Relationship Between Credit Default Swaps (CDS) and Government Bonds: A Study on Turkey*

Kredi Temerrüt Takasları (CDS) ve Devlet Tahvilleri Arasındaki İlişki: Türkiye Üzerine Bir İnceleme

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ABSTRACT

The purpose of the study is to examine the relationship between Turkey's dollar-denominated Eurobonds and CDS contracts that are related to these Eurobonds and also to present the price discovery process. First, ADF and Lee-Strazicich unit root tests were applied to variables regarding daily data for the period 02.01.2014-31.12.2019. With finding structural breaks after unit root tests, causality relations between variables were examined by the Toda-Yamamoto causality method. There is a very strong one-way causality relationship from CDS premiums to bond premiums at the 5% significance level and a causality relation from bond premiums to CDS premiums at the 10% significance level. This situation shows that the credit risk premium pricing is realized primarily in CDS contracts.

MAKALE BİLGİSİ

ÖZ

Bu çalışmanın amacı, Türkiye dolar cinsi Eurobondlar ile bu menkul kıymetleri referans varlık olarak belirlemiş olan CDS sözleşmeleri arasındaki ilişkiyi incelemek ve fiyat keşif sürecini ortaya koymaktır. Bu çerçevede 02.01.2014–31.12.2019 dönemi günlük verileri kullanarak değişkenlere öncelikle ADF ve Lee-Strazicich birim kök testleri uygulanmış ve yapısal kırılmaların varlığı ile değişkenler arasındaki nedensellik ilişkisi Toda-Yamamoto nedensellik yöntemi ile incelenmiştir. Araştırma bulgulara göre; %5 anlamlılık düzeyinde CDS primlerinden tahvil primlerine doğru tek yönlü çok kuvvetli bir nedensellik ilişkisi, %10 anlamlılık düzeyinde ise tahvil primlerinden CDS primlerine doğru bir nedensellik ilişkisi bulunmaktadır. Bu durum kredi risk primi fiyatlamasının öncelikle CDS sözleşmelerinde gerçekleştiğini göstermektedir.

1. Introduction

The debt securities market is one of the most significant fundamentals for the development of a country. Countries need various investments, especially in the healthcare, education industry, and service sectors, to provide sustainable growth and development. A developed bond market provides a pushing power for economic growth (Pradhan et al., 2020). At this point, the debt securities market plays a major role. The debt securities market is the marketplace where the people with excess funds and those in need of funds meet. Because of the developed debt securities market, governments, local governments, and companies in need of funds can access funds faster and at lower costs than markets that do not have financial depth (Herring and Chatusripitak, 2000).

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For many years, bank credit has been preferred as a traditional financing method which provided funds to companies' demand. Through the development of the debt securities market, alternative financing instruments have appeared. Borrowing cost has started to decrease because of forming competition in the credit market (Hattori and Takats, 2015). Bonds are also one of the fundamentals of the debt securities market. Bonds are debt securities that allow debt relation directly between people with excess funds and those in need of funds without the need for having a bank credit channel or deposit pool such as a bank (Matos et al., 2017). Establishing legal arrangements and regulations by financial authorities, being involved in credit rating agencies in the market actively, and using alternative bonds types have extensively gained financial depth to the debt securities market. Thus, investing and issuance of fixed-income securities has been more attractive by both investors and those in need of funds (Choudhry, 2010).

Governments prefer bond issuance primarily for financing budget deficit. Because they need large capital for funding investments and growth. Also, bond issuance is necessary for corporates and institutions to fund their projects. Even, corporates might prefer bond issuance rather than credit channel. Since it ensures at lower costs than credit channel and provides more flexibility to themselves in terms of capital budgeting. The development of the primary market in bond issuance, the deepening of the debt securities market, and the occurrence of legal financial regulations have paved the way for the formation and growth of the secondary bonds market (Turner, 2002; Yelghi, 2019).

The formation of a deep market in debt instruments is of great importance for both investors and fund seekers. Developed primary and secondary bond markets in a country makes easier to attract the attention of international and local investors when a bond has been issued. Thence, demanding for bonds – both at primary and secondary markets- will have been increased. This situation can provide borrowing at lower costs for government and private sector firms (Hattori and Takats, 2015).

With the development of the secondary market, bonds have become one of the main indicators providing information about the benchmark interest rates of the countries. Benchmark interest rates are of great importance for a country's financial system because these are using in the valuation of financial contracts, calculating discounted cash flows, and determining monetary policies at central banks. These tools are taken considered by the investor for transferring funds and taking information about the risk level of the investment (ECB, 2020).

An instrument reflecting the risk carried on reference assets considered within scope debt securities is credit default swaps contracts (CDS). CDS are derivatives that act as an insurance policy for investors in the occurrence of the credit event that the issuer cannot fulfil its obligation to their investors (Palladini and Portes, 2011: 8). CDS contracts have been developed to transfer credit risk to a third party in return for regular payments paid by the investors to financial institution sells related CDS contracts, in case of occurring default or bankruptcy of reference assets held by investors (Gök and Arslan, 2019). Although CDS contracts are traded in over-the-counter (OTC) markets, they are liquid. For this reason, CDS spreads are quite dynamic and

can instantly reflect the credit risk of the reference assets (Danacı et al., 2017; Ersoy and Unlü, 2016). CDSs are seen as one of the most innovative derivatives in financial markets (Saretto and Tookes, 2013).

CDS transactions could be categorized as of countries' bankruptcy risk. CDS contracts are considered as insurance against related debt securities, provide the most realistic picture of the borrower's risk perception because of the financial depth experienced in the CDS market. Since a country's CDS spreads affect the risk premium and borrowing costs of institutions, it is of great importance to investigate and consider the fundamentals and dynamics of pricing in the CDS market for financial stability. CDS spreads include and reflect changes in the credit risk of the government, private sector, and household members of a country and is therefore considered as a leading indicator of the country's economic performance. At the same time, the fact that CDS spreads are largely affected by developments and changes in international markets proves the importance of the global financial system for CDS premiums (Kisgergely, 2009).

The rise in CDS spreads also apply pressure on the reference assets. Because, as a result of the increase in the risk premium of CDS contracts, the investors demand more returns as risk increases in the reference assets that are related to CDS. For this reason, a relationship occurs between the CDS contracts and these reference assets. In this context, the study aims to investigate the relationship between Turkey's dollar-denominated Eurobonds and CDS contracts that are related to these Eurobonds. The aspect that makes the study unique in the finance literature is the approach in preparing the data set. Although CDS contracts are one of the basic instruments that reflect credit risk premium, benchmark interest rates on bonds also reflect and incorporate reel interest rate, expected inflation, and credit risk premium into one indicative. Therefore, it is necessary to focus on the credit risk premium rather than reel interest rate or expected inflation while examining the relationship between the two instruments. In this study, U.S. 5-year government bonds have been accepted as a proxy and benchmark because of the risk-free rate nomination of U.S. 5-year government bonds (Palladini and Portes, 2011; Zhu, 2006; Varga, 2009) in order to clear and focus the credit risk premium from nominal interest rate and credit risk spreads have been cleaned by excluding U.S. 5- year government bonds interest rates from interest rates of Turkey's dollar-denominated Eurobonds. Another aspect that makes the study original is the analysis method. Due to occurring exchange rates shocks in Turkey's economy, structural breaks have occurred in the data set; therefore Toda-Yamamoto causality analysis method which permits to analyze structural breaks has been preferred. The dataset, which covers the period between 02.01.2014 and 31.12.2019 and is compiled from Thomson Reuters (2020) data terminal consists of daily data thus this research has become one of the most current studies related to relation between CDS and bonds.

The structure of paper is as follows: first, in line with the purpose of this study, a literature review on the relationship between bond premium and CDS premium was discussed. Then the data set and analysis method were stated. After that, the empirical findings section was presented, and

lastly, the study has been completed with the conclusion section.

2. The Relationship between CDS Spreads and Bond Spreads: Literature Review

During and after the global crises, many innovations and diversity have developed in financial products and derivatives to manage financial risks by investors and financial institutions. CDS contracts have become one of the tools used as a risk management in many important institutions operating both in the financial and non-financial sector (Cherny and Craig, 2009). Therefore, it can be argued that the CDS market is one of the most sensitive indicators of corporate financial market health nowadays. CDS markets contain a lot of important information about the issuer that can be used to gain profit by fund managers or to regulate by authorities. If this data is processed properly and interpreted correctly, the information on CDS can warn financial authorities against risk and possible problems of banks, financial institutions, and insurance companies. More importantly, within the framework of regulations where there is a market failure for controlling risk-taking, CDS contracts can help investors, lenders, and financial markets to provide discipline and assist in applying financial discipline on markets (Wallison, 2008).

The CDS premium is a value that mirrors the credit risk of the issuer and the possibility of falling to fulfil its obligations arising from the bond. This value can be calculated as called spread which is a determined rate on reference bond's principal that the buyer must pay to the seller to protect against credit risk. Therefore, the amount paid by the protection buyer to the seller when pricing the credit derivative instrument is called CDS premium (spread) (Kunt, 2008). In this way, CDS spreads are expressed as a percentage of the principal amount of reference assets. Compared to CDS spreads, bond spreads show discount rates used to calculate the discounted cash flow of a bond's value.

CDS spreads and bond spreads are expected to behave similarly (Weistroffer, 2009). This is because the two markets are affected by each other through an arbitrage probability. However, when the bond spreads are evaluated, sufficient information about the CDS spreads cannot be reached. In practice, these two indicators differ significantly for a variety of reasons. Bond spreads are affected by many risk types, such as credit risk, liquidity risk, and interest risk. When CDS spreads are considered, it might not be associated directly with default risk because there are uncertainty of the recovery rate of the bond default, contractual counterparty risk, and the difference in pricing of contract-specific issues. Moreover, CDS spreads try to evaluate the credit risk separately from the interest rate risk; this situation causes the price mechanism to not work properly. Consequently, these two different spreads should be considered as complementary to each other (Weistroffer, 2009).

According to model in structural form (Merton, 1974), CDS spreads can be calculated by extracting the real interest rate from the yield to maturity of the reference asset. In theoretical framework at structural form models, the variables affecting the CDS spreads are yield to maturity of

reference assets and the real interest rates. When assumed a theoretical framework where arbitrage is not possible, CDS contracts can be simulated synthetically by taking the short position of the same bond with the same maturity and coupon payment and investing returns to risk-free bonds. The credit risk spread of the reference asset and the CDS spread should theoretically be equal. Under an assumption that arbitrage is possible; If the CDS spread is higher than the difference between the yield to maturity of the reference asset and the real interest rate, the investor firstly can sell the relevant CDS contract in the over-the-counter markets. Secondly can buy the risk-free security, and thirdly can short sell the reference asset related to the CDS, as a result, can make arbitrage. It is expected that there will be a long-term relationship between bond premiums and CDS premiums to avoid arbitrage opportunities. When the short-term relationship is examined, deviations in the pricing of contracts and bonds can be observed as a result of factors such as the incorrect assumption that the real interest rate will remain constant in the process, the liquidity of the markets, and the bonds and contracts have specific characteristics (Zhu, 2006).

For these reasons, the price discovery process between CDS and bonds has been the research topic of many studies in the finance literature. Various studies that pertain to relation government bonds of developed or developing countries and related CDSs and also corporate bonds of these countries and related CDSs can be seen. The relationship between bonds and CDS is examined within the framework of empirical studies that stand out in the literature in this part of the study.

2.1.   Empirical Studies on Developed Countries

Blanco et al. (2005) examined the link between investment-grade bonds and CDS contracts. They handled the 5-year bond and CDS spreads of 119 European and American companies. Paper consists of data between 2001 and 2002, Granger causality and Johansen cointegration analysis were used. As a result of empirical findings, it is concluded that CDS spreads lead the bond spreads.

Zhu (2006) investigated the relationship between bond spreads, and CDS spreads in his study. Cointegration test, vector error correction model, and panel analysis were used in the study that included corporate bonds in the North American, Asian, and European markets on dates between 1999-2002. Empirical findings confirmed that there is a long-term relationship between CDS premiums and bond premiums, as the theory predicts. However, it has been shown that this relationship is not always valid for the short term. CDS spreads, especially in US-originated assets, are ahead of bond spreads in price discovery, because of the effect of liquidity. It has also been observed that short-selling restrictions on CDS have a surprisingly small effect.

Forte and Pena (2009) investigated the relationship between stock market implied credit spreads, CDS spreads, and bond spreads of 17 companies operating outside the financial sector firms with at least 250 samples in the USA, and Europe on dates between 2001 and 2003. While selecting the bonds to be included in the study, attention has been taken to ensure that the bonds are in the same currency, and the bonds have not specific features like convertible bonds. A vector error correction model was

established as the analysis method and it was concluded that stock market implied credit spreads lead CDS spreads and bond spreads more frequently compared to vice versa and CDS spreads also lead bond spreads.

Palladini and Portes (2011) examined the price relationship between the CDS spreads and the bond spreads. The government bond spreads of 6 European countries between 2004-2011 and the CDS spread related to these bonds were examined. In empirical results, cointegration analysis confirms that two prices in equilibrium must be equal, as the arbitrage theory predicts. The vector error correction model shows that the CDS market is ahead of the bond market in terms of the price discovery process, and these findings are confirmed by the Granger causality test.

O'Kane (2012) analyzed the empirical and theoretical relationship of government bonds and CDS contracts in the Euro zone between 2009-2011. In this framework, firstly, a model was established with the assumption that arbitrage between CDS and bond premiums is not possible, and then this model was tested with Granger causality analysis. The reason for deviations between CDS and bond spreads have been investigated. Although a one-day delay has been determined in Spain and Greece CDS spreads to bond spreads, the opposite has happened in Italy and France. Lastly, a mutual relationship has been found for Ireland and Portugal.

Giorgione and Patane (2016) focused on the connection between CDS and bond markets and explored the price discovery process in these markets. The study was conducted within the scope of government bonds in the Eurozone and data between 2008-2014 were used. The long and short-term relationships of CDS spreads and bond spreads were investigated. Empirical findings show that bond spreads lead the price discovery process in the study where the vector error correction model and vector autoregression model methods are used.

Bai and Collin-Dufresne (2018) focused on the arbitrage relationship between CDS contracts and bonds. Cross section analysis method was preferred in the study. As the theory predicts, while the arbitrage base should not form, empirical evidence found that bonds with higher ratios in transaction liquidity, funding cost, counterparty risk, and collateral quality were consistent with arbitrage limits theories and the theoretical expectation was met. While selecting bonds, U.S. private sector bonds between 2006 and 2014 were selected with a maturity of 3,5 to 7 years, thus ensuring compliance with 5-year CDS spreads data.

Patane et al. (2019) researched the relationship between government bonds and corporate bonds in Eurozone and CDS spreads related to bonds in the period 2011-2018. New empirical findings regarding new theoretical studies and which variable leads the other in the price discovery process were researched. In the study where the vector autoregression and vector error correction model were applied, it was found that the mean of the movements of CDS spreads and bond spreads was positive and that bond market leads the price discovery process.

In studies examining the relationship between bond spreads and CDS spreads in developed countries, Granger causality relationship test and Johansen cointegration test are frequently used. The studies reveal the long-term relationship between bonds and credit default swaps within the limits of the theoretical framework of arbitrage limits, as the theory predicts. The CDS premiums are an indicator that reflects the credit risk, bond spreads and the CDS spreads have been compared regarding indicator of credit risk in all studies. Therefore, although it varies with the region where the study has been conducted, the U.S. 5-year government bonds and Germany 5-year government bonds have been used as a risk-free interest rate. By taking the difference between the bond nominal interest rate, and the risk-free interest rate, the credit risk premium of the bonds has been reached. The findings reveal that sometimes CDS spreads and sometimes bond spreads lead the price discovery process as the period and region under investigation changes.

2.2. Empirical Studies on Developing Countries

Chan-Lau and Kim (2004) studied on Brazil, Bulgaria, Colombia, Mexico, Philippines, Russia, Turkey and Venezuela using data on dates between 2001-2003 period, and they investigated the equilibrium relationship between CDS, bond and stock prices through Granger causality and Johansen cointegration analysis method. While the findings have indicated a significant relationship between variables in groups including Brazil, Bulgaria, Colombia, Russia, and Venezuela, a significant relationship has not been observed in many countries in which Turkey is also included.

Varga (2009) examined the relationship between the Hungarian Eurobonds and the CDS contracts for these bonds on dates between 2005-2008. In the study in which the Johansen cointegration test was applied, it was observed that 5-year Hungarian Eurobonds and CDS premiums were in close relationship and it was concluded that CDS spreads and bond spreads moved characteristically one after the other. According to findings, Hungary credit risk premium is primarily priced in the CDS market. It is concluded that the Hungarian Eurobond market is not an efficient market sufficiently owing to the bond risk spreads had to adapt to CDS premiums later. Especially in the more volatile market periods, it has been observed that CDS premiums have increased more than they should have been.

Ersan and Günay (2009) investigated the effect of the closure trial against the governing party on the country's CDS premiums by vector autoregression model. Researchers reached that there is no impact of closure trial against the governing party on the country's CDS spreads. It has been reached that variables that impact on CDS spreads of Turkey, is the return of Eurobonds traded abroad and the Dow Jones Index return rather than domestic variables related to Turkey.

Ammer and Cai (2011) investigated the relationship between bonds of 9 developing countries and CDS spreads between 2001-2005. In the study, it is concluded that CDS spreads deviate significantly from bond yields in the short term due to the liquidity and contract specifications of the CDS contracts, but a balanced relationship is established in the long term. Whether CDS contracts having the cheapest delivery option has an effect on premiums was investigated using a cross-section analysis method and it was found that it had an effect on spreads. As a result of the vector error correction model and the cointegration test, the relationship between CDS and bond premiums, in the long term, has

been verified as predicted by the theory. In some cases, it was found that CDS spreads lead the price discovery process.

Özman et al. (2018) using vector autoregression analysis, examined the relationship between the exchange rate for USD with TL and CDS spreads between the years 2015-2017 in Turkey. It has been determined that there is a positive relationship between the USD-TL exchange rate and the country's CDS level in both the long and short term, in other words, both variables move together in the long term. It has been concluded that the direction of the relationship is a one-way causality from USD-TL to CDS only.

Tanyıldızı (2020), conducted a study on commodity prices between the years 2008 to 2018 to measure the impact on Turkey's CDS premiums. In the study in which autoregressive models were used, CDS premiums were used as dependent variables and commodity prices were used as independent variables. Internal and external factors were used as control variables. As internal factors; BIST and benchmark interest data, as an external factor; VIX index data was used. As a result of the study, it was found that benchmark interest rates have a significant effect in explaining CDS premiums in both the long and short term.

When the studies on developing countries are examined, it is seen that similarly, analysis methods used in studies on developed countries are used. Ersan and Günay (2009) have tried to measure the effect of the political conjuncture in the country on risk premiums and have added depth to the finance literature. Tanyıldızı (2020) has created a regression model in his study and empirically has tested the explanatory power of internal and external factors on CDS premiums, which are determined as dependent variables. In conclusion, it has been found that CDS spreads lead the bond market in the price discovery process in cases where the Eurobond bond market does not have enough financial depth.

2.3. Empirical Studies Covering Developed and Developing Countries Together

Pan and Singleton (2008), in their study, have tried to identify structural factors affecting the CDS using data from Turkey, Korea, and Mexico between 2001-2006. In the study in which countries with different credit ratings and geopolitical characteristics were selected as a sample, also maximum likelihood (ML), OLS regression and Monte Carlo simulation analysis methods were used. Among the factors that determine the CDS spreads, it has been found that the global risk perception of investors in some sub-periods is the main factor that determines the spreads compared to the evaluation of local economies.

Coudert and Gex (2010) investigated the relationship between the CDS contracts and corporate bonds on dates between 2006-2010 and the relationship between the CDS contracts and government bonds on dates between 2007-2010 and aimed to determine which one was the leader in the price discovery process. Since the government bonds and corporate bonds market dynamics are separate, the study has been divided into two groups. In the study involving 18 countries, the relationship between 5-year bonds spreads and CDS spreads were discussed with panel

analysis. Empirical findings reveal that CDS spreads lead the price discovery process in the private sector debt instruments market. Moreover, CDS spreads lead the bond spreads in the price discovery process in the public sector debt instruments market in countries which have relatively low interest rates.

Longstaff et al. (2011), using the CDS data of government bonds of 26 developed and developing countries such as Romania, Mexico, Chile, Korea, Malaysia, and Japan between 2000 and 2010, established the regression model. The explanatory power of local variables (local stock index return, the rate of exchange the dollar against the local currency) and global variables (such as the U.S. stock index return, the U.S. government bond spreads) of credit risk has been tested empirically. The findings conclude that the country's CDS spreads are more closely connected to the U.S. stock market and the volatility index (VIX) compared to local economic indicators.

Koy (2014), in her study of the relationship between CDS spreads and Eurobonds of Germany, France, Italy, Spain, Portugal, Ireland, Greece and Turkey on dates between 2009 and 2012 have used Granger causality method. Empirical findings have provide evidence that the French and Italian CDS spreads lead the bond premiums.

When the studies of developed and developing countries are examined together, it is seen that developed countries and global financial indicators are more explanatory in pricing CDS premiums compared to local economic indicators. This is because developing countries' Eurobonds are less liquid for global investors than CDS contracts in Dollar or Euro currency. Besides the fact that global investors make investment decisions taking into account the developed financial market performances rather than evaluating the macroeconomic performance of the relevant country in the decision-making process. In the price discovery process studies based on developed and developing countries, many different methods such as regression models, panel data analysis, ML analysis, and Granger causality analysis have been used, and it has been found that CDS premiums lead bond premiums.

When the finance literature on bond premiums CDS contracts is examined, risk-free rate security such as U.S. government bonds, used as a benchmark in order to focus on the concept of credit risk premium, especially in studies on developing countries. The data set created by subtracting the risk-free interest rate from the bond premiums was cleared from the real interest rate, allowing more meaningful comparison of bond premiums with CDS premiums. The long-term relationship has been analyzed usually with the Johansen cointegration test in studies.

Within the framework of the current literature, in this study, to test the CDS premiums in a more meaningful way, the U.S. 5-year government bond interest rates were determined as the benchmark, and these interest rates have been removed from interest rates of Turkey's dollar-denominated Eurobonds to focus on credit risk. In addition, the exchange rate shocks that Turkey experienced in 2018 resulted with structural breaks in the dataset. For this reason, the causality relationship analysis of Toda-Yamamoto was tested on daily data with the presence of structural breaks. This research is one the most updated

research related to relation CDS and bond spreads currently as of the dates examined in data set. The approach in the preparation of the data set of the study, the analysis method used due to structural break, and the period examined; makes this study original in the finance literature.

3. Data and Methodology

Bond spreads and CDS spreads have been the research subject of many studies in the literature. One of the most prominent of these research topics is which variable leads the price discovery process. This situation may offer arbitrage opportunities to investors in inefficient financial markets, and it also provides a way for regulators to bring the market into a more efficient form. The purpose of the study is the relationship between Turkey's dollar-denominated Eurobonds, related CDS contracts is examined and the price discovery process is determined.

CDS contracts are financial instruments that reflect the credit risk premium of the reference asset. Bond spreads also include the pricing of the country's credit risk premium. In this study, while investigating the price discovery process, it is ensured to focus on the relationship between the credit risks premiums by clearing the related assets from other components. Thus, a possible relationship between them can be interpreted in a more meaningful way.

Daily data covering the period 02.01.2014-31.12.2019 were used and all data were obtained from Thomson Reuters (2020) Eikon financial data terminal. Data started as of January 2014 just because CDS data was available in Thomson Reuters data terminal as of this date. The reason why the data ends as of the end of December 2019 is to separate the COVID-19 pandemic effect from the analysis.

The data used for the CDS has covered 5 years of contracts related to Turkey's dollar-denominated Eurobonds issued in the U.S. market. The data on interest rates in the secondary market of Turkey's dollar-denominated government bonds is based on the bond yield curve method prepared by Reuters. According to this index, bond interest rates are classified. While classifying bond rates, it has been attended whether bonds have special features like having convertible bonds or not. Interest rates included in the index should be a part of at least 5 or more bonds having a fixed-rate coupon payment for each slope. Then bond interest rates consist of calculating the interest rates of eligible bonds in the secondary market according to the methodology determined by Reuters. Also, another data used as a benchmark and proxy measure in the study is the benchmark interest rates of the U.S. 5-year government bond.

Regarding CDS contracts, CDS premiums are based on 5-year Turkish government bonds in dollars at the U.S. market. For this reason, it is necessary to pay attention to the currencies while choosing the government bond interest rates as the dependent variable. In this study, benchmark interest rates of Turkey's government bonds dollar-denominated 5-year term has been used to purify the exchange rate effect on interest rates and to compare the interest rates of the same currency units.

One of the research topics in the study is to compare credit risk premiums across variables. Because CDS contracts are

an indicator showing the credit risk of the underlying asset. For this reason, the 5-year U.S. government bond benchmark interest rate, which as the globally accepted risk-free rate, has been deducted from the government bond interest rates. The components of interest include real interest rate, credit risk premium and expected inflation rate. By subtracting the U.S. government interest rates from the dollar-denominated Turkish government bond interest rates, it is aimed to purge the real interest rate component from the data set and focus on the credit risk premium.

Descriptive statistics of the variables used in the study are shown in Table 1.

Table 1. Descriptive Statistics of Variables

	Bonds	**CDS**
Mean	3.028132	262.4283
Median	2.714000	243.5800
Maximum	6.543550	582.0198
Minimum	1.638000	153.5600
Standard Deviation	0.996050	82.53810
Skewness	1.091427	1.103320
Kurtosis	3.403247	3.792830
Observations	1484	1484

Time series graphics related to the variables used in the study are presented in Figure 1. When the time series charts are examined, it is seen that there are structural breaks in the data set in 2018 and 2019. It is estimated that the main reason for this situation is the exchange rate shocks of the country experienced in these years.

Figure 1. Time Series Graphs of Variables
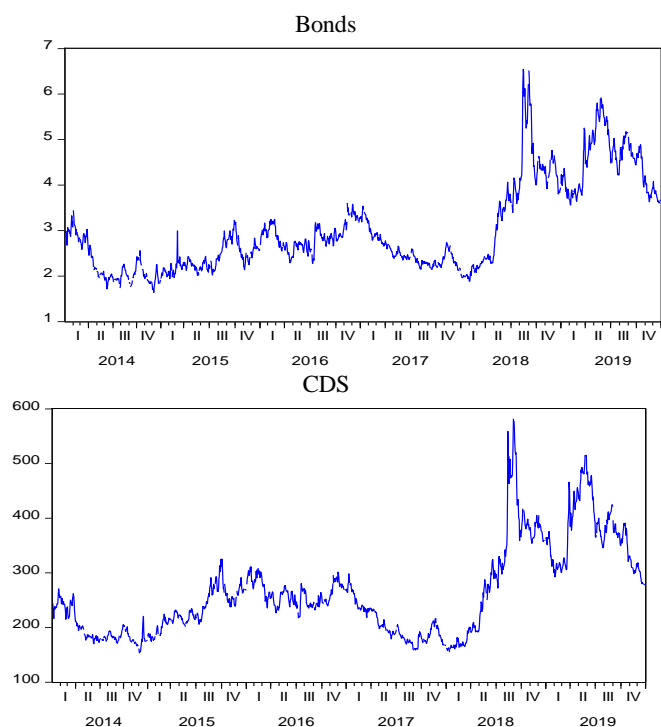
The Toda-Yamamoto causality method, which allows structural break analysis, was used to reveal the relationship among variables and to analyze which of the relevant variables lead each other in the price discovery process in financial markets.

Before performing statistical analysis of a time series, it should be checked whether the data constituting that time series are constant within the relevant period and whether the series is stationary or not (İğde, 2010). The condition for a time series to be stationary is based on the condition that the mean and variance of the series do not change over time and the covariance between the two periods depends only on the distance between the two periods, not on the period in which this covariance is calculated (Gujarati, 2011). Not being stationary causes the variable to not concentrate around its expected value in its movement over time. For this reason, the series should be stationary to make healthy predictions (Kocabıyık, 2016). The stationarity of the bond and CDS variables will be tested with the Augmented Dickey-Fuller (ADF) unit root test. Then, Lee-Strazicich (2003) unit root test has applied to test whether the variables have a unit root with structural breaks.

The preference of Lee-Strazicich from the unit root tests with structural break prevents the false rejection problem caused by the Zivot-Andrews and Perron tests, which are among the ADF type unit root tests with structural breaks (Tıraşoğlu, 2014). However, in the Lee-Strazicich unit root tests with structural break, model selection is important. Lee-Strazicich unit root tests have different models, which are model A, model B, and model C. One of these models has some advantages compared to others. Model C allows a shift in both level and trend, it is superior to Model A and Model B. Therefore, in this study, Model C is used (Tıraşoğlu, 2014).

After applying unit root tests, Toda - Yamamoto method was used for the causality relationship between variables. Toda - Yamamoto causality analysis is a model that does not require preliminary information on whether the relationships between series are stationary levels or cointegrated (Büyükakın et al., 2009). Toda - Yamamoto causality analysis differs from VAR and VECM methods, which are frequently used as traditional causality analysis, and the presence or absence of long-term relationships between variables does not affect the applicability of the analysis (Kocabıyık et al., 2020).

Toda and Yamamoto (1995), have developed a causality analysis method on the expanded VAR model as a result of their studies on Granger (1969) causality analysis. The application stages of this analysis method are listed below (Dritsaki, 2017):

- The first step is to determine the stationarity levels of the series. If the series are stationary at different levels from each other, the maximum stationarity level is used.
- Secondly, the VAR model is established regardless of the level at which the series are stationary level.
- The number of appropriate lag lengths to be used for the VAR model is determined in line with the guideline determined by the information criteria.
- Under the extended VAR model, the appropriate delay length k; and the maximum stationary level between the series is added to the VAR model by adding the d_max value.
- The analysis continues regardless of whether there is a cointegration relationship between the series.

- For the test of the no causality hypothesis; Granger causality analysis and advanced Wald test are analyzed on VAR model parameters estimated with k + d_max value.
- Finally, if there is a cointegration relationship between the series, there is also a reciprocal or unidirectional causality relationship between the series.

To perform Toda - Yamamoto causality analysis, it is necessary to determine the appropriate number of lag lengths within the VAR model. Lag length analysis is related to the decision phase of how many periods of lag data will be included in the analysis (Kocabıyık et al., 2020).

The appropriate lag length for the VAR model should be determined under the guidance of information criteria. The way to follow is important while determining the length of the delay. When the delays to be used in VAR analysis are determined larger than they are, the variables rise to higher values than they should be. This situation is also known as excessive parameterization problem (Katos et al., 2000: 300 as cited in Kayahan and Hepaktan, 2016).

While determining the number of lag lenght, it can benefit from many different information criteria. Selecting the information criterion that meets the smallest criterion from these criteria and determining the number of delay lengths accordingly is one of the ways to follow. If the model created with lag length includes an autocorrelation problem, then the number of lag lengths indicating the second-lowest critical value is selected and the model is reconstructed and this process continues until the autocorrelation problem is eliminated (Karagöl et al., 2007). In cases where information criteria show different lag lengths, another method that is frequently used is to choose according to the information criteria of LR (Sequential Modified LR Test Statistics) (Akkaş and Sayılgan, 2015). Besides it is seen that the Akaike (AIC) information criterion is preferred when determining the number of lag lengths in empirical studies in the economics literature (Çetin and Işık, 2019; Taş et al., 2016). After we will test the short-term relationship between variables with Toda - Yamamoto analysis, variance decomposition methods, and impulse-response functions will be used.

Variance decomposition analysis obtained from the part of the moving average of the established VAR model is the analysis method that expresses the source in which the shocks were occurring on the variables. It shows what percentage of a change that will occur in the variables used is due to the shock created by the other variable. Variance decomposition analysis also shows percantage of a change due to the shock at variables from itself. If the majority of the change in percentage in a variable are caused by itself, this variable acts externally (Enders, 1995: 311 as cited in Barışık and Kesikoğlu, 2006).

Impulse response functions, on the other hand, are used to measure the response of the other variable to this shock against a unit of standard deviation shock that will occur randomly in a variable (Aytaç and Güran, 2010). These functions reflect the current and future impact of a one-unit standard deviation shock in random error terms on endogenous variables. While the most important variable affecting a macroeconomic indicator is determined by

variance decomposition, whether this effective variable can be used as a policy tool is assigned by impulse-response functions (Özgen and Güloğlu, 2004).

4. Empirical Findings

In this part of the study, research findings regarding unit root tests, lag length selection, Toda - Yamamoto causality test, variance decomposition and impulse-response functions will be discussed.

4.1. Unit Root Tests

As a first step in the study, Augmented Dickey - Fuller (1979-1981) unit root test was applied to time series and the level values of the series were examined.

H_0: Series has a unit root. (Series is not stationary)

H_1: Series has not a unit root. (Series is stationary)

Table 2. Bond and CDS Variables ADF Unit Root Test Results

		Bonds		CDS	
		t- statistics	Probability*	t- statistics	Probability*
Level (Trend and Intercept)	Test Statistics	-3.567.482	0.033	-2.891731	0.1654
	1% seviye	-3.964248		-3.964248	
	5% seviye	-3.412.845		-3.412845	
	10% seviye	-3.128.408		-3.128408	
1st. Difference (Trend and Intercept)	Test Statistics	-	-	-33.82186	0.000
	1% level	-		-3.964248	
	5% level	-		-3.412845	
	10% level	-		-3.128408	

Table 2 shows the Augmented Dickey-Fuller (ADF) unit root test results for the bond and CDS series. According to results of unit root test, it is seen that the level test statistics for the bond series are greater than the critical value of Mac Kinnon (1996) at 5% and 10% significance levels in absolute value at the trend and intercept model. It is seen that the probability value is also less than 0.05 and in this case, the series has unit root hypothesis is rejected. However, at the 1% significance level, the series has unit root hypothesis cannot be rejected. The fact that the series does not have a unit root is an indication that the series is stationary, since the 5% significance level is taken as basis in the study.

According to results of ADF unit root test, it is seen that the level test statistics for the CDS series are smaller than the critical value of Mac Kinnon (1996) at 1%, 5% and 10% significance levels in absolute value at the trend and intercept

model. It is seen that the probability value is also more than 0.05 and in this case, the hypothesis that the series has unit root is not rejected. The unit root of the series is an indication that the series is not stationary and the first difference should be taken for the CDS series. When the first difference for CDS series is taken, it is seen that the level test statistics for the CDS series are greater than the critical value of Mac Kinnon (1996) at 1%, 5% and 10% significance levels in absolute value at the trend and intercept model. It is seen that the probability value is also less than 0.05 and in this case, the hypothesis that the series has unit root is rejected. Actually if the series does not have a unit root then it is an indication that the series is stationary.

The existence of structural breaks for variables was tested by the Lee-Strazicich unit root test. In this test, rejection of the basic hypothesis is an indicator of stationarity (Lee and Strazicich, 2003: 1082).

Table 3. Bond and CDS Variables Lee-Strazicich Unit Root Test Results with Structural Break

		Bonds	CDS			Bonds	CDS
Level	Minimum test stat.	-4.086955	-3.681926	1st.Difference	Minimum test stat.	-	-16.19559
	Break Point	05.09.2018	07.09.2018		Break Point	-	06.06.2018
	1% level	-4.513603	-4.501373		1% level	-	-4.507716
	5% level	-3.982322	-3.968424		5% level	-	-3.975632
	10% level	-3.701895	-3.687441		10% level	-	-3.694938

As seen in Table 3, the test statistic of the bond series is determined as - 4.086955. Since this result is greater than the absolute value of -3.982322 and -3.701895, which is the critical level at the 5% and 10% significance level, respectively, the null hypothesis is rejected and it is concluded that the series is stationary. At the 1% significance level, the null hypothesis cannot be rejected. The fact that the series does not have a unit root is an indication that the series is stationary, since the study is based on a 5% meaning level.

According to the results of the Lee-Strazicich structural break unit root test of the CDS series, the test statistic is found to be as -3.681926. Since this result is smaller than the absolute value at the 1%, 5% and 10% significance level, the null hypothesis cannot be rejected, and it is seen that the series has a unit root with a structural break. Since

the CDS series is not stable at significance level values, the first difference of the series was taken and the Lee-Strazicich unit root test was applied again. When the first difference is taken for the CDS series, the test statistic has been determined as -16.19559. This result is greater than the absolute value of the critical level -4.507716, -3.975632 and -3.694938 at the 1%, 5% and 10% significance level, respectively, the null hypothesis is rejected and the series is stationary.

For the Toda-Yamamoto analysis, the maximum stationarity level (dmax) of the variables must be known. As a result of two different stationarity tests, it was concluded that the bond was stable in both the ADF unit root test and the Lee-Strazicich unit root test. However, CDS was found to stationarity at the first difference both in the ADF unit root test and in the Lee-Strazicich unit root

test with a structural break. While analyzing with the Toda-Yamamoto causality test, dmax should be added to the number of lags by determining the maximum difference in which the variables become stationary. If the series have different stationary levels, the maximum stationary level should be included in the model (Toda and Yamamoto, 1995). While the variables are included in the VAR model, raw data should be included in the model instead of the series differencing. Therefore, since the bond variable is stationary at the level and the CDS variable is stationary at the first difference, dmax (1) should be added to the lag length number.

Table 4. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-8670.059	NA	434.8512	11.75076	11.75794	11.75343
1	-3474.729	10369.54	0.383154	4.716435	4.737968	4.724463
2	-3302.531	343.2289	0.305065	4.488525	4.524413	4.501905
3	-3267.942	68.84954	0.292679	4.447076	**4.497320***	**4.465809***
4	-3263.767	8.300116	0.292610	4.446838	4.511437	4.470923
5	-3262.697	2.123580	0.293774	4.450809	4.529763	4.480246
6	-3246.278	32.54935	0.288872	4.433981	4.527290	4.468770
7	-3244.395	3.728096	0.289702	4.436849	4.544513	4.476990
8	-3229.736	**28.97982***	**0.285548***	**4.422406***	4.544426	4.467900

One of the basic assumptions of the regression models is that there is no relationship between the error terms of the variables in the regression model. If there is a relationship between error terms, the autocorrelation problem in the model reveals (Ünver and Gamgam, 1996 as cited in Yavuz, 2009).

Table 5. VAR Residual Serial Correlation LM Tests

| Lags	LM-Stat.	Prob.
1	7.766161	0.1005
2	2.395853	0.6634
3	3.207004	0.5238
4	5.550130	0.2354
5	1.624856	0.8043
6	15.39160	0.0040
7	3.254733	0.5161
8	**6.618287**	**0.1575**

In the case of autocorrelation problem, deviations occur from the values that should be in tests such as T and F, and this situation reduces the reliability of the test (Yavuz, 2009).

LM test was performed to determine if there is an autocorrelation problem in the model. The null hypothesis which argues there is not any autocorrelation problem between the error terms has been tested at the 5% significance level. The autocorrelation problem is a condition that questions the reliability of the dataset used in the time series as to its suitability for analysis. Therefore, the number of lags included in the analysis should be evaluated by the autocorrelation test. Consequently, the probability value of the 8 lag lengths selected for the model is greater than 0.05 indicates that there is no autocorrelation problem in the model.

4.2. Lag Length

After the VAR equation was established, VAR lag length determination test was performed to state the appropriate number of lags to be included in the analysis. According to VAR lag order selection criteria, 3 out of 6 information criteria pointed to 8 as appropriate lag. One of the common methods used in determining the appropriate lag length in the literature is to consider the Akaike information criterion. Choosing the length of the lag indicated by the lowest value of information criterion is another common approach. For all these reasons, the VAR lag length was chosen as 8.

Figure 2. Inverse Roots of AR Characteristic Polynomial
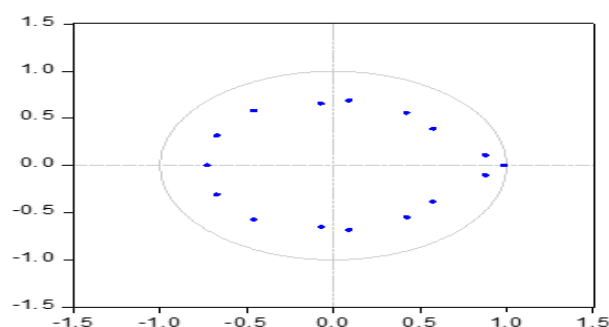
The fact that the inverse roots of the AR characteristic polynomial related to the stationarity of the series related to the established VAR model are in the unit circle shows that the VAR process is stationary (Güder et al., 2016; Çelik et al., 2013). The fact that the inverse roots of the AR characteristic polynomial belonging to the VAR model are in the unit circle (being less than 1) shows that the model established does not pose a problem in terms of stationarity.

4.3. Toda - Yamamoto Causality Test

Toda - Yamamoto causality equation was established by considering the maximum stationarity level (1) obtained from unit root tests in addition to the 8 lags obtained as a result of the lag length selection test. The hypotheses for the model are presented below.

H_0: The independent CDS variable is not the Granger cause of the dependent bond variable.

H_1: The independent CDS variable is the Granger cause of the dependent bond variable.

Table 6. Toda - Yamamoto Causality Analysis

Dependent Variable	Independent variable	Chi-sq	Df	Prob.
Bond	CDS	369.2125	8	0.0000
CDS	Bond	14.59822	8	0.0674

In the Toda-Yamamoto causality analysis, the null hypothesis has the proposition that there is no causal relationship between the variables, while the H1 hypothesis suggests that there is a causality relationship between the variables. If the probability value is less than 0.05 at the 5% significance level, it means rejecting the null hypothesis (Toda and Yamamoto, 1995). The findings reveal that there is a causality relationship from CDS to bond. According to the Toda-Yamamoto causality test results, there is a very strong one-way causality relationship from CDS spreads to the bond variable.

When the causality relationship from bonds to CDS is tested;

H_0: The independent bond variable is not the Granger cause of the dependent CDS variable.

H_1: The independent bond variable is the Granger cause of the dependent CDS variable.

From bonds to CDS, the probability value greater than 0.05 at the 5% significance level indicates that the null hypothesis should be accepted (Toda and Yamamoto, 1995). There is no causality relationship from bonds to CDS at the 5% significance level. If the same analysis is performed at the 10% significance level, it is also seen that there is a significant relationship from bonds to CDS. The fact that the probability value is 0.0674 proves this.

As a result of the Toda-Yamamoto causality analysis, a one-way causality relationship from CDS premiums to bond premiums has been determined at the 5% significance level.

4.4. Variance Decomposition

After Toda-Yamamoto causality analysis, variance decomposition was performed in terms of both bonds and CDS. The results of variance decomposition are presented in Table 7.

Table 7. Variance Decomposition

Period	Variance Decomposition of Bonds			Variance Decomposition of CDS		
	S.E	Bond	CDS	S.E	CDS	Bond
1	0.088596	100.0000	0.000000	8.522853	100.0000	0.000000
2	0.141122	91.29283	8.707167	12.85763	99.86870	0.131297
3	0.184468	85.71906	14.28094	16.29613	99.73221	0.267791
4	0.215686	82.89652	17.10348	18.80670	99.53694	0.463064
5	0.240403	81.19330	18.80670	20.95976	99.48380	0.516198
6	0.264077	78.89079	21.10921	22.99548	99.23100	0.769002
7	0.283050	77.45013	22.54987	24.60874	99.00316	0.996840
8	0.299887	75.75751	24.24249	26.15089	98.80490	1.195099
9	0.313139	74.78845	25.21155	27.45136	98.58065	1.419348
10	0.323941	74.06173	25.93827	28.56804	98.32459	1.675408
11	0.332250	73.47346	26.52654	29.46518	98.02349	1.976506
12	0.338494	73.04254	26.95746	30.19755	97.69969	2.300310
13	0.343172	72.72189	27.27811	30.80540	97.35718	2.642816
14	0.346568	72.47051	27.52949	31.29954	96.99057	3.009426
15	0.349012	72.29243	27.70757	31.71053	96.60571	3.394291
16	0.350672	72.15818	27.84182	32.04502	96.20878	3.791217
17	0.351760	72.06652	27.93348	32.32223	95.80331	4.196685
18	0.352430	72.00831	27.99169	32.55236	95.38905	4.610955
19	0.352816	71.97337	28.02663	32.74581	94.97268	5.027317
20	0.353021	71.95370	28.04630	32.91180	94.55507	5.444930
21	0.353114	71.94485	28.05515	33.05585	94.14083	5.859174
22	0.353147	71.94154	28.05846	33.18360	93.73169	6.268311
23	0.353153	71.94102	28.05898	33.29841	93.32935	6.670649
24	0.353153	71.94100	28.05900	33.40334	92.93571	7.064293
25	0.353159	71.94017	28.05983	33.50042	92.55174	7.448258
26	0.353175	71.93780	28.06220	33.59135	92.17834	7.821655
27	0.353203	71.93365	28.06635	33.67735	91.81602	8.183976
28	0.353241	71.92780	28.07220	33.75932	91.46504	8.534964
29	0.353286	71.92046	28.07954	33.83800	91.12543	8.874568
30	0.353335	71.91200	28.08800	33.91390	90.79714	9.202861

According to the result of the variance decomposition regarding the situation in which the dependent variable is bond and the independent variable is CDS, while the change of 1 unit in the bond is initially explained by the bond data itself, after that the effect of CDS data on the bond increases. Especially after the 19th period, the disclosure power of the CDS premium increases by up to 28% and continues in this way for a long time.

According to the result of the variance decomposition regarding the situation where the dependent variable is CDS and the independent variable is the bond, while the 1 unit increase in the CDS premiums is initially explained by the CDS variable itself, 30 days later, approximately 9.3% of this change is explained by the bond variable. This shows that the bond variable is much less effective in explaining a possible change in CDS premiums compared to CDS' disclosure power of bond premiums.

## 4.5. Impulse - Response Functions

According to the results of the impulse-response functions, the reaction of the other variable to the shock of 1 standard error applied to a variable is explained with the help of the figures below. While the x-axis of the figures shows the number of periods, the y-axis shows the response to the effect with a standard error of 1 unit.

**Figure 3.** Bond's Response to the CDS
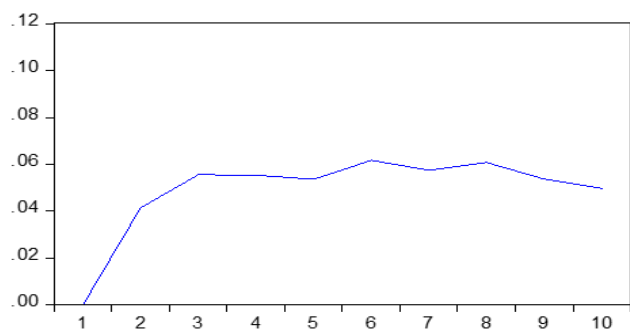
As can be seen in Figure 3, the response of the bond positively increases against a random one-unit standard deviation shock experienced in CDS premiums and this effect reaches its peak on the 6th day. This shock causes an increase of approximately 6 basis points as of the 6th day.

Figure 4. CDS' Response to the Bond
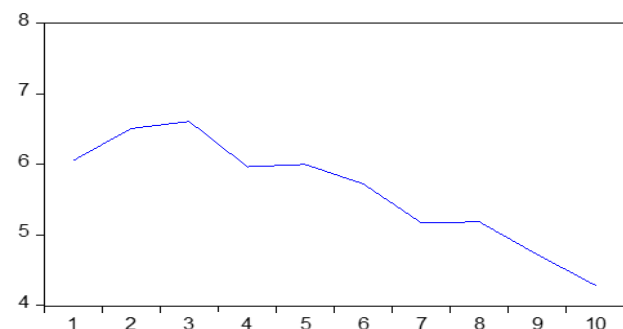
As can be seen in Figure 3, for the first 3 days the response of the CDS positively increases against a random one-unit standard deviation shock experienced in bond premiums, and then their reaction gradually decreases. As of the 3rd day, there is an increase of approximately 7 points in the CDS premiums.
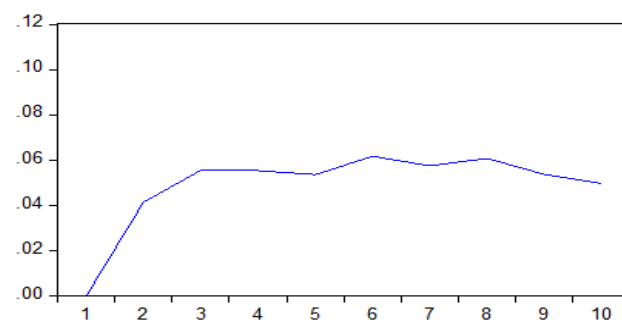
Figure 5. Bond's Response to the Bond
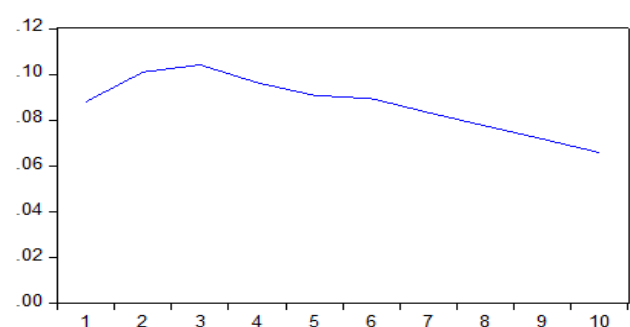
As can be seen in Figure 5, in the face of a random unit of standard deviation shock experienced in the bond premiums itself, the bond gives a positive response in the first 3 days, and its response to shock reaches its peak with an increase

of approximately 3 basis points as of the 3rd day. After the 3rd day, although the severity of its reaction decreased, the effect of the shock continues.

Figure 6. CDS' Response to the CDS

As can be seen in Figure 6, in the face of a random unit of standard deviation shock experienced in the CDS premiums itself, the CDS premiums give a positive response for the first 3 days and then enter a declining trend until the 5th day, after that as of the 6th day, its response to shock reaches its peak with an increase of about 6 points.

5. Conclusions

The relationship between bond premiums and CDS premiums has been the subject of many studies in the finance literature (Blanco, 2005; Zhu, 2006; Forte and Pena, 2009). These studies tried to determine which variable leads another in the price discovery process. This discovery process is also important for investors. One of the main reasons for this is that investors can take positions according to this situation. The price discovery process is also important by regulators; thus they can create policies to ensure market efficiency.

Another important point is the credit risk premium indicator. CDS contracts reflect the credit risk premium of the reference asset, which can be government bonds as well as private sector bonds. Bond premiums are another indicator that reflects the credit risk premium along with other components contained in it. For these reasons, the relationship between the two variables, which includes the credit risk premium, has also been of interest in the finance literature.

When the pricing models of CDS spreads are examined, the rate of yield to maturity for the asset to which CDS is a reference is one of the basic building blocks of CDS spreads pricing models. This situation may pave the way for the arbitrage situation in financial markets. Many studies in the literature have focused on the arbitrage relationship between CDS and bonds, and it has been concluded that they are in relation within arbitrage limits in the long term (Bai and Collin-Dufresne, 2018; Palladini and Portes, 2011).

The relationship between benchmark interest rates of Turkey's 5-year Eurobonds and CDS spreads of Turkey's 5-year U.S. dollar-denominated Eurobonds on dates between 02.01.2014-31.12.2019 was empirically examined. The level values of the variables were taken as the basis and the U.S. 5-year government bond benchmark interest rates were used as a benchmark (Palladini and Portes, 2011; Zhu, 2006; Varga, 2009). ADF and Lee-Strazicich unit root tests

were applied for the two variables. As a result of the analysis of variables with the Lee-Strazicich unit root test, structural breaks were found in both variables. With detecting the presence of structural breaks, the short-term relationship between variables was investigated through daily data by using the Toda-Yamamoto causality analysis, which allows the causality analysis with structural breaks.

Empirical findings reveal a very strong causality relationship from CDS premiums to bonds at the 5% significance level. Also, it is observed that there is a causality relationship from bond premiums to CDS premiums based on the 10% significance level. The analysis of variance decomposition shows that 28% of the 1-unit change in bond spreads is explained by CDS spreads after 19 days and this effect continues for a long time. Only approximately 9.3% of the 1-unit change experienced in CDS spreads can be explained by the bond. According to the impulse-response functions, it was observed that a random standard deviation shock experienced in CDS spreads positively increased the bond spreads and this effect reached its peak as of the 6th day. The response of the CDS spreads to a one standard deviation change in the bond increases by giving a positive response in the first 3 days and then the magnitude of their response gradually decreases. It was observed that the response of the bond premiums to a standard deviation shock experienced in the bond itself was positive and reached its peak as of day 3. The response of the CDS premiums to a standard deviation shock experienced in itself reaches a peak by 6 days and the direction of the reaction is positive.

Among the findings of the study, it is seen that there is a strong causality relationship from CDS spreads to bond spreads, and credit risk premium pricing is primarily realized in CDS premiums. In this context, similar to the findings of the study; Blanco et al. (2005), Zhu (2006), Forte and Pena (2009), Palladini and Portes (2011) concluded that CDS spreads lead to bond spreads. O'Kane (2012) concluded that CDS spreads lead the bond market in Spain and Greece, and unlike the findings of the study, bond spreads in Ireland and Portugal lead the CDS spreads. Similarly, Giorgione and Patane (2016) and Patane et al. (2019) found that bond spreads lead CDS spreads as different from the findings of the study. These studies were conducted within the scope of developed countries, and it is observed that empirical findings have changed with the differentiation of the period examined.

The studies on developing countries, Varga (2009) investigated the relationship between the Hungarian government bond market and CDS and reached the conclusion that credit risk pricing was first realized in CDS and CDS spreads lead bond spreads. The obtained results are similar to the findings of this study. Chan-Lau and Kim (2004) concluded that CDS and bonds in Bulgaria, Colombia and Venezuela have equal weights in the price discovery process, while bond spreads lead CDS spreads in Brazil. Ammer and Cai (2011) found that bond and CDS are in a long-term relationship, and in some cases, CDS spreads lead the bond spreads in the price discovery process. Özman et al. (2018), were unable to find a causal relationship between bonds and CDS conducted in Turkey. Tanyıldızı (2020) found that benchmark interest rates of Turkey's government bonds have a meaningful and

significant effect on CDS spreads in both the short-term and long-term. When the findings of the study are compared with the finance literature; although the price discovery process varies according to the country and period examined, it has been observed that there are different results. Similarly in the studies regarding developed countries, we have found that CDS leads the bond premiums in the price discovery process. It has been observed that sometimes, bond premiums can also lead the price discovery process in studies on developing countries.

Examining the researches on both developed and developing countries, Coudert and Gex (2010) found that CDS spreads lead the price discovery process in the private sector debt instruments market. Koy (2014) analyzed both developed and developing countries and found that CDS spreads lead bond spreads in Turkey, Italy and France which are similar to our results.

The empirical findings found may vary with the depth of the countries' debt securities market and the period examined. In their study, Pan and Singleton (2008) tried to determine the structural factors affecting CDS premiums, and it was concluded that investors' global risk perception is the main factor affecting premiums compared to local economic macroeconomic indicators. The reason for this may be that Eurobonds, which are references to CDS, do not have a deep enough financial market, and CDS contracts are considered more liquid for global investors. Thus, global risk perception is primarily priced in CDS spreads.

As a result of empirical findings, it is concluded that CDS spreads are the cause of bond spreads. This indicates that the credit risk perceptions of Turkey are primarily priced in CDS contracts. By reducing bond premiums, to reduce borrowing costs and to finance the investments required for the growth of the country's economy, CDS premiums should be taken into account. The control of credit risk premium perception will be ensured by controlling CDS spreads. Because Eurobond markets do not have a liquid market as much as CDS contracts have. The frequent use of CDS contracts by global investors shows the importance of global risk perception in pricing credit risk. Emphasis on global risk perception management and thus downward suppression of financing costs and liquidity risk are among the policy recommendations of this study. In upcoming studies, the bond spreads and CDS spreads relationship can be tested with models that can analyze the long-term relationship with structural breaks in the data set.

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