

9. THE ROLE OF MACROECONOMIC AND MARKET INDICATORS IN EXPLAINING SOVEREIGN CREDIT DEFAULT SWAPS (CDS) SPREAD CHANGES: EVIDENCE FROM TÜRKIYE

Mustafa Tevfik KARTAL¹

Abstract

The study investigates the role of macroeconomic and market indicators on Türkiye's sovereign CDS spreads, which represent the riskiness and vulnerability in terms of credit default that affects foreign investment flows. In this context, Türkiye, which has high and volatile CDS spreads, is selected, and ten explanatory indicators including five macroeconomic and five market are selected. Moreover, monthly data between January 2010 and January 2022, which covers the most recent accessible data, is used and multivariate adaptive regression splines (MARS) approach is performed. The empirical results reveal that (i) all macroeconomic and market indicators used in the analysis have a significant effect on the CDS spreads; (ii) foreign exchange (FX) rates, Treasury bond interest rates, and deposit interest rates are the most influential three indicators, whereas credit interest rate and industrial production index are the least effective indicators; (iii) the effects of the indicators changes according to different thresholds; (iv) the effect of the indicators vary according to interactions with other indicators. Overall, excluding FX rates, the market indicators have higher importance with regard to the macroeconomic indicators in terms of effects on the CDS spreads. Furthermore, policy implications regarding having low-level CDS spreads to stimulate foreign investments inflows are discussed by considering the boundaries of the study. Hence, Türkiye as well as other emerging countries can have low-level CDS spreads by decreasing the adverse effects of the influential indicators.

Keywords: CDS spreads; macroeconomic indicators; market indicators; MARS, Türkiye.

JEL Classification: C22; E44; F31; G12.

Introduction

Although countries have been facing new challenges, economic issues have been still the most important priority. While there are many economic indicators such as consumer prices

¹Borsa İstanbul Strategic Planning, Financial Reporting, and Investor Relations Directorate, İstanbul/Türkiye, Email: mustafatevfikkartal@gmail.com. Address: Reşitpaşa Mahallesi Borsa İstanbul Caddesi No: 4 34467 Sarıyer, İstanbul/Türkiye.

index (CPI), FX rates, interest rates, reserves, and unemployment (Orhan *et al.*, 2019; Kartal, 2020; Kartal *et al.*, 2021), each of them has high importance for countries due to the fact that they reflect conditions and progresses in different parts of economies. In this context, CDS spreads take place among the most significant indicators for countries, economies, and economic actors, especially international ones. Because, international investors consider CDS spreads of countries in the allocation of assets in order to benefit from diversification (Dooley & Hutchison, 2009; Yang *et al.*, 2018; Kartal, 2020).

CDS spreads are financial derivative products, which are used for protection against losses on debts that are provided by foreign investors (Hibbert & Pavlova, 2017; Kartal, 2020; Kartal *et al.*, 2022). While corporate CDS spreads are related to companies taking debts, sovereign CDS spreads are much related to countries' riskiness, soundness, and vulnerabilities (Shahzad *et al.*, 2017). Hence, CDS spreads can be used by investors at either macro (country) or micro (company) level for financial protection purposes.

Due to the negative effects of the high-level CDS spreads, countries generally have difficulties in attracting foreign investments through the portfolio flow channel. High-level CDS spreads decrease contributions of foreign portfolio investments to the economic growth and development of countries. Thus, having and sustaining low-level CDS spreads has become important. But, this is not easy because there are many factors that should be considered, that affect CDS spreads. Hence, having low-level CDS spreads requires consideration of multiple factors at the same time. From this perspective, international (global), macroeconomic, and market (financial) factors can have effect on the CDS spreads of countries (Galil *et al.*, 2014; Kocsis & Monostori, 2016; Kartal, 2020; Kartal *et al.*, 2022). Considering that international factors are mainly out of the control of countries most of the time, focusing on macroeconomic and market factors can be beneficial in having low-level CDS spreads.

As a matter of fact, developed countries have low-level CDS spreads. On the other hand, most emerging countries have relatively high-level CDS spreads with regard to developed countries. In recent conditions, Türkiye, which takes place among important emerging countries, has quite high-level CDS spreads and it has faced sudden increases sometimes. Appendix 1 presents the progress of sovereign CDS spreads of Türkiye since September 2008. As one may see from Appendix 1, Türkiye had high-level CDS spreads when Global Financial Crisis (GFC) continued. After the ending of the GFC, Türkiye's CDS spreads went down to a level of 300 basis points (bps) until mid-2018. With the beginning of macroeconomic deteriorations, the CDS spreads of Türkiye began to increase and reached the level of 570 bps in September 2018. Then, the CDS spreads decreased gradually with the effects of measures taken. At the end of January 2020, they arrived at 240 bps. However, they reached 611 bps in April 2020 and 624 bps in December 2021.

The progress of Türkiye's sovereign CDS spreads shows that Türkiye has quite high and volatile CDS spreads that are a threat to sustaining foreign portfolio inflows. Also, Türkiye has still quite high CDS spread level with regard to its peers (The Central Bank of the Republic of Türkiye-CBRT, 2020a; Bloomberg, 2022). In this context, researching Türkiye case and determining the role of macroeconomic and market factors on the CDS spreads can be beneficial.

It is acknowledged that there are some studies in the current literature that examine the CDS spreads of Türkiye, such as Kartal (2020) and Kartal *et al.* (2022). However, the main perspective of these studies is to focus on a specific viewpoint, such as global factors (in Kartal, 2020) or behavior of the CDS spreads in different economic conjunctures (in Kartal

et al., 2022). When the current literature is examined from viewpoint of the role of macroeconomic and market indicators on the CDS spread changes, it may be concluded that the Türkiye case has not been comprehensively examined and there is a literature gap. Hence, a new study that examines the CDS spreads of Türkiye from this perspective by including the most available data and using a novel method can fill in the gap.

By taking the literature gap into account and the importance of Türkiye among the emerging countries, this study investigates the role of macroeconomic and market indicators on the CDS spreads in Türkiye. Parallel to this aim, a total of ten explanatory indicators including five macroeconomic ones and five market ones is included by benefitting from the literature, monthly data between January 2010 and January 2022 as the most recent accessible data is used, and the MARS approach is applied. Hence, this study aims to (i) determine the role of the macroeconomic and market indicators on the CDS spreads; (ii) define the relative importance of macroeconomic and market indicators; (iii) investigate whether the effects of the indicators change according to different thresholds; (iv) search whether effects of the indicators vary according to interactions with other indicators. The empirical outcomes reveal that (i) all macroeconomic and market indicators have a significant effect on the CDS spreads; (ii) FX rates, Treasury bond interest rate, and deposit interest rates are the most influential indicators, whereas credit interest rate and industrial production index are the least effective indicators; (iii) the effects of the indicators change according to different thresholds; (iv) the effect of the indicators vary according to interactions with other indicators. Overall, market indicators have higher importance with regard to macroeconomic indicators; moreover, some policy implications are proposed based on the empirical outcomes.

The study contributes to the literature in the following ways. First, this study focuses on Türkiye as an emerging market case that has quite high-level CDS spreads by focusing on the macroeconomic and market indicators. Hence, the study gives much more importance to internal factors rather than to external factors in explaining CDS spread changes, which is consistent with studies of Galil *et al.* (2014), Fontana and Scheicher (2016), Hibbert and Pavlova (2017), and Akçelik and Fendoğlu (2019). Second, this study applies the MARS approach as a non-parametric regression that builds the functional relationship between indicators without any assumption. The MARS approach has been recently used in the economics and finance areas and is rarely used for examination of the CDS spreads in the literature. Third, this study uses monthly data between January 2010 and January 2022 by considering the frequency of the indicators included in the analysis.

The remaining sections of the study are as follows. Section 2 reviews the literature. Section 3 explains indicators, data sources, and methodology. Section 4 presents empirical results. Section 5 presents the conclusion and policy implications.

1. Literature Review

As mentioned above, sovereign CDS spreads reflect the riskiness, soundness, and vulnerabilities of countries (Shahzad *et al.*, 2017; Kartal, 2020; Kartal *et al.*, 2022). For this reason, there is a variety of indicators that may have an effect on the CDS spreads. While some of these indicators may be found among the macroeconomic indicators, some others can be included in the market indicators as well.

The first group of studies focuses on the effects of macroeconomic indicators on the CDS spreads. In this group, CPI, current account (CA) balance, FX rates, industrial production index (IPI), and unemployment indicators are considered.

CPI is one of the main indicators that is considered in examining CDS spreads. Galil *et al.* (2014), Benbouzid *et al.* (2017), Akçelik and Fendoğlu (2019), CBRT (2020a), and Kartal *et al.* (2022) examine the effect of the CPI on the CDS spreads and determine that there is a positive (*i.e.*, increasing) effect of the CPI on the CDS spreads. In this context, as the CPI indicator, the annual rate of change in CPI is used.

CA balance is another important indicator for emerging countries due to the fact that they have generally a CA deficit. In the present literature, Kocsis and Monostori (2016), Yılmaz and Çetiner (2017), Akçelik and Fendoğlu (2019), Akın and Işıklı (2020), CBRT (2020a), Anelli and Patané (2022), and Huyugüzel Kışla *et al.* (2022) consider the CA balance as an indicator in examining CDS spreads and conclude that there is a positive (*i.e.*, increasing) effect of the CA deficit on the CDS spreads.

Another important indicator is the FX rates. For instance, Grammatikos and Vermeulen (2012), Ertuğrul and Öztürk (2013), Fontana and Scheicher (2016), Hassan *et al.* (2017), Augustin (2020), Kartal (2020), Bernoth and Herwartz (2021), Kartal *et al.* (2021), and Kartal *et al.* (2022) examine the relationship between CDS spreads and FX rates and determine that there is a positive relationship. In line with these studies, United States Dollar (USD)/Turkish Lira (TRY) FX rates are included as the most used FX rates in Türkiye.

Also, IPI is another macroeconomic indicator that is used in the current studies. For example, Chen *et al.* (1986), Johnson (2002), Sagi and Seasholes (2007), Liu and Zhang (2008), and Galil *et al.* (2014) take IPI into account in examining CDS spreads and state that there is a negative (*i.e.*, decreasing) effect of the IPI on the CDS spreads.

Furthermore, the unemployment rate is included in various studies. Liu and Morley (2013), Şahin *et al.* (2016), Doshi *et al.* (2017), Aytekin and Abdioglu (2021), Anelli and Patané (2022), and Hao *et al.* (2022) are some examples of the current studies that consider unemployment rate in examining CDS spreads and they determine that there is a positive (*i.e.*, increasing) effect of the unemployment on the CDS spreads.

The second group of studies examines the effects of the market indicators on the CDS spreads. In this group, interest rates, nonperforming loans (NPL), and reserves are considered.

In the current literature, there are a variety of studies that consider a different types of interest rates in examining CDS spreads. Longstaff *et al.* (1995), Collin-Dufresne *et al.* (2001), Alexander and Kaeck (2008), Galil and Soffer (2011), Galil *et al.* (2014), Hassan *et al.* (2015), Hibbert and Pavlova (2017), Yang *et al.* (2018), Kartal (2020), Kartal *et al.* (2022) examine the effect of the interest rates on the CDS spreads. In such studies, different interest rate types, such as credit interest rates, deposit interest rates, Treasury bond interest rates, and the weighted average cost of funding of central banks are used and concluded that either a positive (*i.e.*, increasing) or a negative (*i.e.*, decreasing) effect of interest rate may be revealed on the CDS spreads. In line with these studies, credit interest rates, deposit interest rates, and 10-year Treasury bond interest rates are selected to be included in the analysis. That is why because these interest rate indicators are much more significant in Türkiye as an emerging country with a bank-based financial system and a debt-based economic growth structure.

Besides, NPL can be influential on the CDS spreads. Benbouzid *et al.* (2017), Di Tommaso and Pacelli (2022), and Kartal *et al.* (2022) include NPL in examining CDS spreads and define a positive (*i.e.*, increasing) effect of the NPL on the CDS spreads. In line with the studies, NPL is included as a market indicator.

As a last market indicator, the reserves of central banks are considered. In the current literature, Afonso and Strauch (2007), Akçelik and Fendoğlu (2019), CBRT (2020a), Kartal *et al.* (2022), and Rathi *et al.* (2022) use reserves in examining CDS spreads and they define negative (*i.e.*, decreasing) effect of the reserves on the CDS spreads. In line with these studies, reserves are used in this study and a total of FX and gold reserves are considered because there is a nearly equal amount of FX and gold reserves in the total reserves of Türkiye.

Moreover, a variety of econometric and statistical methods are used to examine CDS spreads. In this context, autoregressive distributed lag bounding test, causality and cointegration tests, regression, vector autoregressive model, vector error correction model as well as machine learning algorithms are used in the current literature. For example, in studies focused on Türkiye, Şahin and Altay (2016) use cointegration and dynamic least squares; Akın and Işıklı (2020) apply the cointegration test and Fourier Toda-Yamamoto causality test; and Kartal *et al.* (2022) use machine learning algorithms. Even, Kartal (2020) use the MARS approach to examine CDS spreads of Türkiye by including some global, macro, and pandemic-related indicators via using daily data.

When evaluating studies in the literature, it may be summarized that some indicators and methods are used frequently, whereas some others are much less considered. In line with the studies of Galil *et al.* (2014), Fontana and Scheicher (2016), Hibbert and Pavlova (2017), and Akçelik and Fendoğlu (2019) concluding that country-specific macroeconomic and market indicators are much more important for the CDS spreads, this study selects a total of ten macroeconomic and market indicators by benefitting from the literature review. Also, this study performs the MARS approach that is rarely used to examine the CDS spreads in the current literature.

2. Indicators, Data Sources, and Methodology

2.1. Indicators

5-years sovereign CDS spreads of Türkiye are used as a dependent indicator because of the fact that this maturity in the CDS spreads has the highest liquidity (CBRT, 2020a). Also, a total of ten independent indicators are selected to analyze their effects on the CDS spreads by following previous literature. Table 1 presents a summary of the indicators.

Table 1

Details of the Indicators

Symbols	Indicator Types	Indicators	Descriptions	Units	Expected Effects
CDS	Dependent	CDS Spreads	Türkiye 5-Year Sovereign USD CDS Spreads	Point	*
CA	Macroeconomic	CA Balance	CA Balance (US Dollar)	Billion USD	+
CPI	Macroeconomic	Inflation	CPI (Annual Rate of Change)	%	+
CRD	Market	Credit Interest Rate	Commercial Credits Interest Rates (Annual)	%	+,-

Symbols	Indicator Types	Indicators	Descriptions	Units	Expected Effects
DPST	Market	Deposit Interest Rate	Deposit Interest Rates (Annual)	%	+,-
IPI	Macroeconomic	Industrial Production Index	IPI	Point	-
NPL	Market	NPL	NPL Amount	Billion TRY	+
RSRV	Market	Reserves	FX and Gold Reserves	Billion USD	-
THVL	Market	Treasury Bond Interest Rates	10-Year Treasury Bond Interest Rates	%	+,-
UNEMP	Macroeconomic	Unemployment	UNEMP Rate (Annual)	%	+
USD/TRY	Macroeconomic	FX Rates	USD/TRY FX Rates	Point	+

Notes: * represents dependent indicator; + denotes positive (increasing) effect on the CDS spreads; - shows negative (decreasing) effect on the CDS spreads.

2.2. Data Sources

The scope of the study includes Türkiye due to the fact that Türkiye faced an increasing CDS spreads many times in the last periods. The study covers the period between January 2010 and January 2022. As it is known, there was the global financial crisis in 2008 and its negative effects continued in 2009. For this reason, data is started from 2010, which can be evaluated as a normal year.

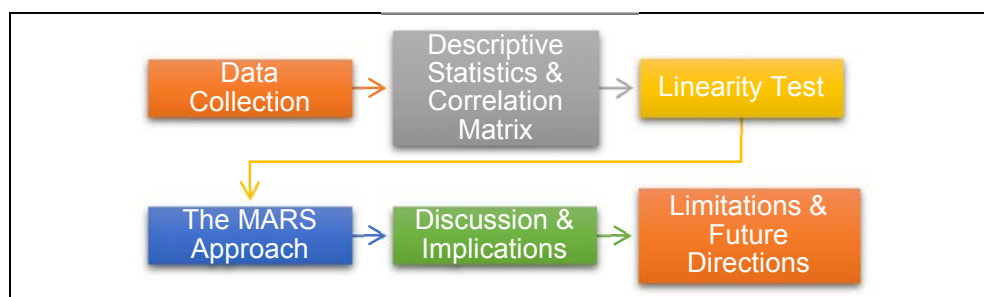
Data for the 10-Year Treasury Bond Interest Rate is gathered from Bloomberg (2020), data for NPL is obtained from Banking Regulation and Supervision Agency (BRSA) (2020), and data for all other indicators are collected from the CBRT (2020b).

2.2. Methodology

A multi-step methodology is applied to examine the role of the macroeconomic and market indicators on the CDS spreads in Türkiye as seen in Figure 1.

Figure 1

The Applied Methodology



In the first step, the data is collected from various data sources. In the second step, the descriptive statistics and correlation matrix are examined in detail. In the third step, the BDS test is used to examine the linearity of the indicators (Broock *et al.*, 1996). Naturally, it is

much more appropriate to use non-linear techniques when indicators are non-linear. Hence, the characteristic of the indicators is important in determining the analysis technique. In the fourth, the MARS approach is applied (Friedman, 1991). This approach analyzes the effects of the explanatory indicators on the dependent indicator by considering the interactions between the explanatory indicators as well as the thresholds of each explanatory indicator. In the fifth step, discussion and policy implications are presented based on the empirical outcomes. Finally, limitations and future directions are discussed in the conclusion part of the study.

In the empirical analysis, the MARS approach is used as a non-parametric regression modeling of high dimensional data developed by Friedman (1991) in order to predict underlying functional relationships. Whereas linear models have various assumptions to make a prediction, non-linear models generally do not have any assumptions. Hence, the MARS algorithm is a flexible and accurate predictor of piecewise-defined polynomials from correlated data (Goh *et al.*, 2017; Liu, 2018).

A general MARS model can be formulated as follows:

$$Y = B_0 + \sum_{k=1}^K a_n B_n(X_t) + \varepsilon \quad (1)$$

where: Y is the dependent indicator, X represents independent indicators, B_0 denotes the constant term, $B_n(X_t)$ describes the basis function that is estimated by minimizing the residual sum of squares, and a_n shows the coefficient of n^{th} basis functions (Friedman, 1991).

There is a two-step procedure that consists of forward and backward stages in the MARS model. In the first stage, the algorithm starts from a constant term that is the mean of the dependent values. Then, the piecewise linear segments, known as basis functions (BFs), are iteratively added to the model. BFs are dependent on spline functions that are defined on a given segment and the end points of the segment are called knots. The forward step finds the potential knots to improve the performance and leads to overfitting. In the second stage, it can be eliminated the redundant knots that have the least contribution to the complex model by using Generalized Cross-Validation (GCV).

GCV is defined as follows:

$$GCV(K) = \frac{1}{N} \sum_{i=1}^N [y_i - f(x_i)]^2 / \left[1 - \frac{K + dK}{N} \right]^2 \quad (2)$$

where: d is the penalizing parameter for each basis function and N is the number of observations. The best model is the one that has the lowest GCV value and the highest coefficient of determination (R^2) (Sephton, 2001; Hastie *et al.*, 2009).

In order not to extend the study unnecessarily, the MARS approach is not very much discussed in detail. Much more information regarding the MARS approach can be obtained from the original study by Friedman (1991).

3. Empirical Analysis

3.1. Descriptive Statistics

Monthly data consists of 145 observations that occurred from January 2010 to January 2022. Table 2 shows the descriptive statistics and correlation matrix of the indicators.

Table 2

Descriptive Statistics & Correlation Matrix

Panel A: Descriptive Statistics											
	CDS	CA	CPI	CRD	DPST	IPI	NPL	RSRV	THVL	UNEMP	USD/TRY
Observations	145	145	145	145	145	145	145	145	145	145	145
Mean	270.98	-3.25	11.12	15.26	11.33	101.03	65.73	106.32	11.36	10.81	3.81
Standard Deviation	115.88	2.47	5.73	5.20	4.21	20.50	48.76	16.70	3.57	1.66	2.49
Minimum	117.81	-9.41	3.99	8.42	5.95	56.84	18.41	71.84	6.16	8.00	1.43
Maximum	592.29	3.04	48.69	34.48	24.11	165.56	161.27	135.24	23.00	14.60	13.55
Jarque-Bera	31.52	2.12	1.328.26	52.84	48.46	2.53	21.26	6.75	44.23	7.34	71.70
Probability	0.0000	0.3472	0.0000	0.0000	0.0000	0.2823	0.0000	0.0342	0.0000	0.0255	0.0000
Panel B: Correlation Matrix											
	CDS	CA	CPI	CRD	DPST	IPI	NPL	RSRV	THVL	UNEMP	USD/TRY
CDS	1.00										
CA	0.45	1.00									
CPI	0.64	0.36	1.00								
CRD	0.52	0.55	0.74	1.00							
DPST	0.56	0.59	0.77	0.95	1.00						
IPI	0.58	0.36	0.59	0.61	0.60	1.00					
NPL	0.82	0.47	0.65	0.52	0.61	0.77	1.00				
RSRV	-0.29	-0.07	-0.18	-0.08	-0.21	0.15	-0.19	1.00			
THVL	0.78	0.53	0.87	0.80	0.86	0.66	0.75	-0.28	1.00		
UNEMP	0.62	0.54	0.47	0.41	0.56	0.49	0.79	-0.36	0.62	1.00	
USD/TRY	0.83	0.41	0.82	0.61	0.67	0.80	0.94	-0.15	0.85	0.66	1.00

According to Table 2, the standard deviation is highest for the CDS spreads followed by NPL, IPI, CPI, CRD, DPST, etc. Also, while there is a little difference between the minimum and maximum values of the indicators, unlikely, there is a huge interval for the CDS spreads. Moreover, almost all indicators excluding CA and IPI are not normally distributed based on the Jarque-Bera probability statistics. Furthermore, correlation coefficients between CDS spreads and other indicators change between -29% and 83%. These correlation coefficients show a positive and high correlation relationship of the explanatory indicators except for reserves with the CDS spreads.

3.2. Linearity Test

Table 3 presents the results of the BDS test that is used to verify the linearity of the indicators.

Table 2

Linearity Test Results					
Indicators	Dimensions				Results
	2	3	4	5	
CDS	0.13864 [0.0000]	0.22386 [0.0000]	0.27924 [0.0000]	0.31657 [0.0000]	Non-linear
USD/TRY	0.18464 [0.0000]	0.30893 [0.0000]	0.39545 [0.0000]	0.45573 [0.0000]	Non-linear
THVL	0.16604 [0.0000]	0.27533 [0.0000]	0.34513 [0.0000]	0.38957 [0.0000]	Non-linear
NPL	0.20069 [0.0000]	0.33567 [0.0000]	0.42752 [0.0000]	0.49039 [0.0000]	Non-linear
DPST	0.17727 [0.0000]	0.29866 [0.0000]	0.37461 [0.0000]	0.42183 [0.0000]	Non-linear
CPI	0.16762 [0.0000]	0.27687 [0.0000]	0.34636 [0.0000]	0.38930 [0.0000]	Non-linear
UNEMP	0.16966 [0.0000]	0.28551 [0.0000]	0.36214 [0.0000]	0.40991 [0.0000]	Non-linear
RSRV	0.16954 [0.0000]	0.28336 [0.0000]	0.35571 [0.0000]	0.39889 [0.0000]	Non-linear
IPI	0.09991 [0.0000]	0.17449 [0.0000]	0.22916 [0.0000]	0.26151 [0.0000]	Non-linear
CRD	0.17043 [0.0000]	0.28627 [0.0000]	0.36066 [0.0000]	0.40599 [0.0000]	Non-linear
CA	0.07844 [0.0000]	0.12074 [0.0000]	0.13491 [0.0000]	0.13229 [0.0000]	Non-linear

Notes: Values indicate BDS statistics. [] represents probability values.

According to Table 3, the results show that p-values for all indicators are lower than 0.05. Thus, the null hypothesis, which is an indicator is linearly distributed, is rejected and it is concluded that all indicators are non-linear.

When considering the non-normal distribution and non-linear condition of the indicators, it is required that non-linear approaches should be used instead of the linear method for empirical analysis. Hence, it is decided to use the MARS approach. That is why because the MARS approach is a non-parametric regression modeling to estimate underlying functional

relationships between the dependent indicator and independent indicators by considering the interaction between independent indicators as well as not having pre-assumptions to make a prediction (Friedman, 1991).

3.3. Analysis Results

By applying the 10-fold cross-validation approach, the MARS algorithm produces a total of 57 different models (BFs) that are presented in Appendix 2. The best model among all models is chosen based on the GCV and R^2 statistics. Hence, BF 31 is determined as the best model on the basis of the GCV and R^2 values. According to the best model, all macroeconomic and market indicators included in the analysis have a statistically significant effect on the CDS spreads. Besides, the adjusted R^2 of the best model is 0.987, which shows that explanatory indicators used in the model can explain 98.7% of the changes in the CDS spreads.

Also, the MARS approach determines the importance of the explanatory indicators in the best model (BF 31). Table 4 presents the importance levels of the indicators.

Table 3

Importance Level			
Types	Indicators	Importance Levels	-GCV
Macroeconomic	USD/TRY	100.00	4,037.76
Market	THVL	85.75	3,155.99
Market	DPST	83.70	3,040.52
Market	NPL	69.60	2,320.51
Market	RSRV	46.54	1,428.35
Macroeconomic	CPI	40.45	1,251.70
Macroeconomic	UNEMP	37.04	1,163.73
Macroeconomic	CA	23.15	885.36
Market	CRD	13.08	763.78
Macroeconomic	IPI	12.51	758.94

According to Table 4, all indicators included in the empirical analysis affect CDS spreads. Specifically, the most significant indicator is the USD/TRY FX rates. Also, Treasury bond interest rates, deposit interest rates, and nonperforming loans come after the USD/TRY FX rates in terms of their importance in the best model. Moreover, although other indicators like CA, CRD, and IPI have the lowest importance in the model, they still have a low effect on the CDS spreads that contribute to the prediction model. Hence, it can be stated that excluding FX rates, the market indicators have higher importance with regard to the macroeconomic indicators in terms of their effects on the CDS spreads. This is consistent with the studies of Galil *et al.* (2014), Fontana and Scheicher (2016), Hibbert and Pavlova (2017), and Akçelik and Fendoğlu (2019).

The MARS approach analyses a total of ten explanatory indicators with minimal loss of information. While the details of the BF 31 are presented in Appendix 3 as a whole, basis functions based on each independent indicator are exhibited below. In this context, Table 5 presents the basis functions regarding the effects of USD/TRY FX rates on the CDS spreads.

Table 4

Basis Functions for USD/TRY

Basis Functions	Details	Coefficient	Parent
2	$\max(0, 6.831 - \text{USD/TRY})$	-	-
19	$\max(0, \text{USD/TRY} - 4.637) * \text{BF18}$	-4.49	RSRV
20	$\max(0, 4.637 - \text{USD/TRY}) * \text{BF18}$	-7.241	RSRV
27	$\max(0, \text{USD/TRY} - 3.073) * \text{BF4}$	-10.939	NPL
28	$\max(0, 3.073 - \text{USD/TRY}) * \text{BF4}$	-3.647	NPL
53	$\max(0, 7.521 - \text{USD/TRY}) * \text{BF11}$	-16.731	DPST

While the most important indicator on the CDS spreads is the USD/TRY FX rates, they alone do not have an effect on the CDS spreads. On the other hand, USD/TRY FX rates interact with the reserves. When USD/TRY FX rates are higher than TRY 4.637 and reserves are lower than TRY 102.733 billion, then CDS spreads decrease. In this case, 1 point decrease in the USD/TRY FX rates may induce a 4.49 point decrease in the CDS spreads. Also, the CDS spreads decrease when if USD/TRY FX rates are lower than TRY 4.637 and reserves are lower than TRY 102.733 billion. In this case, 1 point decrease in the USD/TRY FX rates may induce a 7.241 point decrease in the sovereign CDS spreads of Türkiye.

Besides, USD/TRY FX rates interact with the nonperforming loans. When USD/TRY FX rates are higher than TRY 3.073 and NPL amount is less than TRY 68.043 billion, then CDS spreads decrease. In this case, 1 point decrease in the USD/TRY FX rates may induce a 10.939 point decrease in the CDS spreads. Also, the CDS spreads decrease when USD/TRY FX rates are less than TRY 3.073 and NPL amount is lower than TRY 68.043 billion. In this case, 1 point decrease in the USD/TRY FX rates may induce a 3.647 point decrease in the CDS spreads.

Moreover, USD/TRY FX rates interact with the deposit interest rates. If USD/TRY FX rates are lower than TRY 7.521 and deposit interest rates are higher than 10.25%, then CDS spreads decrease. In this case, 1 point decrease in the USD/TRY FX rates may induce a 16.731 point decrease in the CDS spreads.

Table 6 presents the basis functions regarding the effects of THVL on the CDS spreads.

Table 5

Basis Functions for THVL

Basis Functions	Details	Coefficient	Parent
9	$\max(0, \text{THVL} - 9.610)$	29.761	-
10	$\max(0, 9.610 - \text{THVL})$	-18.474	-
21	$\max(0, \text{THVL} - 18.050) * \text{BF5}$	-0.176	DPST
22	$\max(0, 18.050 - \text{THVL}) * \text{BF5}$	-0.064	DPST

The second important indicator on the CDS spreads is the Treasury bond interest rate. When THVL rates are higher than 9.61%, then CDS spreads increase by 29.761 points for 1 point increase in the THVL. However, the CDS spreads decrease by 18.474 points for 1 point decrease when THVL are lower than 9.61%.

In addition, THVL interact with the deposit interest rates. When THVL are higher than 18.05%, deposit interest rates are higher than 15.095%, and NPL amount is higher than TRY 68.043 billion, then CDS spreads decrease. In this case, 1 point decrease in the THVL can provide a 0.176 point decrease in the CDS spreads. Besides, CDS spreads decrease when THVL are lower than 18.05%, deposit interest rates are higher than 15.095%, and NPL

amount is higher than TRY 68.043 billion. In this case, 1 point decrease in the THVL can provide a 0.064 point decrease in the CDS spreads.

Table 7 presents the basis functions regarding the effects of the DPST on the CDS spreads.

Table 6

Basis Functions for DPST

Basis Functions	Details	Coefficient	Parent
5	$\max(0, \text{DPST} - 15.095) * \text{BF3}$	-	NPL
6	$\max(0, 15.095 - \text{DPST}) * \text{BF3}$	0.642	NPL
11	$\max(0, \text{DPST} - 10.250)$	90.117	-
12	$\max(0, 10.250 - \text{DPST})$	-	-
13	$\max(0, \text{DPST} - 11.017) * \text{BF4}$	-11.115	NPL
14	$\max(0, 11.017 - \text{DPST}) * \text{BF4}$	-3.831	NPL
33	$\max(0, \text{DPST} - 20.542) * \text{BF31}$	0.737	NPL
39	$\max(0, \text{DPST} - 11.776)$	-100.853	-
57	$\max(0, 10.814 - \text{DPST}) * \text{BF8}$	0.332	NPL

The third important indicator on the CDS spreads is the deposit interest rates. The NPL amount does not have an effect on the CDS spreads when they are lower than 10.25%. Also, they have an increasing effect on the CDS spreads when they are higher than 10.25%. In this case, 1 point decrease in the NPL amount causes a 90.117 point increase in the CDS spreads. Besides, they have a decreasing effect on the CDS spreads when they are higher than 11.776. In this case, 1 point decrease in the DPST provides a 100.853 point decrease in the CDS spreads.

On the other hand, the DPST interact with the nonperforming loans. When DPST are lower than 15.095% and NPL amount is more than TRY 68.043 billion, then the CDS spreads increase. In this case, 1 point decrease in the DPST may induce a 0.642 point increase in the CDS spreads. Also, the CDS spreads decrease when DPST are higher than 11.017% and NPL amount is lower than TRY 68.043 billion. In such a case, 1 point decrease in the DPST may induce a 11.115 point increase in the CDS spreads. Besides, the CDS spreads decrease when DPST are lower than 11.017% and NPL amount is lower than TRY 68.043 billion. In this case, 1 point decrease in the DPST may induce a 3.831 point decrease in the CDS spreads. However, the CDS spreads increase by 0.332 points for a 1 point increase in the DPST when the DPST is lower than 10.814%, the NPL amount is lower than TRY 123.798 billion, and the USD/TRY FX rates is below the TRY 6.831. Similarly, the CDS spreads increase by 0.737 points for 1 point increase in the DPST when the DPST is lower than 20.542%, the NPL amount is higher than TRY 39.862 billion, and the USD/TRY FX rates is below the TRY 6.831.

Table 8 presents the basis functions regarding the effects of NPL on the CDS spreads.

Table 7

Basis Functions for NPL

Basis Functions	Details	Coefficient	Parent
3	$\max(0, \text{NPL} - 68.043)$	-	-
4	$\max(0, 68.043 - \text{NPL})$	18.382	-
7	$\max(0, \text{NPL} - 123.798) * \text{BF2}$	-17.561	USD/TRY
8	$\max(0, 123.798 - \text{NPL}) * \text{BF2}$	-0.97	USD/TRY
31	$\max(0, \text{NPL} - 39.862) * \text{BF2}$	2.972	USD/TRY

The fourth important indicator on the CDS spreads is the nonperforming loans. The NPL amount has an increasing effect on the CDS spreads when it is lower than TRY 68.043 billion. In this case, 1 point decrease in the NPL amount causes an 18.382 point increase in the CDS spreads. If the NPL amount is higher than TRY 68.043 billion, it does not have an effect on the CDS spreads.

Also, the NPL amount interact with the USD/TRY FX rates. When the NPL amount is higher than TRY 123.798 billion and USD/TRY FX rates are lower than TRY 6.831, then the CDS spreads decrease. In this case, 1 point decrease in the NPL may induce a 17.561 point decrease in the CDS spreads. Besides, the CDS spreads decrease when the NPL amount is lower than TRY 123.798 billion, and USD/TRY FX rates are lower than TRY 6.831. In such a case, 1 point decrease in the NPL may cause a 0.97 point decrease in the CDS spreads. Moreover, the CDS spreads increase when the NPL amount is higher than TRY 39.862 billion, and USD/TRY FX rates are lower than TRY 6.831. In this case, 1 point increase in the NPL may induce a 2.972 point increase in the CDS spreads.

Table 9 presents the basis functions regarding the effects of the RSRV on the CDS spreads.

Table 8

Basis Functions RSRV

Basis Functions	Details	Coefficient	Parent
18	$\max(0, 102.733 - \text{RSRV})$	23.425	-
47	$\max(0, 95.213 - \text{RSRV}) * \text{BF9}$	-1.645	THVL

The fifth important indicator on the CDS spreads is the central bank reserves. The RSRV have an increasing effect on the CDS spreads when they are lower than TRY 102.733 billion. In this case, 1 point increase in the RSRV causes a 23.425 point increase in the CDS spreads. Also, the RSRV interact with the THVL. When the RSRV are lower than TRY 95.213 billion and the THVL are higher than 9.61%, then CDS spreads decrease. In this case, a 1 point decrease in the RSRV may induce a 1.645 point decrease in the CDS spreads.

Table 10 presents the basis functions regarding the effects of the CPI on the CDS spreads.

Table 9

Basis Functions for CPI

Basis Functions	Details	Coefficient	Parent
25	$\max(0, \text{CPI} - 10.128) * \text{BF12}$	-32.756	DPST
26	$\max(0, 10.128 - \text{CPI}) * \text{BF12}$	-	DPST
41	$\max(0, \text{CPI} - 10.346)$	4.393	-

The sixth important indicator on the CDS spreads is the consumer prices index. The CPI amount has an increasing effect on the CDS spreads when it is higher than 10.346%. In this case, 1 point increase in the CPI causes a 4.393 point increase in the CDS spreads.

Also, the CPI interact with the DPST. When the CPI is higher than 10.128% and DPST is lower than 10.25%, then the CDS spreads decrease. In this case, 1 point decrease in the CPI may induce a 32.756 point decrease in the CDS spreads. On the other hand, when the CPI is lower than 10.128% and DPST is lower than 10.25%, then CPI does not have an effect on the CDS spreads.

Table 11 presents the basis functions regarding the effects of the UNEMP on the CDS spreads.

Table 10

Basis Functions UNEMP

Basis Functions	Details	Coefficient	Parent
15	$\max(0, \text{UNEMP} - 12.200) * \text{BF8}$	-3.31	NPL
23	$\max(0, \text{UNEMP} - 13.400) * \text{BF8}$	12.02	NPL
38	$\max(0, 8.500 - \text{UNEMP}) * \text{BF26}$	83.358	CPI

The seventh important indicator on the CDS spreads is unemployment. The UNEMP alone does not have an effect on the CDS spreads. In other words, it interacts with the NPL and CPI. The CDS spreads decrease when UNEMP is higher than 12.2%, the NPL amount is lower than TRY 123.798 billion, and the USD/TRY FX rates are lower than TRY 6.831. In this case, a 1 point decrease in the UNEMP may cause a 3.31 point decrease in the CDS spreads. However, the CDS spreads increase when UNEMP is higher than 13.4%, the NPL amount is lower than TRY 123.798 billion, and the USD/TRY FX rates are lower than TRY 6.831. In this case, 1 point increase in the UNEMP may induce a 12.02 point increase in the CDS spreads. Moreover, the CDS spreads increase when UNEMP is lower than 8.5, the CPI is lower than 10.128%, and the DPST is lower than 10.25%. In such a case 1 point increase in the UNEMP may induce an 83.358 point increase in the CDS spreads.

Table 12 presents the basis functions regarding the effects of the CA on the CDS spreads.

Table 11

Basis Functions for CA

Basis Functions	Details	Coefficient	Parent
30	$\max(0, -0.089 - \text{CA}) * \text{BF19}$	-0.428	USD/TRY

The eighth important indicator on the CDS spreads is the current account balance. The CA balance alone does not have an effect on the CDS spreads, but it interacts with the USD/TRY FX rates and RSRV. When CA deficit is lower than TRY 0.089 billion, the USD/TRY FX rates are higher than TRY 4.637, and RSRV is lower than TRY 102.733 billion, then the CDS spreads decrease. In this case, a 1 point decrease in the CA deficit may induce a 0.428 point decrease in the CDS spreads.

Table 13 presents the basis functions regarding the effects of the CRD on the CDS spreads.

Table 12

Basis Functions for CRD

Basis Functions	Details	Coefficient	Parent
43	$\max(0, \text{CRD} - 13.688) * \text{BF26}$	-22.23	CPI
55	$\max(0, 17.993 - \text{CRD}) * \text{BF11}$	-9.127	DPST

The ninth important indicator on the CDS spreads is the credit interest rate. The CRD alone does not have an effect on the CDS spreads, but they interact with the CPI and DPST. The CDS spreads decrease when CRD are higher than 13.688%, the CPI is lower than 10.128%, and the DPST are lower than 10.25%. In this case, 1 point decrease in the CRD may cause a 22.23 point decrease in the CDS spreads. Similarly, the CDS spreads decrease when CRD are lower than 17.993% and the DPST are higher than 10.25%. In such a case, 1 point decrease in the CRD may result in a 9.127 point decrease in the CDS spreads.

Table 14 presents the basis functions regarding the effects of the IPI on the CDS spreads.

Table 13

Basis Functions for IPI

Basis Functions	Details	Coefficient	Parent
45	max (0, IPI - 56.844)	-0.624	-

The tenth and last important indicator on the CDS spreads is the industrial production index. The IPI has a decreasing effect on the CDS spreads when it is higher than 56.844. In this case, 1 point increase in the IPI causes a 0.624 decrease in the CDS spreads.

As a result of the MARS analysis, by using a total of ten macroeconomic and market indicators, Türkiye's sovereign CDS spreads are estimated as follows:

$$\begin{aligned}
 \text{CDS Spreads} = & 133.797 + 18.382 * BF4 + 0.642 * BF6 - 17.561 * BF7 - 0.970 \\
 & * BF8 + 29.761 * BF9 - 18.474 * BF10 + 90.117 * BF11 - 11.115 \\
 & * BF13 - 3.831 * BF14 - 3.310 * BF15 + 23.425 * BF18 - 4.490 \\
 & * BF19 - 7.241 * BF20 - 0.176 * BF21 - 0.064 * BF22 + 12.020 \\
 & * BF23 - 32.756 * BF25 - 10.939 * BF27 - 3.647 * BF28 \quad (3) \\
 & - 0.428 * BF30 + 2.972 * BF31 + 0.737 * BF33 + 83.358 * BF38 \\
 & - 100.853 * BF39 + 4.393 * BF41 - 22.230 * BF43 - 0.624 \\
 & * BF45 - 1.645 * BF47 - 16.731 * BF53 - 9.127 * BF55 + 0.332 \\
 & * BF57
 \end{aligned}$$

4. Conclusion and Policy Implications

High CDS spreads are a phenomenon that plays a critical role in terms of foreign investment in the emerging countries. Therefore, having low-level CDS spreads is important for the developing countries because they need much more foreign investment inflows to finance their economic growth. In this context, the main priority of this study is to define which macroeconomic and market factors have an effect on the CDS spreads of Türkiye according to the scope of the study and, hence, provide the decreases in the CDS spreads. For this aim, 5-years CDS spreads of Türkiye are used as dependent indicators, while a total of ten independent indicators, which consist of five macroeconomic and five market indicators, are included by benefitting from the current studies. Also, monthly data between January 2010, and January 2022 is gathered from Bloomberg, BRSA, and CBRT sources. Moreover, the MARS approach, which provides the predictive accuracy of the results, is used for empirical analysis.

As a result of the MARS analysis, it is determined that all macroeconomic and market indicators included in the analysis have a statistically significant effect on the CDS spreads. Specifically, the USD/TRY FX rates is the most important indicator affecting the CDS spreads of Türkiye followed by Treasury bond interest rates, deposit interest rates, nonperforming loans, central bank reserves, consumer prices index, unemployment rate, current account deficit, credit interest rates, and industrial production index. Hence, it can be generalized that by excluding the USD/TRY FX rates, the market indicators have much more effect on the CDS spreads than the macroeconomic indicators. Moreover, the MARS results show that the effects of the explanatory indicators on the CDS spreads can change according to different thresholds as well as to interactions with other explanatory indicators.

The results, which are gathered from the MARS analysis, are generally consistent with the current studies (e.g., Bernoth and Herwartz (2021) and Kartal *et al.* (2022) for the FX rates; Hibbert and Pavlova (2017), Yang *et al.* (2018), Kartal (2020), Kartal *et al.* (2022) for the interest rates; Di Tommaso and Pacelli (2022) and Kartal *et al.* (2022) for the nonperforming loans; CBRT (2020a) and Rathí *et al.* (2022) for the central bank reserves; Akçelik and Fendođlu (2019), CBRT (2020a), and Kartal *et al.* (2022) for the consumer prices index; Aytekin and Abdioglu (2021), Anelli and Patanè (2022), and Hao *et al.* (2022) for the unemployment; Akçelik and Fendođlu (2019) and CBRT (2020a) for the CA deficit; Liu and Zhang (2008) and Galil *et al.* (2014) for the industrial production index) and pre-expectations.

Although the results are generally consistent, however, there is an important difference that the current paper brings relative to these studies in the literature, namely that the results of the MARS approach reveal that the effects of the explanatory indicators change according to thresholds. For example, the effects of the Treasury bond interest rates on the CDS spreads are negative until 9.61%, but positive after this barrier. Similarly, the effects of the deposit interest rates on the CDS spreads are neutral when they are lower than 10.25%, but positive when higher than 10.25%, and negative when exceeding 11.776%.

Another important difference, is that the effects can also change when an explanatory indicator interacts with some other explanatory indicators. For instance, nonperforming loans can have a positive effect on the CDS spreads, but the effect is negative when nonperforming loans interact with the USD/TRY FX rates. Similarly, whereas the effects of the reserves are positive, the effects are negative when they interact with the Treasury bond interest rates. Even, the effects can change in case of interaction with some explanatory indicators, but thresholds change as one may see from the case of unemployment.

By considering the empirical results, it may be concluded that negative developments in the explanatory macroeconomic and market indicators used in the analysis cause negative effects on the CDS spreads. For this reason, such negative effects should be minimized to have low-level CDS spreads. Hence, in line with the empirical results, some policy implications might be proposed, as follows.

Firstly, the Turkish policymakers should deal with the most important indicators, such as foreign exchange rates. After achieving successful input from these indicators, less important indicators should be dealt with as well.

Secondly, the Turkish policymakers should consider that there are no straight-line effects of the macroeconomic and market indicators on the CDS spreads. Instead, the effects change according to the thresholds that change also for each indicator. Hence, these thresholds should be followed up continuously and considered when developing and implementing policies.

Thirdly, the Turkish policymakers should consider that there are no straight-line effects of the macroeconomic and market indicators on the CDS spreads, but that the effects change according to the interaction of the indicators with other explanatory indicators. Thus, these interactions should be also followed up and taken into account in policy development and implementation processes.

Fourthly, although all indicators included in the analysis have an important and statistically significant effect on the CDS spreads, excluding the FX rates the market indicators have higher importance with regard to the macroeconomic indicators. For this reason, it is highly recommended to the Turkish policymakers that they should focus on market indicators while also continuously following up macroeconomic indicators. By taking necessary measures as proposed above in a timely manner, Türkiye may have stable and low-level CDS spreads

and stimulate foreign investments inflows in turn. Naturally, the Turkish policymakers might develop more policies by using much more high-frequency data that most of the time is not publicly available. The important point in here is that thresholds and interactions should be taken into consideration altogether when taking measures.

In this study, Türkiye is selected as the scope, since it has been faced with volatile CDS spread trend. By focusing on the example of Türkiye, the study presents important findings, such as the fact that market variables are generally more important than the macroeconomic indicators; and that the effects of the explanatory indicators change according to different thresholds and interactions. Hence, it is believed that the study makes contributions to the literature. On the other hand, focusing solely on Türkiye may be considered as the main limitation of this study. For this reason, new studies consisting of a different bundle of countries and including more emerging countries, or emerging country groups like BRICST and Fragile Five countries, could be conducted and they would be beneficial in terms of extending current literature into new scopes. In addition, new indicators could be added into empirical analyses, and different and new statistical and econometric methods, such as quantile-on-quantile regression dated 2015, non-parametric causality in quantiles dated 2016, Granger causality in quantiles dated 2018, and dynamic ARDL simulations dated 2018, can be applied in the new studies, so that different findings can be obtained by using these new methods.

References

- Afonso, A. and Strauch, R., 2007. Fiscal Policy Events and Interest Rate Swap Spreads: Evidence from the EU. *Journal of International Financial Markets, Institutions and Money*, 17(3), pp.261-276. <https://doi.org/10.1016/j.intfin.2005.12.002>.
- Akçelik, F. and Fendoğlu, S., 2019. Country Risk Premium and Domestic Macroeconomic Fundamentals When Global Risk Appetite Slides. *CBRT Research and Monetary Policy Department*, No. 2019-04.
- Akın, T. and Işıklı, E., 2020. The Relationship Between Credit Default Swap, Economic Growth and Current Account Deficit: A Case of Turkey. *Anemon Journal of Social Sciences of Mus Alparslan University*, 8, pp.91-98.
- Alexander, C. and Kaeck, A., 2008. Regime Dependent Determinants of Credit Default Swap Spreads. *Journal of Banking & Finance*, 32(6), pp.1008-1021. <https://doi.org/10.1016/j.jbankfin.2007.08.002>.
- Anelli, M. and Patanè, M., 2022. The Role of CDS Market in the Price Discovery Process of the "PIIGS" Countries Sovereign Credit Risk During the Recent Decade of Monetary Easing. *Journal of Finance and Investment Analysis*, 11(1), pp.1-29.
- Augustin, P., Chernov, M. and Song, D., 2020. Sovereign Credit Risk and Exchange Rates: Evidence from CDS Quanto Spreads. *Journal of Financial Economics*, 137(1), pp.129-151. <https://doi.org/10.1016/j.jfineco.2019.12.005>.
- Aytekin, S. and Abdioglu, N., 2021. Do CDS Spreads and Inflation Move Together? The Experience of the Fragile Five Countries and the BRICS-T. *Scientific Annals of Economics and Business*, 68(2), pp.163-175.
- Benbouzid, N., Mallick, S. K. and Sousa, R. M., 2017. An International Forensic Perspective of the Determinants of Bank CDS Spreads. *Journal of Financial Stability*, 33, pp.60-70. <https://doi.org/10.1016/j.jfs.2017.10.004>.
- Bernoth, K. and Herwartz, H., 2021. Exchange Rates, Foreign Currency Exposure and Sovereign Risk. *Journal of International Money and Finance*, 117, 102454.
- Bloomberg., 2022. Bloomberg Terminal, 01.03.2022.

- Broock, W.A., Scheinkman, J.A., Dechert, W.D. and LeBaron, B. 1996. A Test for Independence Based on the Correlation Dimension. *Econometric Reviews*, 15(3), pp.197-235. <https://doi.org/10.1080/07474939608800353>.
- BRSA, 2020. Monthly Data [online]. Available at: <<https://www.bddk.org.tr/BultenAylık>> [Accessed in February 2020].
- CBRT, 2020a. Inflation Report 2020-I [online], Available at: <<https://www.tcmb.gov.tr/wps/wcm/connect/EN/TCMB+EN/Main+Menu/Publications/Reports/Inflation+Report>> [Accessed in February 2020].
- CBRT, 2020b. Elektronik Data Distribution System (EVDS) [Online], Available at: <<https://evds2.tcmb.gov.tr/index.php?/evds/serieMarket>> [Accessed in February 2020].
- Chen, N.F., Roll, R. and Ross, S.A., 1986. Economic Forces and the Stock Market. *Journal of Business*, 59(3), pp.383-403.
- Collin-Dufresne, P., Goldstein, R. S. and Martin, J. S., 2001. The Determinants of Credit Spread Changes. *The Journal of Finance*, 56(6), pp.2177-2207. <https://doi.org/10.1111/0022-1082.00402>.
- Di Tommaso, C. and Pacelli, V., 2022. Does Nonperforming Loan Securitization Affect Credit Default Swap Spreads? Evidence from European Banks. *Journal of International Financial Management & Accounting*, 33(2), pp.285-306. <https://doi.org/10.1111/jifm.12147>.
- Dooley, M. and Hutchison, M., 2009. Transmission of the US Subprime Crisis to Emerging Markets: Evidence on the Decoupling-Recoupling Hypothesis. *Journal of International Money and Finance*, 28(8), pp.1331-1349.
- Doshi, H., Jacobs, K. and Zurita, V., 2017. Economic and Financial Determinants of Credit Risk Premiums in the Sovereign CDS Market. *The Review of Asset Pricing Studies*, 7(1), pp.43-80. <https://doi.org/10.1093/rapstu/rax009>.
- Ertuğrul, H. M. and Öztürk, H., 2013. The Drivers of Credit Swap Prices: Evidence from Selected Emerging Market Countries. *Emerging Markets Finance & Trade*, 49, pp.228-249.
- Fontana, A. and Scheicher, M., 2016. An Analysis of Euro Area Sovereign CDS and Their Relation with Government Bonds. *Journal of Banking & Finance*, 62, pp.126-140. <https://doi.org/10.1016/j.jbankfin.2015.10.010>.
- Friedman, J., 1991. Multivariate Adaptive Regression Splines. *The Annals of Statistics*, 19(1), pp.1-67. <https://doi.org/10.1214/aos/1176347963>.
- Galil, K., Shapir, O.M., Amiram, D. and Ben-Zion, U., 2014. The Determinants of CDS Spreads. *Journal of Banking & Finance*, 41, pp.271-282. <https://doi.org/10.1016/j.jbankfin.2013.12.005>.
- Galil, K. and Soffer, G., 2011. Good News, Bad News and Rating Announcements: An Empirical Investigation. *Journal of Banking & Finance*, 35(11), pp.3101-3119. <https://doi.org/10.1016/j.jbankfin.2011.04.010>.
- Goh, A.T.C., Zhang, Y., Zhang, R., Zhang, W. and Xiao, Y., 2017. Evaluating Stability of Underground Entry-Type Excavations Using Multivariate Adaptive Regression Splines and Logistic Regression. *Tunnelling and Underground Space Technology*, 70, pp.148-154. <https://doi.org/10.1016/j.tust.2017.07.013>.
- Grammatikos, T. and Vermeulen, R., 2012. Transmission of the Financial and Sovereign Debt Crises to the EMU: Stock Prices, CDS Spreads and Exchange Rates. *Journal of International Money and Finance*, 31(3), pp.517-533.
- Hao, X., Sun, Q. and Xie, F., 2022. The COVID-19 Pandemic, Consumption and Sovereign Credit Risk: Cross-Country Evidence. *Economic Modelling*, 109, 105794. <https://doi.org/10.1016/j.econmod.2022.105794>.

- Hassan, M.K., Ngene, G.M. and Yu, J.S., 2015. Credit Default Swaps and Sovereign Debt Markets. *Economic Systems*, 39(2), pp.240-252. <https://doi.org/10.1016/j.ecosys.2014.07.002>.
- Hassan, M.K., Kayhan, S. and Bayat, T., 2017. Does Credit Default Swap Spread Affect the Value of the Turkish Lira Against the US Dollar? *Borsa İstanbul Review*, 17(1), pp.1-9. <https://doi.org/10.1016/j.bir.2016.10.002>.
- Hastie, T., Tibshirani, R. And Friedman, J., 2009. *The Elements of Statistical Learning: Data Mining, Inference and Prediction*. 2nd Edition. New York: Springer.
- Hibbert, A. M. and Pavlova, I., 2017. The Drivers of Sovereign CDS Spread Changes: Local Versus Global Factors. *Financial Review*, 52(3), pp.435-457. <https://doi.org/10.1111/fire.12140>.
- Johnson, T.C., 2002. Rational Momentum Effects. *The Journal of Finance*, 57(2), pp.585-608. <https://doi.org/10.1111/1540-6261.00435>.
- Kartal, M.T., 2020. The Behavior of Sovereign Credit Default Swaps (CDS) Spread: Evidence from Turkey with the Effect of Covid-19 Pandemic. *Quantitative Finance and Economics*, 4(3), pp.489-502.
- Kartal, M.T., Depren, Ö. and Kılıç Depren, S., 2021. Do Monetary Policy Measures Affect Foreign Exchange Rates during the COVID-19 Pandemic? Evidence from Turkey. *Journal of BRSA Banking and Financial Markets*, 15(2), pp.175-202. <https://doi.org/10.46520/bddkdergisi.987416>.
- Kartal, M.T., Kılıç Depren, S. and Depren, Ö., 2022. Sovereign Credit Default Swap (CDS) Spreads Changes in Various Economic Conjunctures: Evidence from Turkey By Machine Learning Algorithms. *Journal of Management and Economics Research*, 20(1), pp.354-374. <https://doi.org/10.11611/yead.1076897>.
- Huyugüzel Kışla, G., Muradoğlu, Y.G. and Önder, A.Ö., 2022. Spillovers from One Country's Sovereign Debt to CDS (Credit Default Swap) Spreads of Others during the European Crisis: A Spatial Approach. *Journal of Asset Management*, pp.1-20. <https://doi.org/10.1057/s41260-022-00263-3>.
- Kocsis, Z. and Monostori, Z., 2016. The Role of Country-Specific Fundamentals in Sovereign CDS Spreads: Eastern European Experiences. *Emerging Markets Review*, 27, pp.140-168. <https://doi.org/10.1016/j.ememar.2016.05.003>.
- Liu, Y. and Morley, B., 2013. Sovereign Credit Ratings, the Macroeconomy and Credit Default Swap Spreads. *Brussels Economic Review*, 56(3/4), pp.335-348.
- Liu, L.X. and Zhang, L., 2008. Momentum Profits, Factor Pricing, and Macroeconomic Risk. *The Review of Financial Studies*, 2(6), pp.2417-2448. <https://doi.org/10.1093/rfs/hhn090>.
- Liu, T., 2018. Multivariate Adaptive Regression Splines in Standard Cell Characterization for Nanometer Technology in Semiconductor. In: Young Kinh-Nhue Truong, ed. *Topics in Splines and Applications*. Chapter 3, pp.47-62.
- Longstaff, F.A. and Schwartz, E.S., 1995. A Simple Approach to Valuing Risky Fixed and Floating Rate Debt. *The Journal of Finance*, 50(3), pp.789-819. <https://doi.org/10.1111/j.1540-6261.1995.tb04037.x>.
- Orhan, A., Kırıkkaleli, D. and Ayhan, F., 2019. Analysis of Wavelet Coherence: Service Sector Index and Economic Growth in an Emerging Market. *Sustainability*, 11(23), 6684. <https://doi.org/10.3390/su11236684>.
- Rathi, S., Mohapatra, S. and Sahay, A., 2022. Central Bank Gold Reserves and Sovereign Credit Risk. *Finance Research Letters*, 45, 102127. <https://doi.org/10.1016/j.frl.2021.102127>.
- Sagi, J.S. and Seasholes, M.S., 2007. Firm-Specific Attributes and the Cross-Section of Momentum. *Journal of Financial Economics*, 84(2), pp.389-434. <https://doi.org/10.1016/j.jfineco.2006.02.002>.

- Sephton, P., 2001. Forecasting Recessions: Can We Do Better on MARS? *Review Federal Reserve Bank of Saint Louis*, 83(2), pp.39-49.
- Shahzad, S.J.H., Nor, S.M., Ferrer, R. and Hammoudeh, S., 2017. Asymmetric Determinants of CDS Spreads: US Industry-Level Evidence through the NARDL Approach. *Economic Modelling*, 60, pp.211-230.
- Şahin, C. and Altay, H., 2016. Examination of the Relationship between Turkey's Credit Default Swap (CDS) Points and Unemployment. *Eurasian Business & Economics Journal*, 4, pp.52-67.
- Yang, L., Yang, L. and Hamori, S., 2018. Determinants of Dependence Structures of Sovereign Credit Default Swap Spreads between G7 and BRICS Countries. *International Review of Financial Analysis*, 59, pp.19-34.
<https://doi.org/10.1016/j.irfa.2018.06.001>.
- Yılmaz, A. and Çetiner, Ö., 2017. Risk in Turkish Economy; the Linkage between Credit Default Swap (CDS), Current Account Deficit and Exchange Rate. *International Social Research Congress*, April 20-22, Congress Book, pp.563-576.