricted error correction model in Equation (11), the long-term coefficients for positive and negative changes are calculated as follows:

$-a_4/a_3 \rightarrow Long - term\ Positive\ Coefficients$

$-a_5/a_3 \rightarrow Long - term\ Negative\ Coefficients$

The asymmetric ARDL method and cointegration analysis developed by Shin, Yu, and Greenwood-Nimmo (2014) suggest that the impact of an increasing or decreasing series on the dependent variable may vary in direction or magnitude depending on the existence of an asymmetric relationship between the series in the long-term and/or short-term (Çeştepe & Güdenoğlu, 2020, p. 245). Therefore, to perform cointegration analysis and estimate long-term coefficients, it is necessary to first identify at least one of the long-term or short-term asymmetric effects. In this context, the study first conducted an analysis of long-term and short-term asymmetry between the series, and the results are presented in Table 5, Panel A.

Table 5. Results of Long-term and Short-term Asymmetry Tests

Panel A: Results of Long-term and Short-term Asymmetry Tests			
$W_{LR} = H_0: (-\alpha_4/\alpha_3) = (-\alpha_5\ \alpha_3)$ $W_{SR} = H_0: \omega_i^+ = \omega_i^-$	**Long-term Asymmetry (W_{LR})**	**Short-term Asymmetry (W_{SR})**	**Result**
REKS All - CDS	1.9470(0.162)	0.0907(0.763)	Long-term and Short-term Symmetric Effect
REKS Foreign - CDS	1.9122(0.166)	26.9779(0.000)	Short-term Asymmetric Effect
REKS Domestic - CDS	10.0214(0.001)	4.4731(0.034)	Long-term and Short-term Asymmetric Effect
REKS Domestic Individual - CDS	11.3688(0.000)	0.3875(0.533)	Long-term Asymmetric Effect
REKS Domestic Corporate - CDS	24.8528(0.000)	4.5974(0.032)	Long-term and Short-term Asymmetric Effect
REKS Domestic Funds - CDS	33.2830(0.000)	3.0363(0.081)	Long-term and Short-term Asymmetric Effects
REKS Qualified - CDS	5.4319(0.019)	1.3475(0.245)	Long-term Asymmetric Effect

Note: The χ^2 table value with 1 degree of freedom at the 5% significance level is 3.84 for both long-term and short-term asymmetry. LR denotes long-term, while SR denotes short-term.

When comparing the test statistics calculated for the presence of long-term asymmetric effects presented in Table 5 with the χ^2 table value of 3.84 at 1 degree of freedom, the null hypothesis of a long-term symmetric effect is rejected for REKS Domestic, REKS Domestic Real, REKS Domestic Institutional, REKS Domestic Funds, and REKS Qualified with the CDS premium. Based on this result, it is possible to affirm the validity of long-term asymmetry. On the other hand, according to the long-term asymmetry results in Table 5, the null hypothesis of a long-term symmetric effect cannot be rejected for REKS All and REKS Foreign with the CDS premium. Additionally, when comparing the test statistics calculated for the presence of short-term asymmetric effects presented in Table 4 with the χ^2 table value of 3.84 at 1 degree of freedom, the null hypothesis of a short-term symmetric effect is rejected for REKS Foreign, REKS Domestic, REKS Domestic Institutional, and REKS Domestic Funds with the CDS premium, indicating the presence of short-term asymmetric effects as well. Evaluating the results where both long-term and short-term asymmetric effects were identified, the REKS indices, calculated separately for different types of investors, respond to positive and negative changes in the CDS premium with varying magnitudes.

In the asymmetric ARDL method developed by Shin et al. (2014), after identifying at least one of the long-term or short-term asymmetric effects, the cointegration test between REKS Foreign, REKS Domestic, REKS Domestic Real, REKS Domestic Institutional, REKS Domestic Funds, REKS Qualified, and the CDS premium was conducted. The cointegration test results are reported in Table 6.

Table 6. Cointegration Test Results

Panel B: Bounds Test Results *(H_0 : No Long-term Relationship)*				
Critical Values[a]	***1%***	***2.5%***	***5%***	***10%***
Lower Bound	4.13	3.55	3.10	2.63
Upper Bound	5.00	4.38	3.87	3.35
$\mathbf{H_0: \alpha_3 = \alpha_4 = \alpha_5 = 0}$	**F- statistic (F_{PSS})**	**k**	**Result**	
REKS Foreign - CDS	1.46963	2	No Cointegration	
REKS Domestic - CDS	4.67715	2	Cointegration Exists	
REKS Domestic Individual - CDS	4.69134	2	Cointegration Exists	
REKS Domestic Corporate - CDS	4.01740	2	Cointegration Exists	
REKS Domestic Funds - CDS	5.39184	2	Cointegration Exists	
REKS Qualified - CDS	3.53280	2	Cointegration Exists	

Note: a: The lower and upper bound critical values for the bounds test are obtained from Pesaran, Shin, and Smith (2001).

The presence of long-term cointegration is investigated under the bounds testing approach by comparing the calculated (F_{PSS}) test statistics with the critical values. If the F_{PSS} test statistic is greater than the critical value for the upper bound, the null hypothesis of no cointegrated relationship is rejected. Upon examining the results presented in Table 6, it is observed that there is a cointegrated relationship between the CDS premium and all other REKS indices (REKS Domestic, REKS Domestic Real, REKS Domestic Institutional, REKS Domestic Funds, and REKS Qualified), except for the REKS Foreign index, when the REKS indices are the dependent variables.

After establishing a long-term cointegrated relationship among the variables, the long-term asymmetric relationship was examined by calculating the long-term coefficients for positive and negative changes in the independent variable. Additionally, the results presented in Table 5 indicate the validity of asymmetry in both the long and short terms. The coefficients demonstrating the long-term asymmetric relationship between the REKS indices and the CDS premium are reported in Table 7. Upon examining the long-term coefficients of the nonlinear ARDL model presented in Table 7, it is observed that the CDS premium is statistically significant for all REKS indices.

Table 7. Long-term Coefficients

Panel C: Long-Term Asymmetric Coefficients		
Dependent Variable: REKS Domestic		
Variable	**Coefficient**	**Probability**
CDS^+	0.00430	0.002
CDS^-	0.00304	0.000
Dependent Variable: REKS Domestic Individual		
Variable	**Coefficient**	**Probability**
CDS^+	0.00384	0.008
CDS^-	0.00850	0.001
Dependent Variable REKS Domestic Corporate		
Variable	**Coefficient**	**Probability**
CDS^+	0.02617	0.004
CDS^-	0.02768	0.015
Dependent Variable: REKS Domestic Funds		
Variable	**Coefficient**	**Probability**
CDS^+	0.01357	0.046
CDS^-	0.01506	0.026
Dependent Variable: REKS Qualified		
Variable	**Coefficient**	**Probability**
CDS^+	0.02194	0.013
CDS^-	0.02130	0.023

According to the long-term coefficients presented in Table 7, for the REKS Domestic index, the long-term coefficient for positive changes in the independent variable CDS premium is 0.00430, while the long-term coefficient for negative changes is 0.00304. This result indicates that a one-unit increase in positive changes in the CDS premium raises the REKS Domestic index by 0.00430 units, whereas a one-unit decrease in negative changes in the CDS premium lowers the REKS Domestic index by 0.00304 units. Positive changes in the CDS premium have a greater impact on the REKS Domestic index compared to negative changes. For the REKS Domestic Real index, the long-term coefficient for positive changes in the CDS premium is 0.00384, while the long-term coefficient for negative changes is 0.00850. For the REKS Domestic Institutional Index, the long-term coefficient for positive changes in the CDS premium is calculated as 0.00430, while the long-term coefficient for negative changes is 0.00304. Examining the results for REKS Domestic Funds in the table, the long-term coefficient for positive changes in the CDS premium is 0.01357, while the long-term coefficient for negative changes is 0.01506. Finally, for the REKS Qualified index, the long-term coefficient for positive changes in the CDS premium is 0.02194, while the long-term coefficient for negative changes is 0.02130. Overall, the results in the table indicate that positive changes in the CDS premium have a greater impact on the REKS Domestic and REKS Qualified indices compared to negative changes, while negative changes in the CDS premium have a greater impact on the REKS Domestic Real, REKS Domestic Institutional, and REKS Domestic Funds indices compared to positive changes.

4.2.3. Hatemi-J and Roca (2014) Asymmetric Causality Test

The classical causality tests used to determine the direction of causality between variables assume that the causal effects of positive shocks are the same as those of negative shocks when examining the existence of a possible causality relationship between variables (Eryüzlü & Bayat, 2018, p. 188). Granger and Yoon (2002) first suggested that the relationship between positive and negative shocks might differ from the relationship between the variables themselves (Yılancı & Bozoklu, 2014, p. 214). Granger and Yoon (2002) transformed the data into cumulative positive and negative shocks and applied a cointegration approach to these shocks, demonstrating that the relationships between the shocks could vary (Öztürk & Zeren, 2019, pp. 63-64). Hatemi-J (2012) developed an asymmetric causality test that separates shocks in variables into positive and negative, considering the potential impacts of these shocks separately. Essentially, this asymmetric test is a decomposition of the Hacker and Hatemi-J (2006) bootstrap causality test into positive and negative shocks. The asymmetric causality test is an analytical method that determines whether causality varies according to the type of shock (Türk, 2024, p. 102). Hatemi-J and Roca (2014) combined the tests by Granger and Yoon (2002), Hacker and Hatemi-J (2006), and Hatemi-J (2012) to develop a new test (Öztürk, 2020, pp. 144-145). The test examines whether causality is symmetric under the influence of different types of shocks. In the asymmetric causality test, let P_{1t} *and* P_{2t} be two cointegrated variables (Hatemi-J & Roca, 2014, pp. 8-9):

$$P_{1t} = P_{1t-1} + \varepsilon_{1t} = P_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i}, \tag{13}$$

$$P_{2t} = P_{2t-1} + \varepsilon_{1t} = P_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i}, \tag{14}$$

In these equations, while t = 1,2,…,T, the constants $P_{1,0}$ *and* $P_{2,0}$ represent the initial values. The positive and negative changes of each variable are defined as $\varepsilon_{1t}^{+} = \max(\varepsilon_{1t}, 0)$, $\varepsilon_{2t}^{+} = \max(\varepsilon_{2t}, 0)$, $\varepsilon_{1t}^{-} = \min(\varepsilon_{1t}, 0)$ *ve* $\varepsilon_{2t}^{-} = \min(\varepsilon_{2t}, 0)$. In terms of error terms, they are defined as $\varepsilon_{1t} = \varepsilon_{1t}^{+} + \varepsilon_{1t}^{-}$ *ve* $\varepsilon_{2t} = \varepsilon_{2t}^{+} + \varepsilon_{2t}^{-}$. Therefore, if Equations (13) and (14) are rearranged:

$$P_{1t} = P_{1t-1} + \varepsilon_{1t} = P_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i}^{+} + \sum_{i=1}^{t} \varepsilon_{1i}^{-}, \tag{15}$$

$$P_{2t} = P_{2t-1} + \varepsilon_{1t} = P_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i}^{+} + \sum_{i=1}^{t} \varepsilon_{2i}^{-} \tag{16}$$

Thus, the cumulative sums of the positive and negative shocks for each variable are expressed as follows: $P_{1t}^{+} = \sum_{i=1}^{t} \varepsilon_{1i}^{+}, P_{1t}^{-} = \sum_{i=1}^{t} \varepsilon_{1i}^{-}, P_{2t}^{+} = \sum_{i=1}^{t} \varepsilon_{2i}^{+}\, ve\ P_{2t}^{-} = \sum_{i=1}^{t} \varepsilon_{2i}^{-}$. The cumulative components in the equations enable the application of the asymmetric causality test. The causality relationship between the positive cumulative shocks is tested using the vector $P_{t}^{+} = (P_{1t}^{+}, P_{2t}^{+})$. The k-lag Vector Autoregressive (VAR) model, where the lag length is accepted as "k," is specified as follows:

$$P_{t}^{+} = v + A_1 P_{t-1}^{+} + \cdots + A_L P_{t-k}^{+} + u_{t}^{+}, \tag{17}$$

In Equation (17), v denotes the (2x1) vector of constant terms, while u_t^{+} represents the (2x1) vector of error terms occurring in positive shocks. The term A_r, for r=1,2,…,k, represents the (2x2) parameter matrix. The optimal lag length k is determined using the following test statistic developed by Hatemi-J (2003, 2008):

$$HJC = ln(|\widehat{\Omega}_f|) + k2T^{-1}(m^2 lnT + 2m^2 \ln(lnT), \quad k = 0, \ldots, k_{max}, \tag{18}$$

In Equation (18), $|\widehat{\Omega}_f|$ represents the variance-covariance matrix of the error term in the VAR model based on the optimal lag length k. In the equation, m represents the number of equations in the model, while T denotes the sample size in the model. The null hypothesis of the asymmetric causality test is defined as the j. row and k. column of the A_r matrix is equal to zero, and the Wald test statistic is used to test this hypothesis. If the test statistic is smaller than the critical values, the null hypothesis cannot be rejected. If it is larger, the null hypothesis stating that there is no causality is rejected.

In this study, the asymmetric causality relationship between Turkey's CDS premium and the REKS indices, which are calculated separately for different types of investors, was tested using the Hatemi-J and Roca (2014) asymmetric causality test. The results are presented in Table 8.

Table 8: Results of Hatemi and Roca (2014) Asymmetric Causality Analysis

Null Hypothesis (H_0)	**MWALD**	***Critical Values***[a,b]			**Null Hypothesis (H_0)**	**MWALD**	***Critical Values***[a,b]		
		1%	**5%**	**10%**			**1%**	**5%**	**10%**
$CDS^{+} \neq> REKSDomestic^{+}$	12.851***	12.61	8.13	6.36	$REKSDomestic^{+} \neq> CDS^{+}$	0.483	11.81	7.97	6.27
$CDS^{+} \neq> REKSDomestic^{-}$	1.894	12.23	8.13	6.35	$REKSDomestic^{+} \neq> CDS^{-}$	6.519	12.41	8.146	6.42
$CDS^{-} \neq> REKSDomestic^{-}$	20.226***	12.49	8.03	6.28	$REKSDomestic^{-} \neq> CDS^{-}$	5.257	11.98	7.99	6.26
$CDS^{-} \neq> REKSDomestic^{+}$	5.580	12.08	8.09	6.35	$REKSDomestic^{-} \neq> CDS^{+}$	2.790	11.59	7.77	6.28
$CDS^{+} \neq> REKSIndividual^{+}$	15.337***	12.51	8.15	6.46	$REKSIndividual^{+} \neq> CDS^{+}$	1.220	11.84	8.07	6.33
$CDS^{+} \neq> REKSIndividual^{-}$	0.842	9.73	6.19	4.67	$REKSIndividual^{+} \neq> CDS^{-}$	8.69	12.33	7.98	6.39
$CDS^{-} \neq> REKSIndividual^{-}$	19.281***	9.76	6.16	4.66	$REKSIndividual^{-} \neq> CDS^{-}$	3.941	9.25	5.99	4.67

(Table 8 cont.)

$CDS^{-} \neq> REKSIndividual^{+}$	8.797^{**}	10.08	6.16	4.64	$REKSIndividual^{-} \neq> CDS^{+}$	6.003	11.48	7.80	6.29
$CDS^{+} \neq> REKSCorporate^{+}$	2.600	12.23	8.13	6.38	$REKSCorporate^{+} \neq> CDS^{+}$	1.654	12.07	7.97	6.27
$CDS^{+} \neq> REKSCorporate^{-}$	1.291	12.49	7.98	6.30	$REKSCorporate^{+} \neq> CDS^{-}$	3.088	12.12	8.19	6.42
$CDS^{-} \neq> REKSCorporate^{-}$	10.839^{**}	12.53	8.13	6.38	$REKSCorporate^{-} \neq> CDS^{-}$	4.471	12.22	7.97	6.28
$CDS^{-} \neq> REKSCorporate^{+}$	4.702	12.12	8.03	6.27	$REKSCorporate^{-} \neq> CDS^{+}$	1.115	11.96	8.17	6.40
$CDS^{+} \neq> REKSFunds^{+}$	2.386	12.17	7.99	6.34	$REKSFunds^{+} \neq> CDS^{+}$	1.332	12.19	7.96	6.33
$CDS^{+} \neq> REKSFunds^{-}$	7.611^{***}	12.05	8.02	6.49	$REKSFunds^{+} \neq> CDS^{-}$	2.456	12.99	8.54	6.62
$CDS^{-} \neq> REKSFunds^{-}$	25.957^{***}	13.07	8.67	6.73	$REKSFunds^{-} \neq> CDS^{-}$	0.494	11.77	7.96	6.31
$CDS^{-} \neq> REKSFunds^{+}$	3.107	12.56	8.09	6.44	$REKSFunds^{-} \neq> CDS^{+}$	1.727	12.14	8.14	6.41
$CDS^{+} \neq> REKSQualified^{+}$	13.029^{***}	11.79	8.06	6.38	$REKSQualified^{+} \neq> CDS^{+}$	4.724	12.05	8.07	6.41
$CDS^{+} \neq> REKSQualified^{-}$	2.100	12.45	8.17	6.39	$REKSQualified^{+} \neq> CDS^{-}$	4.595	12.22	8.01	6.34
$CDS^{-} \neq> REKSQualified^{-}$	5.994	12.21	7.98	6.43	$REKSQualified^{-} \neq> CDS^{-}$	9.543	11.84	7.98	6.30
$CDS^{-} \neq> REKSQualified^{+}$	3.114	12.08	8.01	6.39	$REKSQualified^{-} \neq> CDS^{+}$	1.636	11.47	7.93	6.29

Note: The notation $\neq>$ in the table indicates the null hypothesis of no causality in the direction shown between the variables. a: The HJC information criterion was used to select the optimal lag length. b: Bootstrap critical values were obtained with 10,000 iterations. *, **, *** indicate the presence of a causality relationship from the first variable to the second at the 10%, 5%, and 1% levels of statistical significance, respectively.

In the Hatemi-J and Roca (2014) asymmetric causality test, if the MWALD test statistic, which indicates the direction of the causality relationship between the relevant variables, is greater than the critical values, the null hypothesis of no causality between the variables is rejected. According to the Hatemi-J and Roca (2014) asymmetric causality test results, a causality relationship at the 1% significance level was found from positive shocks in the CDS premium to positive shocks in the REKS Domestic, REKS Real, and REKS Qualified indices. This indicates that a positive shock in the CDS premium will lead to a positive response in the REKS Domestic, REKS Real, and REKS Qualified indices, as determined through both asymptotic and bootstrap methods.

Additionally, according to the asymmetric causality test results in the table, there is a causality relationship at the 1% significance level from negative shocks in the CDS premium to negative shocks in the REKS Domestic, REKS Real, REKS Institutional, and REKS Funds indices. Furthermore, the asymmetric causality test results in the table show that there is no causality relationship at the 5% statistical significance level from positive and negative shocks in the REKS indices, calculated separately for each type of investor, to positive and negative shocks in the CDS premium.

5. CONCLUSION

The relationship between Investor Risk Appetite Indices (REKS) and Credit Default Swap (CDS) premiums in Turkey is evaluated as an indicator of market sentiment and perceived credit risk. The indicator defined as "investor risk appetite" increases with positive market expectations and decreases with negative ones, reflecting the decision of savers or investors to make purchases. In Turkey, the Risk Appetite Indices (REKS) are calculated by the Central Securities Depository as a measure of the risk appetite of investors in different groups. The Credit Default Swap (CDS) market, which insures the principal or interest payments of securities issued by the government, public, or private sector, has rapidly grown over the past two decades and become one of the most closely monitored indicators in the financial literature.

In this study, the relationship between the Risk Appetite Indices, calculated separately for each investor type, and Turkey's CDS premium was examined using the nonlinear ARDL (NARDL) method with weekly data from 09.04.2010 to 31.12.2023. The stationarity levels of the series were determined using the Lee and Strazicich (2003) LM unit root test, which allows for two endogenous breaks to account for possible structural breaks in the series. To test for a cointegrated relationship between the REKS indices and the CDS premium, it is first necessary to identify at least one long-term or short-term asymmetric effect between the series. In this context, an analysis of long-term and short-term asymmetry was initially conducted between the series. The results indicated asymmetric effects between the CDS premium and the REKS Foreign Investors, REKS Domestic Investors, REKS Domestic Institutional Investors, REKS Domestic Funds, and REKS Qualified Investors indices. Following the identification of at least one long-term or short-term asymmetric effect, the cointegration relationship between the CDS premium and the REKS indices—REKS Foreign, REKS Domestic, REKS Domestic Real, REKS Domestic Institutional, REKS Domestic Funds, and REKS Qualified Investors—was tested using the asymmetric ARDL method developed by Shin, Yu, and Greenwood-Nimmo (2014). The results of the applied asymmetric ARDL (NARDL) method indicated the existence of a cointegrated relationship between the CDS premium and the REKS Domestic, REKS Domestic Real, REKS Domestic Institutional, REKS Domestic Funds, and REKS Qualified Investors indices. After establishing the existence of a cointegrated relationship, long-term coefficients for positive and negative changes in the independent variable were calculated to show the long-term asymmetric relationship. According to the long-term coefficients, positive changes in the CDS premium have a greater impact on the REKS Domestic and REKS Qualified indices compared to negative changes, while negative changes in the CDS premium have a greater impact on the REKS Domestic Real, REKS Domestic Institutional, and REKS Domestic Funds indices compared to positive changes. In the final stage of the analyses, the asymmetric causality relationship between the REKS indices and Turkey's CDS premium was examined using the asymmetric causality test developed by Hatemi-J and Roca (2014), which separates shocks in variables into positive and negative and considers their potential impacts separately. According to the results of the Hatemi-J and Roca (2014) asymmetric causality test, there is a statistically significant causality relationship from positive shocks in the CDS premium to positive shocks in the REKS Domestic, REKS Real, and REKS Qualified indices, and from negative shocks in the CDS premium to negative shocks in the REKS Domestic, REKS Real, REKS Institutional, and REKS Funds indices. On the other hand, no statistically significant causality relationship was found between positive and negative shocks in the REKS indices to positive and negative shocks in the CDS premium.

The findings of this study provide insights into market efficiency and the psychological dimensions of investor behavior. The stronger impact of positive changes in CDS premiums on the REKS Domestic and REKS Qualified indices suggests that investors are more responsive to improving credit risk conditions. Conversely, the greater influence of negative changes on the REKS Domestic Real, Institutional, and Funds indices reflects heightened sensitivity to deteriorating risk conditions, consistent with the concept of loss aversion.

The Hatemi-J and Roca (2014) asymmetric causality test reveals a unidirectional causality from shocks in CDS premiums to REKS indices, with no significant causality observed in the opposite direction. While this finding aligns with the Efficient Market Hypothesis, the asymmetric effects underscore the influence of psychological factors on investor behavior, highlighting potential limitations in market efficiency.

In Turkey's liberal, export-oriented, free-market economy, adopted after the 1980s, a significant transition occurred from a fixed exchange rate policy to a flexible exchange rate policy. As a result of these policies, market risks stemming from fluctuations in interest rates and exchange rates have become a significant source of stress for investors and portfolio managers over time. While various factors influence investment decisions—including market liquidity, monetary and fiscal policies of central banks and governments, economic and political structures, and other macroeconomic variables—CDS premiums and risk appetite indicators have emerged as critical determinants of foreign portfolio investors' decisions regarding Turkey. In this context, risk appetite can be defined as a function of investors' sensitivity to risk and macroeconomic variables.

Financial market participants can prepare themselves for potential future uncertainties with effective risk policies and financial information. CDS premiums, which can change daily based on a country’s economic and political risk levels, reflect current market dynamics. In this context, CDS premiums are among the instruments closely monitored by investors as risk indicators. Investors' risk perception and their attitudes towards risk are reflected in their investment decisions and risk appetites.

Success in financial markets can be achieved through the level of information market participants possess about their transactions, their ability to understand and mitigate potential risks, and the selection and implementation of appropriate financial instruments and risk management policies. Accordingly, many macroeconomic variables, such as investor risk appetite and country risk (CDS premiums), are closely monitored by market participants as key indicators. Both indicators we are studying fluctuate daily based on countries' economic and political risk levels, making them primary sources of information for financial decision-makers.

Consequently, the findings from empirical analyses can assist financial institutions, portfolio managers, and investors in protecting their savings or making the right investment decisions during periods of market stress. The results of this study can contribute to the goal of return maximization for savers, collective investment institutions engaged in portfolio management, financial intermediaries, and individual investors by enabling them to make informed decisions, select appropriate risk management tools, and adjust their positions as needed. Stakeholders can use these insights to make informed decisions and allocate resources in line with their strategic objectives. This, in turn, can lead to stable growth, support efficiency in resource allocation, achieve competitive advantage, and protect investors and savings, resulting in sustainable financial outcomes.

Overall, our results indicate that investor risk appetite and CDS premiums are significant factors in investment decisions. The findings offer potential implications for financial institution managers and policymakers in forming financial policies to reduce market uncertainty and strengthen economic and financial stability. From an investor’s perspective, the results show that risk appetite indices have a strong relationship with CDS premiums. The results show that risk appetite and CDS premium are considered important indicators in predicting risk and return expectations and determining investor behavior in financial markets.

The CDS premium is an important indicator frequently used by foreign investors for portfolio diversification and assessing country risks. Therefore, the investment decisions of international investors are significantly influenced by CDS premiums. As a result, for economic and financial policies to be effectively implemented in real markets, decisions and strategies concerning Turkey's capital markets should be developed by considering the factors that influence investors' risk appetite, alongside market risks and uncertainties. In this context, the regular monitoring of market risks and uncertainties, which significantly impact investors' risk appetite, may play a pivotal role in supporting sound and rational investment decisions.

In this study, only the positive and negative effects of the CDS premium on risk appetite indices are analyzed. In future studies, it is suggested to include fear indices representing market uncertainty in addition to the CDS premium. Moreover, future research could examine in detail the relationship between different economic conditions (e.g. crisis periods), various macroeconomic indicators or different types of volatility and investors' risk appetite. Finally, econometrics literature is always evolving and can, therefore, be further extended through the implementation of new econometric methodologies in future studies.

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors declare that they all equally contributed to all processes of the research.

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