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Kredi Temerrüt Takası, Büyüme ve Cari Açık İlişkisi: Türkiye Örneği

The Relationship Between Credit Default Swap, Economic Growth and Current Account Deficit: A Case of Turkey

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ÖZ

Son yıllarda kredi temerrüt takasları (CDS), piyasada ülke risklerini fiyatlandırmada ve araştırmada önemli bir kavram olarak ortaya çıkmıştır. Türkiye gibi ekonomik kırılganlıkları ve dışa bağımlılığı yüksek gelişmekte olan ülkeler için bu kavram daha önemli hale gelmiştir. Ülke riskini etkileyen makroekonomik göstergelerden cari açık ve ekonomik büyüme çalışmada kullanılmıştır. Çalışmada CDS ile olan ekonomik büyüme ve cari açık arasındaki ilişki 2007:Q2-2018:Q4 dönemi için Kapetanios (2005) birim kök testi, Maki (2012) eşbütünleşme testi ve Fourier Toda-Yamamoto nedensellik testi ile analiz edilmiştir. Elde edilen sonuçlar teorik açıdan cari açığın ve ekonomide yaşanan daralmanın ülkenin dış borçlanma riski primi ve CDS oranlarında bir artışa neden olduğu beklentisiyle uyumlu olup; Türkiye'ye yönelik risk algısının makroekonomik değişkenlerinden etkilendiği tespit edilmiştir.

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ABSTRACT

In recent years, credit default swaps (CDS) have occured as a fundemental concept in pricing and surveying country risks in the market. This concept has gained greater significance for developing countries such as Turkey because of their economic fragility and higher dependency to foreign funds. Of the most important macroeconomic indicators affecting country risks, the current account deficit and economic growth were studied in terms of their relationship with CDS. In this regard, this relationship was investigated for the period of 2007:Q2-2018:Q4 by using Kapetanios (2005) unit root test, Maki (2012) cointegration test and Fourier Toda-Yamamoto causality test. Obtained results suggested that the current account deficit and the economic constriction caused an increase with the country's external borrowing risk, and that risk perception towards Turkey was found to be affected by the concerned macroeconomic variables.

1. Introduction

Sovereign credit risk denotes the credit risk of a country relevant with current account payable balance against debtor parties, and it is realized in case of failure of the concerned government in honouring its obligations. Accordingly, the sovereign risk premium is an essential component of the cost of using foreign funds; and it is especially higher for emerging and developing economies due to their higher default probability perceived by the market.

In this regard, for monitoring financial risks, CDS premiums have become an alternative tool in the market (Mora, 2006:9, Flannery et al., 2010: 2095; Başarır and Keten, 2016). After CDS's introduction to the financial

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world by JP Morgan in 1994 (Augustin et al., 2016), it has been recognized as a useful tool to differentiate the default risk of bond issuer party from other risks and to the price of the current credit risk (Whetten, et al., 2004). Sovereign CDS functions as a credit insurance policy issued against a debt (e.g. sovereign bonds, treasury bills etc.) of a country.

As described by Fontana and Scheicher (2016), a CDS contract carries over the risk from the ‘‘protection buyer” to the ‘‘protection seller” in exchange for the payment of a regular premium. Briefly, The CDS premium, is the cost for protection against default. CDS premiums have become an indicator of the risk status of countries today. So the greater the CDS premium of a specific country’s bonds, the higher the cost of funding from external resources.

Baum and Wan (2010) considered CDS as the most common credit derivative instrument enabling enterprisers to insure against a credit event, especially the default of a reference entity (e.g. a bond issuer). Enterprises can provide hedging at a relatively lower cost because of traded CDS over the counter. CDS spreads fluctuate in progress of time to represent variances in the credibility of the financial instruments. In this line, CDS is utilized by a debtee as a hedging opportunity against the default risk of borrowed parties. As CDS emerged from hedging purposes first, investors have started to exploit this insurance for arbitrage opportunities between diverse pricing of default risk as well as speculators to take advantage of the inefficient distribution of information or differentiated investor sentiments across the markets. Accordingly, as CDS has gained greater interest by markets, it's trading volume CDS derivatives has increased dramatically over time (Alexander and Kaeck, 2008; Liu and Morley, 2012).

Especially increasing fragility of some countries attracts investors’ attention to accurately evaluate and price the risks associated with certain developing countries especially charaterized among the fragile ones. As country risks are priced and surveyed by CDS premiums in the market, this urges researchers to draw more accurate conclusions on variations in CDS premiums and potential underlying factors.

Whereas developed economies are viewed roughly default-free in nature, CDS premiums are considered more important for developing economies, especially for fragile ones such as Turkey. Since financially fragile countries have comparatively low domestic savings rates and persistently high current account deficit, they depend on foreign sources in form of direct investments or net cash inflow to maintain country account balance. In the framework of the present study, an increase in CDS premium of Turkey is expected to have negative impact on country’s macroeconomic variables (Gebeşoğlu and Varlık, 2018) or vice versa. Turkey’s inclusion into almost all global financial fragility rankings puts the country more sensitive position before investors who closely follow statistical indices, especially CDS, and fundamental macroeconomic figures. To the objective of the present study, we narrowed our focus on developing and especially fragile economy of Turkey from the perspective of its sovereign CDS index.

In this regard, the present study investigated the relationship between Turkey’s CDS premium and its two specific macroeconomic indices namely current account deficit and growth rate which have gained significant popularity across economic debates carried on Turkey’s fragility and fundamental reasons behind it.

As a rationale for following such path, it is important to bring various valuble conclusions from the relevant literature. The increase in CDS spreads leads to increased risk perceived by investors on current account deficit and higher interest rates in international financial borrowing. Thus, Turkey's current account deficit increased financial risk exposed by the foreign investors in Turkey so does their perception of risk; and consequently this has led to an increase in CDS premiums (Yılmaz and Çetiner, 2017:565).

Furthermore, unstable economic growth negatively affects cash flow from abroad negatively during the recession periods of the economy (Tang and Yan, 2010). Theoretically, interest rates have a positive relationship with economic growth and higher growth should, because of ceteris paribus, lead to lower CDS spread (Annaert et al., 2013:450, Shahzad et al., 2017: 215). Fluctuations in the current account deficit and economic growth cause to increase macroeconomic uncertainty; and drag countries like Turkey to become more fragile. The increasing economic uncertainty of Turkey also causes higher pricing of CDS premiums. So, CDS spreads are followed as an indicator for the growth data of the Turkish economy (Kargı, 2014: 65)

It is possible to find abundant works of literature about CDS spread affected by financial factors in Turkey. However, there is also need to examine the concept for Turkey in terms of macroeconomic perspective. In this study, the main question of the research is that how the country economic growth and current account deficit are effective on Turkey’s CDS spread.

With this study, it is aimed to investigate into the relationship between CDS, growth rate and current account deficit over data from Turkey referred as “the most fragile economy” through new generation econometric analysis methods for the period of 2007:Q12-2018:Q4. The literature summary in Section 1 will be followed by the introduction of the empirical analysis employed in Section 3. Finally, Section 4 will draw the conclusion.

2. Literature Overview

As an emerging economy, Turkey relies on international funds for financing its growth. Hence an increase in its sovereign risk premium is expected to have a negative impact on the sustainability of international capital flows into the country and on the macroeconomic view of Turkey (Gebeşoğlu and Varlık, 2018).

To date, there have been numbers of empirical studies on CDS spreads and macroeconomic fundamentals, but the majority has focused on corporate CDS spreads instead of sovereign ones. Of these previous researches, the risk-free interest rate, the yield of the reference obligation and credit ratings are the explanatory variables commonly included in studies (Liu and Morley, 2012). There are also some macroeconomic indicators examined with regard to their correlation with CDS. For instance, Greatrex (2008), as a result of his analysis on the variation in monthly CDS

spread changes through structural variables, concludes that macroeconomic indicators could explain the 30% of the overall variation.

The empirical literature provides significant evidence for the relationship between CDS premium and macroeconomic variables. Bhansali et al. (2008) conclude that macroeconomic factors feature an important role in assessment CDS spreads, especially in times of global crisis. The authors find that CDX is priced by both the sector-wide risk and economy-wide risk. Similarly, Wu and Zhang (2008) identify that real output growth, financial market volatility and inflation which define as an economy-wide risks impacts on credit spreads. In the study of Haugh et al., 2009 which analyzes recent notable volatilities in the yield for sovereign bonds within Germany and other euro area countries. Authors report that risk aversion which could be monitored by CDS premiums is a general characteristic of crisis periods, and fiscal performance is also found to be an important factor on its own. In terms of observations of the present study, incremental deteriorations in the current account deficit lead to even larger increases in CDS. Pan and Singleton (2008), investigated that spread of economic growth in the U.S. to other countries' economic growth also contribute to act in concert between countries' risk premiums. The authors also present country-specific and regional economic risks in their models' estimates, which especially considers Turkey, Mexico and Korea.

With the same efforts, Tang and Yan (2010) show that macroeconomic indicators to have a significant impact on CDS and economic growth is the most important factor affecting average credit spreads. Authors emphasize that 1% increase in the GDP growth rate cause to decrease in credit spreads as 6–7 basis points.

Hilscher and Nosbusch (2010) remark the significant variation between the interest rates paid by emerging countries, and study macroeconomic fundamentals in terms of their explanatory power on sovereign yield spreads for 31 emerging market countries for the period of 1994 to 2007. According to results, macroeconomic fundamentals have a significant effect on sovereign yield spreads. On the other hand, Fender, Hayo and Neuenkirch (2012) study the determinants of CDS spreads for emerging market over the period 2002:M04– 2011:M12 by utilizing from using GARCH models. Authors considered the ratio of budget deficit to GDP, foreign liabilities to GDP and central bank interest rate as macroeconomic variables. They report that there is no relationship between CDS spread changes and neither macroeconomic variables nor country ratings.

Aizenman, Hutchison and Jinjarak (2013) study the relationship between external debt ratio, inflation, trade openness and CDS spread for 60 countries from 2005-2010 by using Panel data analysis. Authors report that CDS spreads is relatively defined by fiscal space. Fiscal space, measure by government debt/tax base, is found that it is an important economic determinant of CDS spreads.

Ho (2016) investigates the effect of three macroeconomic variables which are a current account, external debt and international reserves on the spread of sovereign CDS for the period 2008:Q4-2013:Q2. The author used the pooled mean cointegration approach for eight emerging countries. It was found that there is a negative and significant relationship between current account and CDS spread. It means that an increase in financing from abroad cause to reduce in CDS spread in this study.

From Turkey's perspective, Kilci (2017) analyzes the relationship between macroeconomic and financial variables which cause an increase of sovereign credit risk and country CDS premiums through the Toda-Yamamoto Causality Test. Authors study the relationship between CDS and variables of capital adequacy ratios of Turkish Banking Industry, BIST 30 Index, growth, unemployment, inflation, current account deficit and valuation of real currency. Authors remark that there is long term causality relationship between real effective currency, capital adequacy ratio, and BIST 30 variables and 5-year CDS premiums. On the contrary to studies of Brandorf and Holmberg (2010), no causality relationship is found between macroeconomic indicators and CDS premiums.

Gebeşoğlu and Varlık (2018) employed the SVAR model on their study data from the period of 2005:12- 2017:3. Researchers report that sovereign risk premium shocks significantly affect exchange rates, consumer price index, credit, industrial production and current account balance over the open inflation targeting period in Turkey. Şahin (2018), in his study employed multiple-structural break unit root test developed by Carrion-i-Silvestre et al. (2009) and co-integration tests are employed to investigate long term relationships, concludes current account deficit of Turkey could be considered as a prominent variable to variations in CDS scores. Authors report that a 1% increase in current account deficit results in a 0.01 increase in CDS score. The author reveals that changes in Turkey's current account deficit could explain the changes in Turkey's CDS premium positively in the long term. Accordingly, for Turkey, changes in the current account deficit could be regarded as a prominent indicator in the explanation of changes in country's CDS indice.

In the current literature, there are numbers of studies existed on CDS, which investigated the extensive variety of correlations dimensions including variety of determinants, relationships, different periods of time, crisis or tranquil market conditions, sovereign or corporate, developed or developing economies, different economic zones of the world, macro and/or microeconomic factors and so on by employing wide variety of models. Finally, in parallel with the relevant studies above, to bring better explanation and estimates to sovereign credit risk concept through CDS dimension, the present study is expected to make a novel contribution to the existing literature with the new generation econometric methods employed in the analysis.

3. Emprical Analysis

3.1. Data and Model

In this study, the relationship between Credit Default Swap (CDS), Current Account deficit rate (Current debt/GDP) and Gross Domestic Product in USD (GUSD) was analyzed in Turkey for period 2007:Q1-2018:Q4. Study data were

obtained from Central Bank of The Turkish Republic (www.evds.tcmb.gov.tr) and Bloomberg (www.bloomberg.com). Logarithms of CDS and GUSD were included in the analysis to obtain measurable results with certain elasticity. The effect of GUSD and CA on CDS was investigated by using the following model:

$$LNCDS_t = \alpha_0 + \alpha_1 CA_t + \alpha_2 LNGUSD_t + \mu_t \quad (1)$$

3.2. Methods

The stationary of series was analyzed by using Kapetanios (2005) multiple breaks unit root test, the existence of the cointegration relationship between the series was estimated with Maki (2012) test, the long and the short term relations were estimated by Fully Modified Ordinary Least Squares (FMOLS) method and, finally causality relationship between responding and explanatory variables was analyzed by Toda Yamamoto approach with the Fourier approximation (Nazlioglu, Gormus and Soytas, 2016; Gormus, Nazlioglu and Soytas, 2018).

3.3. Kapetanios (2005) Multiple Break Unit Root Test

The stationary of time series means that it has constant average, constant variance and covariance related to its lag level (Gujarati and Porter, 2012). However, there may be structural breaks in the series. The unit root analysis conducted without taking these breaks into account could yield misleading conclusions (Perron, 1989). In this study, the Kapetanios (2005) test exhibited five structural breaks that could be determined endogenously in this method together with their breaking points. The model used in this test is given as follows (Kapetanios, 2005):

$$y_t = \alpha_0 + \alpha_1 t + \beta y_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta y_{t-i} + \sum_{i=1}^{m} \varphi_i DU_{i,t} + \sum_{i=1}^{m} \aleph_i DT_{i,t} + \epsilon_t \quad (2)$$

$$DU_{i,t} = \begin{cases} 1 & t > T_{b,i} \\ 0 & otherwise \end{cases} \text{ and } DT_{i,t} = \begin{cases} t - T_{b,i} & t > T_{b,i} \\ 0 & otherwise \end{cases}$$

where, *DU* and *DT* are intercept and trend break dummy variables, respectively. The null hypothesis is denoted as "*β=1, the serial is not stationary*". In this test, structural breakpoints are determined by using the Bai and Perron (1998) algorithm for the facility of calculation. In this context, each period is evaluated as a possible structural break date. The date of the dummy variable in the model with the minimum sum of squared residuals is taken as the date of the first break. After that, the first break date is pegged and the second break date is being investigated (Murat, et al., 2013). These steps are repeated until *m* break dates, then the number of structural breaks and break dates determined with the minimum *t*-statistic (Capistrán and Ramos-Francia, 2009). In this study, the maximum lag length was determined as 9 by employing the *k=12x(T/100)1/4* formula developed by Schwert (1988). Where, *k* denotes the maximum lag length, and *T* denotes the number of observations. Unit root test results are presented in Table 1.

Table 1. Kapetanios (2005) Multiple Unit Root Test Results

	τ- statistics	***Critical Value***			***Structural Break Dates***
		1%	5%	10%	
LNCDS	-4.545	-5.954	-5.367	-5.089	2012:Q2, 2014:Q4, 2017:Q1, 2018:Q1
CA	-4.784	-5.847	-5.234	-4.941	2009:Q4, 2013:Q2, 2018:Q2
LNGUSD	-5.067	-6.587	-6.113	-5.847	2010:Q1, 2014:Q4
ΔLNCDS	-4.785**	-4.899	-4.354	-4.078	2017:Q4
ΔCA	-8.858***	-8.243	-7.736	-7.426	2010:Q4, 2016:Q4, 2017:Q2, 2018:Q1
ΔLNGUSD	-4.429**	-4.899	-4.354	-4.078	2017:Q3

Note: ** and *** denotes stationarity of series at 5% and 1% significance levels, respectively. Test statistics were obtained with codes written for Gauss program. Critical values were obtained with 1.000 bootstrap replications. As the test method, the model which determines the number of structural breaks according to the data set is selected.

According to results in Table 1, it was seen that the series contain unit root at this level, but that they become stationary when the first differences are taken I(1). Based on the structural break dates indicated by the test method, important structural break dates were observed as 2009, 2014 and 2018. In an attempt to bring explanation to these breaks, prominent economic events occurred in these years were 4.7% contraction in the Turkish economy after the global crisis in 2008, and the current account deficit decreased in 2009. In 2014, the 5-year CDS premiums continued to rise due to the effects of political instability in Turkey. In the first two quarters of 2018, Turkey continued to yield high current account deficit, while in the last two quarters CDS premiums experienced an increase because of adverse developments in foreign exchange and increased risk perception with Turkey. This increase in CDS premiums meant elevated borrowing costs for Turkey along 2019.

3.4. Maki (2012) Multiple Structural Break Cointegration Test

The existence of a cointegration relationship between the series was investigated by the Maki's (2012) method. This method is the cointegration of the unit root test of Kapetanios (2005). Therefore, it is able to test the existence of cointegration between series and to determine the number and date of structural breaks endogenously up to five breaks. In these aspects, this test is stronger than the other cointegration tests employed in the literature (Maki, 2012). According to the test algorithm, each period is taken as a possible breakpoint; and the points, where its *t*-test value is the minimum, are considered as the breakpoint. In this method, all series to be analyzed should be *I(1).* Maki (2012) developed four different models in order to test cointegration with structural breaks:

Model 0: Level Shift;

$$y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \beta x_t + u_t \quad (3)$$

Model 1: Regime Shift;

$$y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \beta x_t + \sum_{i=1}^{k} \beta_i x_i K_{i,t} + u_t \quad (4)$$

Model 2: Regime Shift with Trend;

$$y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \gamma x + \beta x_t + \sum_{i=1}^{k} \beta_i x_i K_{i,t} + u_t \quad (5)$$

Model 3: Level, Trend and Regime Shift;

$$y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \gamma t + \sum_{i=1}^{k} \gamma_i t K_{i,t} + \beta x_t + \sum_{i=1}^{k} \beta_i x_i K_{i,t} + u_t \quad (6)$$

K_i denotes dummy variable, and: $K_i = \begin{cases} 1 & t > T_{Bi} \\ 0 & otherwise \end{cases}$

where, k is the maximum number of breaks, T_{Bi} denotes the time period of the break. The null hypothesis of the test is "*There is no cointegration relationship between series under structural breaks*". Table 3 exhibits the cointegration test results below.

Table 2. Results of Maki (2012) Multiple Structural Break Cointegration Test

Model		*t statistic Value*	*Critical Values*			*Structural Break Dates*
			1%	*5%*	*10%*	
$LNCDS_t = \alpha_{it} + \alpha_{1t}CA_t + \alpha_{2t}LNGUSD_t + \mu_t$	*Model 0*	- 12.7***	-5.96	-5.43	-5.13	2008:Q2, 2010:Q3, 2013:Q2, 2016:Q3, 2017:Q3
	Model 1	-12.1***	-5.83	-5.37	-5.11	2007:Q3, 2010:Q2, 2013:Q1
	Model 2	-11.2***	-6.59	-6.01	-5.72	2012:Q4, 2015:Q1, 2016:Q4, 2018:Q1
	Model 3	-12.4***	-7.55	-7.01	-6.67	2008:Q1, 2010:Q2, 2013:Q1, 2015:Q3

Notes: Critical values are taken from the Table 1 of Maki (2012, p.2013). *** indicates the existence of cointegration relationship between the series at 1% significance level.

According to the results in Table 2, it is seen that there is a co-integration relationship between the series. In other words, these series exhibit similar behavior in the long term; and the long-term analysis of these series with level will not cause spurious regression. In this case, it was concluded that the long-term co-integration coefficients between the series could be estimated. In consideration of the break periods determined by the test method, it could be seen that the growth rate slowed down and current account deficit increased sharply in Turkey along the third quarter in 2007. In 2010, although the current account deficit was a risk factor, Turkey's economy achieved higher growth rate compared to many developing countries. This situation was also reflected positively on Turkey's CDS premium. The Federal Reserve Bank (FED) announced that it would reduce its bond purchases on May 22, 2013, resulting in financial stress in developing countries like Turkey. In 2013, Turkey's financial fragility increased due to the high ratio of current account deficit to GDP and over-dependence on external financing for economic growth. In the third quarter of 2015, the positive effect of low energy prices was seen with the Turkish economy. The coup attempt in the third quarter of 2016 caused losses in the tourism sector, and this was accompanied by the contraction in global and geopolitical circumstances seem to have adverse impacts on Turkey. Hence, these developments caused to increase the perception of risk of Turkey. Despite all political and economic events, in the third quarter of 2017, Turkey has recorded high economic growth because of the government's successful implementation of the credit guarantee fund, the effects of fiscal incentives and its strong banking system. The most common structural breaks in cointegration analysis were included in the long-term analysis as dummy variables.

3.5. Long-Term Analysis

The long-term coefficients were estimated by FMOLS method. This method, developed by Phillips and Hansen (1990), is more powerful than the others because of considering the common co-integration vector between series and using the best linear and unbiased estimator (Hamilton, 1994). Table 4 exhibits the results of FMOLS method below.

According to the results of Table 4, there was a negative relationship between CDS and growth rate, and a positive relationship with the current account deficit. A percent increase in growth rate leads to a 0.88% decrease in CDS risk premium. On the other hand, a percent increase in the current account deficit increases the CDS risk premium by 5.61%. These results showed that the current account deficit and the economic constriction cause to increase the country's external borrowing risk premium and CDS rates; and risk perception toward Turkey is affected by its macroeconomic variables.

Table 4. Results of the long-term coefficients

Dependent Variable	*Constant Term*	*CA*	*LNGUSD*	$K_{2007:Q3}$	$K_{2015:Q3}$	$K_{2017:Q3}$	R^2	$\bar{R}^2$
LNCDS	28.51 [5.32]***	5.61 [5.04]***	-0.88 [-4.25]***	0.15 [1.08]	0.17 [2.17]**	-0.24 [-2.25]**	00.41	00.35

Notes: The values in square brackets are t statistics, and** and *** mean 5% and 1% significance level, respectively. The autocorrelation and heteroscedasticity problems in the estimates were corrected by the Newey-West method.

3.6. Short-Term Analysis (Error Correction Model)

Short term analysis was performed by FMOLS method within the framework of error correction model by using a period lag length (Error Correction Term: ECTt-1)) of the error term series obtained from long term analysis. The results were presented in Table 5.

According to Table 5, the coefficients of error correction terms were found negative and statistically significant.

Therefore, the models were found functional in error correction mechanisms. In other words, the short-term deviations between the series moving together on the long run disappear, and the series converge to long-term equilibrium values again. This situation also proved that long-term analyzes were reliable. In the short term, it was observed that the current account deficit increased the CDS rates; and the increase in growth rate resulted in a decrease in the CDS rates, and these effects were found to be statistically significant.

Table 5: Results of Error Correction Model

Dependent Variable	*Constant Term*	ECT_{t-1}	ΔCA	$\Delta LNGUSD$	R^2	$\bar{R}^2$
ΔLNCDS	-0.003	-0.28 [-4.14]***	6.30[11.16]***	-1.14 [-11.24]***	0.44	0.40

Notes: The values in square brackets are *t* statistics, and *** means 1% significance level. The autocorrelation and heteroscedasticity problems in the estimates were corrected by the Newey-West method.

3.7. The Fourier Toda Yamamoto (FTY) Causality Test

The causality relationship between the variables was examined by Fourier Toda Yamamoto causality analysis (Nazlıoğlu et al., 2016, p.172). Toda Yamamoto causality test (1995) is an improved method of Granger causality approach based on estimating a *VAR (p + d)* a model, where p is lag length and d is the maximum integration degree of the variables. The resulting model employed in the study was given below;

$$Y_t = \alpha + \beta_1 Y_{t-1} + \cdots + \beta_{p+d} Y_{t-(p+d)} + \epsilon_t \quad (7)$$

where, $\alpha(t)$ denotes intercept terms, β denotes coefficient matrices, ϵ_t denote white noise residuals. Y_t contains K endogenous variables. The null hypothesis of test was "*There is no causality between series*"; and this hypothesis accepts zero restriction on the first *p* parameters ($H_o = \beta_1 = \cdots = \beta_p = 0$) of the K^{th} components of Y_t. However, Toda Yamamoto causality analysis does not take brakes into into account at all. Ventosa and Valdés (2008, p.8) criticize this issue and show that the results of the causal analysis do not yield effective results if there was no structural changes. Therefore, the causality analysis allowing breaks was included in the study. When structural break dates cannot be predicted sharply, the Fourier approach is considered and described below by (Nazlıoğlu et al., 2016, p.172);

$$\alpha(t) = \alpha_0 + \sum_{k=1}^{n} \gamma_{1k} \sin\left(\frac{2\pi kt}{T}\right) + \sum_{k=1}^{n} \gamma_{2k} \cos\left(\frac{2\pi kt}{T}\right) \quad (8)$$

where, $\alpha(t)$ depends on time; n is the number of frequencies; γ_{1k} and γ_{2k} evaluates the wideness and displacement of the frequency, respectively. If the resulting of Eq (8) is rewritten with a single Fourier frequency;

$$\alpha(t) = \alpha_0 + \gamma_{1k} \sin\left(\frac{2\pi kt}{T}\right) + \gamma_{2k} \cos\left(\frac{2\pi kt}{T}\right) \quad (9)$$

By substituting Eq (7) and Eq(9), it is obtained;

$$Y_t = \alpha_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \beta_1 Y_{t-1} + \ldots + \beta_{p+d} Y_{t-(p+d)} + \epsilon_t \quad (10)$$

According to Nazlıoğlu, Gormus and Soytas (2019, p.108), the Fourier TY test with single frequency should be preferred when 50 and 100 samples and the Fourier TY with cumulative frequency test should be preferred when approximately 250 samples for more reliable results.

In this context, the results of both analyzes were reported; and it was observed that the FTY causality test with cumulative frequency results was stronger when the number of observations was taken into consideration. Specifically, it was selected the optimal number of *k* and *p* with the lowest information criterion value.

Table 6: The results of FTY causality

	Bivariate VAR Estimation		***Multivariate VAR Estimation***	
To CDS	FTY_{single}	$FTY_{cumulative}$	FTY_{single}	$FTY_{cumulative}$
CA				
Wald Stat	1.848	2.756	2.423	2.777
p-value[a]	0.174	0.097	0.12	0.096
p-value[b]	0.180	0.085	0.13	0.095
Frequency (k)	1	3	1	3
Lags (p)	1	1	1	1
LNGUSD				
Wald Stat	6.439	9.380	2.809	2.278
p-value[a]	0.040	0.009	0.094	0.131
p-value[b]	0.054	0.015	0.100	0.149
Frequency (k)	1	3	1	3
Lags (p)	2	2	1	1

Notes: FTY_{single}: Fourier TY approach with single frequency, and $FTY_{cumulative}$: Fourier TY approach with cumulative frequencies. Maximum k and p are, respectively, determine to 3 and 4, then optimal k and p are determined by Akaike information criterion. p-Value[a] represents the asymptotic chi-square distribution with p degrees of freedom. p-Value[b] is represents the bootstrap distribution with 1000 replications. VAR(p + d) models are estimated with dmax equal to 1. Bivariate VAR models include CDS rate and one independent variable. Multivariate VAR models include CDS, CA and GDP.

According to the results in Table 6, the conventional TY tests based on bivariate VAR model showed that the null hypothesis of Granger non-causality from the gross domestic product in USD to the variable of CDS was to be rejected. Fourier TY analysis with both VAR models yielded different results. Especially, whereas the bivariate description shows a causality relationship, the multivariate model did not support any information transmission. In other respects, there was no evidence supporting causality from current account deficit to CDS for structural shifts by using single frequency. With the cumulative framework, it was found that there was causality from current account deficit to CDS at 10% significance level.

4. Conclusion

CDS premiums are considered one of the prominent tools to assess financial risk levels of individual countries. Additionally, the macroeconomic factors have been found to be significantly effective on risk perception and financial fragility of countries. CDS premiums exhibit rather a volatile pattern especially with the countries with high fragility due to high current deficit such as Turkey. In this context, the relationship between CDS, current account deficit rate (denominated in US Dollars) and GDP rate was analyzed for Turkey for the period of 2007:Q1-2018:Q4 through multiple structural break methods. According to findings, a negative relationship was determined between CDS and growth rate, whereas a positive relationship between CDS and current account deficit. A percent increase in growth rate led to 0.88% decrease in CDS risk premium. On the other hand, a percent increase in the current account deficit causes an increase with CDS risk premium by 5.61%. The augmented format of the Toda Yamamoto model (Nazlıoğlu et al., 2016) supported a demonstration of causality from the current account deficit and growth rate to CDS risk premium with the cumulative framework. These results are found to be consistent with theoretical expectations and showed that the current account deficit and the economic constriction cause an increase with the country's external borrowing risk premium and CDS rates, and risk perception towards Turkey is found to be affected by its macroeconomic variables. The rise of the current account deficit in Turkey resulted in an increase in the perception of sovereign default position; and led an increase in the CDS risk premium, which eventually increases Turkey's cost of borrowing. In this case, it is necessary to eliminate hindrance before doing free business in Turkey and to ensure foreign funds to inflow into the country so as to create an investment environment that may reduce interest rates and current account deficit. In this case, Turkey is expected to reduce the sovereign risks through disciplining current account deficit and improving growth performance. To that end, Turkey is expected to stabilize fluctuations in currency and interest rates mostly by increasing external cash inflow and to create an investment environment for real industry to reverse deficit-making characteristic of the country.

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