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ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

VOLATILITY SPILLOVER EFFECTS FROM GLOBAL AND NATIONAL VARIABLES TO SOVEREIGN CDS SPREADS: EVIDENCE FROM TURKEY

KÜRESEL VE ULUSAL DEĞİŞKENLERDEN ÜLKE CDS PRİMİNE VOLATİLİTE YAYILMA ETKİLERİ: TÜRKİYE ÖRNEĞİ

Assist. Prof. Dr. Çiğdem KURT CİHANGİR[1]

ABSTRACT

In this study global and national variables that affect the sovereign Credit Default Swaps (CDS) spreads for Turkey are examined. The study utilises monthly time-series data, spanning from August of 2009 to September 2018. Empirical analysis is done in two steps: In the first step, the causality relationships between related variables are investigated by the Granger causality test. In the second step, the effect of symmetric and asymmetric spillover effects on sovereign CDS spread is determined. The findings show that both national and global shocks are relevant for Turkey' sovereign CDS spreads volatility, but national variables tend to have a greater impact. Furthermore, there exist mean asymmetric effects for external fragility, domestic interest rate and the VIX variables. It is tested that sovereign CDS spreads react more sharply to domestic interest rates and VIX bad news than a positive shock of equal size. Generally, both uncertainties in global conditions and the relatively high need for external borrowing of Turkey necessitates a multi-faceted policy-making and management process.

Keywords: Sovereign CDS Spreads, Volatility Spillover, External Fragility, Global Liquidity.

JEL Classification Codes: C32, E44, F34, H63, G30.

ÖZ

Bu çalışmada Türkiye için ülke Kredi Temerrüt Takas (CDS) primini etkileyen küresel ve ulusal değişkenler araştırılmıştır. Çalışmada Ağustos 2009 – Eylül 2018 dönemine ait aylık veriler kullanılmıştır. Analiz iki aşamalı yapılmıştır: İlk aşamada ilgili değişkenler arasındaki nedens gvaellik ilişkisi Granger nedensellik testi ile araştırılmıştır. İkinci aşamada ise belirlenen bağımsız değişkenlerden ülke CDS primine simetrik ve asimetrik yayılma etkisi araştırılmıştır. Yapılan analizlerin sonucunda şu sonuçlara ulaşılmıştır: Birincisi, Türkiye'nin ülke CDS primlerindeki oynaklık hem küresel hem de ulusal değişkenlerdeki şoklardan etkilenmekle birlikte, ulusal değişkenlerin etkisinin daha fazla olduğu belirlenmiştir. İkincisi, dış kırılganlık, ulusal faiz oranı ve VIX değişkenleri için ortalama asimetrik etki olduğu belirlenmiştir. Üçüncüsü, ülke CDS priminin ulusal faiz oranları ve VIX'deki kötü bir habere eşit büyüklükteki pozitif bir şoktan daha fazla tepki verdiği test edilmiştir. Genel olarak, hem küresel koşullardaki belirsizlikler hem de Türkiye'nin dış borç ihtiyacının nispeten yüksek oluşu, çok yönlü bir politika oluşturma ve yönetme sürecini gerektirmektedir.

Anahtar Kelimeler: Ülke CDS Primi, Volatilite Yayılması, Dış Kırılganlık, Küresel Likidite.

JEL Kodları: C32, E44, F34, H63, G30.

[1] Hitit University, Faculty of Economics and Administrative Sciences, Department of Business Administration, kurt_cigdem@yahoo.com

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1. INTRODUCTION

The international financial structure is shaped by financial crises that the formation of a new crisis is effected by the policies implemented and the measures taken after last crisis. For instance, after the Asian Crisis in 1997, attention increasingly turned to capital account shocks, and vulnerability has come to be assessed on the basis of short-term external debt (Akyüz, 2014). The Global Financial Crisis, which started in the USA in 2008, is a cumulative crisis in previous years and the financial globalization is a peak process and has spread all over the world through the trade channel, the financial channel and the trust channel. Furthermore, this crisis has illustrated that liquidity risk, along with credit risk, matters and should not be underestimated (Brunnermeier, 2009).

Macroeconomic balances and debt structures, which are sustainable within the framework of internal dynamics, can become unsustainable in the face of negative global shocks (Calvo, Izquierdo and Mejia, 2004; Rozada and Levy-Yeyati, 2008). The main factors that determine the dimensions of these global impacts are the current account balance of the country, as well as, the level, structure, and sustainability of its debts. In other words, it impacts the internal fragilities of the country. The fragility that starts with the "basic sin" (Hausmann and Panizza, 2010; Eichengreen, Hausmann and Panizza, 2005; Hausmann and Panizza, 2003) which is defined as the inability particularly of the developing countries to borrow from the international markets in terms of their own currency is deepened by the debt intolerance and currency mismatch. Reinhart, Rogoff and Savastano (2003) describe the debt intolerance as the inability of developing countries to borrow from international markets in the amount borrowed by developed countries. In the event that both debt dollarization is dominant in an economy and these debts are unhedged, the currency mismatch can also be reflected in other economic units by creating a multiplier effect. Accordingly, the exchange rate increases resulting from the realization of global financial risks reduce the sustainability of debt; and thus, are reflected in the country's risk premium.

On the other hand, sudden and high exchange rates, will adversely affect the financial situation, production and investment of the sectors (and the entire economy with links to financial fragility) that owe unhedged a high level of foreign currency, can result in economic contraction and financial instability (Özmen and Yalçın, 2007). According to Minsky (1992), in a capitalist economy, it is inevitable that trustworthy financial structures will eventually turn into fragile financial structures and he stated that the methods employed by economic units to provide financing had an impact on financial vulnerability. Three types of financing behavior can be defined for economic agents: Hedge financing, Speculative financing and Ponzi financing (Minsky, 1992). Which of these is concentrated gives information about the health status of an economy. Hedge financing is a type of financing in which the borrowing can be closed with current income or future income and is a sign that the economy is healthy. Speculative financing is the type of financing in which debts cannot be closed but can be turned, and its intensity is a sign that economic units are on a unhealthier path than hedge financing. Lastly, Ponzi financing is borrowing from another place to cover a debt, which is the unhealthiest point of economic agents. In other words, the fragility in the economy increases as from hedge financing progresses towards ponzi financing. As a result, a sudden change in exchange rates or a sudden stop/return in capital movements, whether from global or internal factors, adversely affects the sustainability of debts. Therefore, it is a necessity to carefully evaluate the sources of the debt dynamics, the vehicles of response and the consequences.

IMF (1998) states that countries with a high level of short-term debt, floating rate debt or foreign currency debt are more vulnerable to external shocks and have higher financial fragility. Financial fragility is used for countries that become more dependent on foreign capital flows due to their high and rising current account deficits (Morgan Stanley, 2013). According to this definition, financial fragility has increased especially in developing countries. Bloomberg Economics (2018) calculate the vulnerability ranking by taking into account the current account balance, the short-term external debt level, the government's effectiveness, and the inflation rate indicators. In this sense, Turkey is a vulnerable country that is negative decomposing from similar countries. For instance, the average inflation rate for 2018 is realized that 3.2 percent in G20 countries, 2.6 percent in OECD countries, 3.31 percent in fragile countries, while it is 20.35 percent in Turkey.

The reason for this financial fragility is both a sudden stop problem and a debt mechanism problem consisting of maturity and currency mismatch. External creditors may choose not to roll over their short-term debt, indicating a liquidity need for the country that is partially covered with foreign reserves. The liquidity of a country is closely related to its international reserves and short-term external debt (remaining to maturity). The so-called Greenspan-Guidotti (GG) rule (Greenspan, 1999) is a prescription that EMs hold reserves equal to external debt less than one-year in maturity. The size of the GG ratio is considered to be one of the variables that affect the country's risk

premium because it also shows the country's endurance to external shocks and gives information about the country's liquidity. A country's liquidity can be estimated by ((IR-STED)/GDP) ratio.

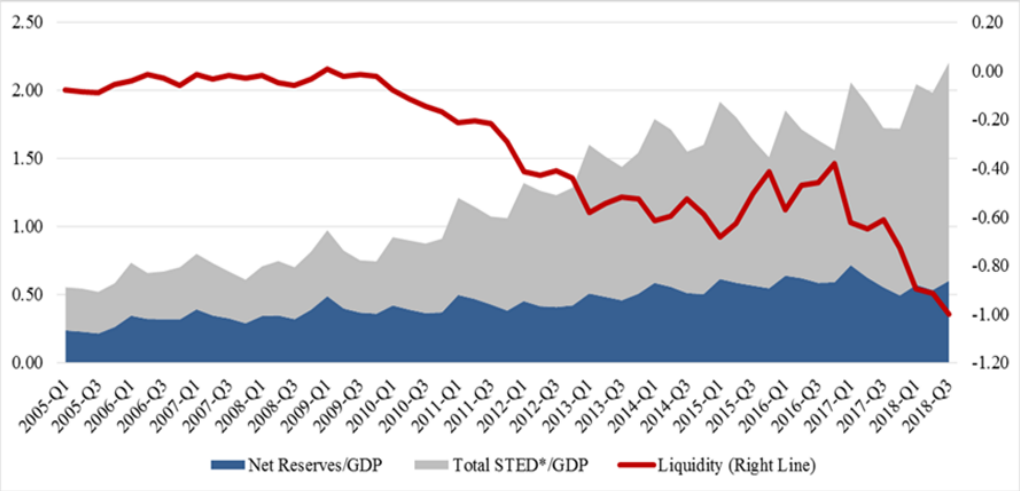

Figure 1. Liquidity Level of Turkey

Figure 1 shows Turkey's liquidity level by years. Accordingly, while the ratio of IR/GDP remained almost the same despite the rapid increase in the rate of STED*/GDP in the post-2008 crisis period, it is observed that the level of liquidity fell sharply. While global liquidity was increasing in the 2009 - 2015 period, Turkey's level of liquidity was decreased by almost half. The downward trend in Turkey's liquidity level also appears to continue in the post-2015 period when global liquidity is declining. Furthermore, Turkey is a country that its reserves cannot cover the country's current account deficit and short-term external debt (Akyüz, 2015). As this situation increases the country's financial fragility and consequently the risk premium, renewal of debts and/or new borrowing becomes costlier.

There are two main components of external borrowing. First, it is the cost of borrowing consisting of the sum of the London Interbank Offer Rate (LIBOR) and the risk premium. The second, it is the level of borrowing. In the 2018 Q3 period, Turkey's external debt liability was realized as about 230 billion dollars. According to IMF (2018) estimates, Turkey's external financing needs will continue to grow until 2023 and will be approximately 300 billion dollars. The debt is impressible to exchange rate fluctuations because over 90 percent of Turkish external debt is denominated in foreign currency (IMF, 2018). The situation in terms of the cost of borrowing is much more complicated, because the country-specific factors that make up the risk premium -as well as the expectations in global interest rates and the risk appetite of investors- are also effective. It is possible to determine the country risk premium with Credit Default Swap (CDS) spreads. Therefore, CDS spreads are a direct indicator of default risk for countries (Chan-Lau, 2003). CDS spreads affect the cost of borrowing from international financial markets because it shows the risk premium of the countries, i.e. the confidence of foreign investors in their ability to pay the debts of this country. Accordingly, CDS spreads increase when the country's risk increases and CDS premiums decrease when its risk decreases (IMF, 2013).

In Figure 2, the banks' borrowings on foreign currency in the national market, deposits in foreign currency and total external debt are included. After the 2008 global crisis, loans to households through foreign currency are prohibited in Turkey. Therefore, the values given in Figure 2 belong to the foreign currency credits used by banks to companies. In September 2018, while the total value of deposits denominated in foreign currency was USD 145 billion, the total value of loans extended to companies denominated in foreign currency was USD 127 billion. Accordingly, Turkish banks have more foreign currency deposits than their foreign currency loans. As a result, the need for funds in banks is for lira, not for dollar (Setser, 2018). Otherwise, banks and most companies face a serious currency risk as they borrow foreign currency and earn lira. Currency risk of banks is higher than companies because they are assumed both the exchange rate risk arising from their own borrowings and the currency risk arising from the default risk of the companies using loans from foreign currency.

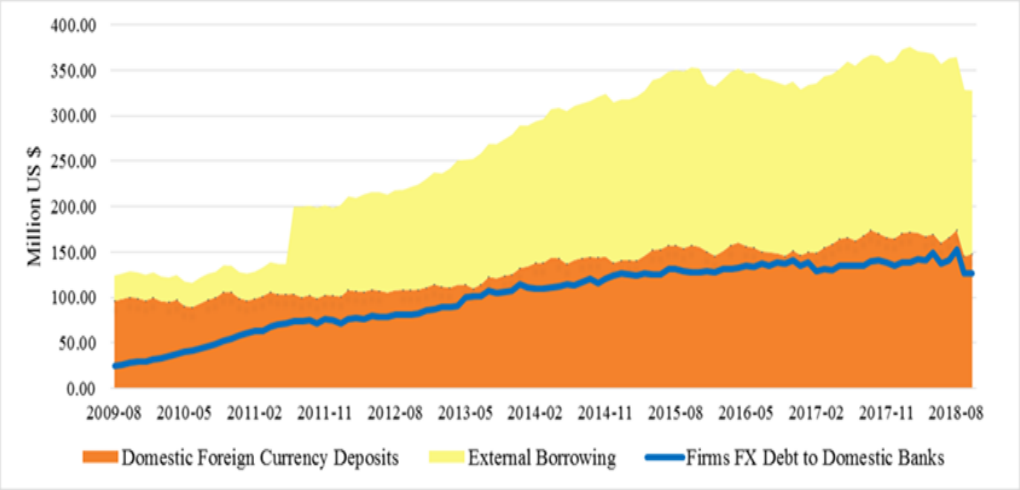

Figure 2. The Relationship between Assets and Liabilities over Foreign Currency for Banks

Especially, when the Ponzi financing method preferred by the companies is preferred together with the economic policies which are not increasing the production capacity, the fragility is inevitable. IMF (2018) indicates that emerging market countries are deemed at high risks when external financing needs are above 15 percent of the GDP benchmark. Gross external financing needs are estimated at 26.3 percent of GDP in 2019 (IMF, 2018). Ultimately, the economy has long been dependent, risky and fragile.

Turkey is in a very difficult period both in terms of global and national conditions. Global problems include volatility in interest rates around the world, the prospect of European region entering recession, slowing China's growth rate and debt problems, uncertainty in trade wars, economic sanctions against Iran, regional risks, etc. global risk is systematic risks that may affect global risk appetite and liquidity levels. On the national side, there are two main problems: first, the country's need for foreign borrowing is high, the second is that it can meet the need for borrowing, creditors the second is that creditors do not have the financial indicators that they can convince to lend. These two problems are reflected in the country's CDS premium, as mentioned above. With this motivation, in this study, the following questions for Turkey's economy are answered. First, is there a causal relationship between the identified national and global variables and the country CDS spreads? If any, what is the direction? Second, is there any effect of volatility and risk spread on sovereign CDS spreads from national - global variables? As national variables; the net international reserves/short-term external debt ratio (IR/STED*-adjusted values according to IMF definition), inflation index (2003=100), and Turkey'treasury bond yield; as global variables (Hilscher and Nosbusch, 2010; Yüksel and Yüksel, 2017); an indicator of international liquidity as global factors, TED spread, investor risk appetite indicator VIX (Pan and Singleton, 2008; Longstaff, Pan, Pedersen and Singleton, 2011; Fender, Hayo and Neuenkirch, 2012; Eyssell, Fung and Zhang, 2013; Eichler, 2014) and global risk-free interest rate are taken. The difference of this study from other studies (Fender et al., 2012, Kim, Salem and Wu, 2015; Varlık and Varlık, 2017) in the literature is the study of the effect of liquidity indicators like IR/STED* ratio and TED spread together with other factors on the volatility of Turkey' sovereign CDS spreads. In the study, the econometric application is done in two parts. In the first part, the causal relationship between global and national variables determined by Turkey' sovereign CDS spreads is investigated with the Granger Causality Test. In the second part, the effect of the same variables on the volatility of the sovereign CDS spreads is investigated by the methodology of symmetric and asymmetric relationship Ng (2000) and Christiansen (2007).

The rest of the paper is organized as follows. The next section presents the related literature. Section 3 provides a description of the data and primary analysis. Section 4 applies an empirical model with symmetric- asymmetric spillover models. Section 5 concludes the analysis.

2. LITERATURE REVIEW

In this study is investigated whether the volatility of sovereign CDS spreads can be explained by global and local factors. The results of the studies in the literature can be divided into three groups. The first group includes studies

that conclude that global factors are dominant in sovereign CDS spreads. The second group focus on the studies that conclude that national factors are dominant in CDS premiums, and the third group sheds light on the studies that claim that the dominant factors in CDS spread will change according to time and macroeconomic conditions of the country concerned.

A number of studies suggest that CDS spreads are mosty influenced by global factors: Pan and Singleton (2008), Dooley and Hutchison (2009), Fontana and Scheicher (2010), Longstaff et al., (2011), Fender et al., (2012), Badaoui, Cathcart and El-Jahel (2013), Wang ve Yao (2014), Heinz ve Sun (2014), Hassan, Ngow, Yu and Hassan. (2013), Yüksel and Yüksel (2017), Izadi and Hassan (2018). Eichengreen and Mody (1998) measure the explanatory power of countries' financial and economic conditions in the pricing of developing countries. In this study, it is concluded that investors made a distinction according to risk in the decision-making process. Accordingly, global risk appetite is fairly effective in the CDS spreads. Pan and Singleton (2008) find a powerful link between sovereign CDS spreads and global risk appetite for Mexico, Turkey, and Korea. Hartelius, Kashiwase and Kodres, (2008) state that expectations of future U.S. interest rates and volatility in those expectations are very important for emerging market spreads. Fontana and Scheicher (2010) argue the high CDS premium during the Eurozone debt crisis may be due to the decline in risk appetite and market liquidity.

Longstaff et al., (2011) investigate the country credit risk and components of this risk by using CDS data from developed and developing countries for the period from October 2000 to January 2010 by used principal component analysis. They find that the sovereign CDS spreads are more associated with global factors (such us US stock, treasury, and high yield markets) than local factors (such us stock return, exchange rate, and foreign reserve). Aizenman, Hutchison and Jinjarak (2013a) researches the relationship between CDS premiums and macroeconomic variables for 50 countries in the period of 2005 - 2010 with panel data analysis. They focused on the 5 countries of the European Union, which had a debt crisis in their work and concluded that the risk pricing of these countries was higher than in other countries. Furthermore, it is found that the most significant variables explaining CDS premiums are TED spread, trade openness, external debt and inflation. Yüksel and Yüksel (2017) investigate sovereign CDS data on 19 countries to examine how global risk factors affect both the change and the volatility of CDS spreads during the European sovereign debt crisis period by using the threshold GARCH model. They find that VIX has a significant effect on the change of sovereign CDS spreads for the majority of countries.

Studies that conclude that national factors are dominant in CDS premiums: After the study of Edward' in 1984, there have been increasing studies that the importance of economic fundamentals as determinants of sovereign risk. He found a significant impact on the spreads of indicators of external vulnerability like external debt, debt service or current account. Maier and Vasishtha (2008), Kliber (2014), Aizenman et al., (2013a), Liu ve Morley (2013), Liu ve Morley (2012), Eyssell et al., (2013). Maier and Vasishtha (2008) investigated the effects of macroeconomic factors on spreads. In this study, it is concluded that the decrease in inflation and long-term borrowing rates are effective in decreasing spreads. Besides, it is stated that global economic developments are less effective than other factors mentioned in explaining the decrease in the spreads in the 2000s. Liu ve Morley (2012) provide evidence that the exchange rate and interest rate are an important determinant of sovereign CDS spreads. Eyssell et al., (2013) examine the relationship between China's CDS premiums and the country's local and global economic variables fort he period from 2001 to 2010. As a result of the study using the VAR method, both local (such as the China stock market index and the real interest rate) and global (such as the VIX and default spreads, and the global stock market) factors are found to have a significant explanatory power of change in China's CDS premiums.

The studies that claim that the dominant factors in CDS spreads will change according to time and macroeconomic conditions of the country concerned: Uribe and Yue (2006), Hilscher and Nosbusch (2010), Bellas, Papaioannou and Petrova (2010), Beirne and Fratzscher (2012), Aizenman et al., (2013b). Uribe and Yue (2006) find that an increase in the world interest rate causes a decline in emerging market spreads in the short run followed by an overall increase in spreads in the long run. Hilscher and Nosbusch (2010) determine that several significant national variables (volume of trade, debts and reserves relative to GDP, and credit ratings) as well as global variables (VIX, corporate default yield spread, 10-year U.S. Treasury yield, and TED spread) that can be used to determine the spread for 31 emerging markets during 1998 – 2007. They find that in the long-term, the volatility of terms of trade, in particular, has a statistically and economically significant effect on spreads, while in the short-term, global factors are important at high frequencies. Bellas et al., (2010) show that economic fundamentals are significant determinants of emerging market sovereign CDS spreads in the long run; although, financial volatility is a more important factor in the short run.

Beirne and Fratzscher (2012) show that economic fundamentals have a strenghtened role in influencing global financial markets during periods of stress than in normal times. Aizenman, Jinjarak and Park (2013b) investigate the links between various economic fundamentals and the sovereign CDS spreads of emerging markets during 2004-2012. Inflation, state fragility, external debt, and commodity terms of trade volatility are positively associated, while trade openness and more favourable fiscal balance/GDP ratio are negatively associated with sovereign CDS spreads. The results indicate that global factors were largest in pricing sovereign risk prior to the crisis, but local factors prominence during and after the crisis. The studies investigating the volatility of CDS spreads are as follows: Fender et al., (2012) study that the determinants of daily spreads for emerging markets, including Turkey, sovereign CDSs over the period April 2002 – December 2011 by using GARCH models. , we find, first, that daily CDS spreads for emerging market sovereigns are more related to global and regional risk premia than to country-specific risk factors. They find that international risk premia are more relevant than domestic factors. Varlık and Varlık (2017) examine the volatility of Turkey' CDS spread for the January 2008 – October 2016 period by using GARCH models. They conclude that the variables that reflect external dominance problem, such as the US 10-year Treasury Bond interest rate, significantly increase the volatility of CDS spreads.

3. DATA AND PRELIMINARY ANALYSIS

3.1. Data Description

In order to gauge a set of potential determinants variables that impact the CDS spreads, this study uses monthly time-series data, spanning from August of 2009 to September 2018, with a total of 110 observations for each variable. The national and global explanatory variables used in the econometric analysis are discussed in more detail below. The beginning of the period was taken as 2009M8 to determine the impact of the changing global financial structure after the global crisis on sovereign CDS spreads for Turkey.

- *National Variables*

External Fragility

Vulnerability and fragility are different concepts from each other. Grabel (2003) defines risk as the vulnerability to internal or external shocks that jeopardise their ability of the economy to meet the current obligations of private and public borrowers. Fragility is more specific, such as macroeconomic fragility, external fragility (see, Guillaumont, 2009). In this study, Net International Reserves (NIR) / Short-Term External Debt (STED) ratio used as an indicator of external fragility, also known as GG rule in literature. The rate of NIR / STED can actually be considered as an indicator of liquidity. Reserves are regarded as a measure of liquidity and show the strength of the payment of foreign currency debts (Remolona, Scatigna and Wu, 2008). Since the NIR / STED rate shows how much of the countries' short-term liabilities can be fulfilled in the absence of access to external financing, the high ratio is a factor that reduces the country's risk premium and fragility. Accordingly, in order for countries to give confidence to investors, they must have a reserve level to meet the minimum amount of STED (Bussiere and Mulder, 1999). Otherwise, the reserves held by the central bank in a negative situation will be insufficient to pay the short-term external debt (Irefin and Yaaba, 2011; Lehto, 1994).

Both components of the ratio for a good indicator of fragility must have the following characteristics (IMF, 2000): The definition of official reserve assets should only cover the total amount of immediately available liquid external assets. The short-term external debt should include all debt instruments held by nonresidents (irrespective of the currency in which the debt is denominated) rather than simply all debt instruments issued abroad. Accordingly, the value of STED* is calculated as follows:

Net International Reserves = Gross Foreign Currency Reserves-Gold

STED*= Short-Term External Debt + Debt Instruments Held by Non-residents

Fragility = NIR / STED*

Inflation Index

As the proxies for the domestic macroeconomic fundamentals, the other variable that it is used is inflation (CPI) measured by a consumer price index. Inflation, which causes the national currency to depreciate against foreign currencies, also reduces the real value of local sovereign debt (Izadi and Hassan, 2018). Thus, inflation can be effect sovereign CDS spreads.

Domestic Interest Rate

As a country with a current account deficit has to import overseas savings, domestic interest rates will necessarily increase (Eğilmez ve Kumcu, 2005). The sustainability of debt depends on the persuasion of foreign investors to use their funds when other national factors are considered stable, namely the attractiveness of interest rates. In this study, a 2-year treasury bond interest rate is taken as the benchmark interest rate.

- *Global Variables*

TED Spread

The lending appetite and the funding conditions of banks that play a role in the distribution of global liquidity are one of the primary indicators affecting capital flows. Adrian and Shin (2010), and Bruno and Shin (2015a) propose indicators such as the TED spread, real credit growth rate or the ratio of loans to gross domestic product (GDP), especially for the lending appetites and conditions of banks.

The TED spread is the difference between three months of interbank rate and three months of government bond yield. The banks with larger TED spread, the greater risk in the financial market (or A higher TED spread in the banking sector increases the level of risk in the financial market). For example, right after Lehman Brothers went down, this difference rose to an incredible 450 base points, i.e. 4.5 percent. Low TED spreads, ie LIBOR approach to TBill indicates that the dollar liquidity is exceeded. The fact that TED spread is low, ie LIBOR is close to TBill, shows that the dollar liquidity is abundant; The high spread shows that the liquidity is low. Accordingly, the difference in interest rate between non-risk-accepted Treasury bills and the interbank market plays a role as a mirror of the financial sector's perception of risk. Furthermore, it proxies for changes in global liquidity (see, for example Longstaff et al., 2011; Baldacci, Gupta and Mati, 2011; Levy-Yeyati, 2008).

VIX Index

The VIX has been used in many studies as an indicator of global risk appetite (IMF, 2004; Gonzales-Rozada and Levy-Yeyati, 2008; Pan and Singleton, 2008; Hacıhasanoğlu and Soytaş, 2009; Bellas et al., 2010; Hilscher and Nosbusch, 2010; Longstaff et al., 2011; Beirne and Fratzscher, 2013; Izadi and Hassan, 2018). While the VIX index shows the perception of global risk, TED spread shows the credit risk in the banking system on a global scale, in other words, it shows the funding liquidity.

Global Risk-free Interest Rate

Finally, the US Treasury 10 year bond yield is taken to represent the global risk-free interest rate (see for examples Levy-Yeyati, 2006; Gonzales-Rozada and Levy-Yeyati, 2008).

The sample period extends from 2009M8 to 2018M9, with a total of 110 observations. Descriptions and sources of variables are given in Table 1.

Table 1. Description of Variables

Variable		Source
Short-Term External Debt	STED	Central Bank of Turkey Republic (CBTR) Electronic Data Distribution System (EDDS)
Debt Instruments by Non-resident		CBTR-EDDS
Net International Reserves	NIR	CBRT -EDDS
Credit Default Swap	CDS	Datastream
Consumer Price Index (2003=100)	CPI	CBRT -EDDS
Domestic Interest Rate The 2-year TR Treasury Yield	TRINT	CBRT -EDDS
Global Risk-free Interest Rate The 10-year U.S. Treasury Yield	USINT	FED-FRED
TED Spread (The difference between 3-months LIBOR and the U.S. Treasury bill rate)	TED	Datastream
Volatility Index	VIX	Datastream

3.2. Preliminary Analysis

In this section, a snapshot of the sample statistics series is presented. Table 2 provides the descriptive statistical properties of the variables. The primary goal of this section is to give an overall idea of the statistics and distribution, which are considered a relevant early visual processing of the data structure. The following table provides descriptive statistics for variables. The sample period is from August 2009 to September 2018.

Only a preliminary analysis is performed in this section. Therefore, these tests do not provide information on the spread of volatility.

Table 2. Summary Statistics

	CDS	CPI	FRAGILE	TRINT	USINT	TED	VIX
Mean	211.1101	242.9109	0.565622	9.775818	0.379091	0.288316	17.55709
Median	201.7800	235.8600	0.502216	9.030000	0.150000	0.249750	16.11000
Maximum	469.0000	390.8400	0.981872	24.48000	1.950000	0.591500	42.96000
Minimum	113.1370	163.2900	0.369356	5.140000	0.070000	0.117826	9.510000
Std. Dev.	56.90592	54.52637	0.143264	2.965932	0.492158	0.110788	5.869166
Skewness	1.284514	0.548100	1.378538	2.555982	1.911478	0.887916	1.462517
Kurtosis	6.463941	2.443861	4.256562	11.99735	5.459184	2.950240	5.710410
Jarque-Bera	85.24450	6.925160	42.07690	490.8038	94.70349	14.46526	72.88485
Prob.	0.000000	0.031349	0.000000	0.000000	0.000000	0.000723	0.000000
Sum	23222.11	26720.20	62.21839	1075.340	41.70000	31.71479	1931.280
Sum Sq. Dev.	352972.9	324070.7	2.237193	958.8461	26.40191	1.337865	3754.734
Obs.	110	110	110	110	110	110	110

Stationarity Test

In order to obtain statistically reliable results in time series analysis, the series must be stationary. Stationarity is that as having a constant mean, constant variance and constant auto covariances for each and every given lag (Brooks, 2008). Several methods can be used to identify stationarity or non - stationarity data. In this research paper, the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test were applied. Results of these tests are presented in Appendix 1. Since the stability of the variables used in the analysis was at different levels, the cointegration relationship was not investigated.

Granger Causality Test

Optimal lag length must be determined to establish the VAR model. According to the lag order selection criterion test, the optimum length is determined as 2 (see Appendix 2) Results of Granger Causality test based on the VAR model (see Appendix 3) are given in Table 3.

There is a mutual causality relationship between sovereign CDS spreads and fragility at the level of 5 percent significance. In addition, national interest rates and VIX are the cause of CDS Granger at a 1 percent significance level.

Table 3. The Results of Granger Causality Test

Causality Decision	Chi-sq (Prob.)		
FRAGIL ↔ CDS	6.7688	(0.0339**)	6.2863 (0.0431**)
TRINT → CDS	77.5324	(0.0000***)	
VIX → CDS	35.4303	(0.0000***)	

p-values are denoted in parentheses. ***, **, * represents the level of significance at 0.01, 0.05, and 0.10 respectively.

4. EMPIRICAL MODELS

4.1. (Unconditional) Symmetric Spillover Model

In this section, it is investigated the nature of return and volatility spillovers from CPI, FRAGIL, TRINT, USINT, TED, and VIX on Turkey's sovereign CDS premium by utilizing unconditional and symmetric spillover models proposed by Ng (2000) and Christiansen (2007). In this study, two-step specifications are used for estimation. In the first step, the univariate AR-GARCH model is estimated for measuring the effect of economic-financial indicators' return. The optimum model is selected by Schwarz Information Criteria (SIC) as GARCH (1,1). The difference of the economic-financial indicators is shown as $R_{\mathrm{CDS_i}}$= CPI, FRAGILE, TRINT, USINT, TED, VIX. In the first step, GARCH (1,1,) model is specified as follows:

$$R_{CDS_{i,t}} = \alpha_{CDS_i} + \sqrt{\sigma^2_{CDS_{i,t}}} Z_{CDS_{i,t}} \quad (1)$$

$$\sigma^2_{CDS_{i,t}} = w_{CDS_i} + \beta_{CDS_i} R^2_{CDS_{i,t-1}} + \gamma_{CDS_i} \sigma^2_{CDS_{i,t-1}} \quad (2)$$

where (1.1) and (1.2) are mean and variance equations, respectively. $Z_{CDS_{i,t}}$ is independently and identically normal distributed with mean 0 and variance 1. Furthermore, there are restrictions as w_{CDS_i}, β_{CDS_i} and γ_{CDS_i}>0 and $\beta_{CDS_i} + \gamma_{CDS_i}$<1. In this step, residuals and volatility series are gathered from estimated model (1.1) and (1.2), namely $Resid\_CDS_i$ and $Vol_{\_CDSi}$, respectively.

In the second step, GARCH (1,1) model is estimated for investigating the spillover effect to dependent variable from each economic-financial indicator. For example, for estimating spillover effect of CDS from each economic-financial indicator, GARCH(1,1) model can be defined as fallows,

$$R_{CDS,t} = c_0 + c_1 R_{CDS,t-1} + \sum_{i=CPI}^{VIX} \gamma_i R_{CDS_{i,t-1}} + \sum_{i=CPI}^{VIX} \delta_i Resid\_CDS_{i,t} + \varepsilon_{CDS,t} \quad (3)$$

$$\sigma^2_{CDS_t} = w_{CDS} + \beta_{CDS} R^2_{CDS_{t-1}} + \gamma_{CDS} \sigma^2_{CDS_{t-1}} \quad (4)$$

where w_{CDS}, β_{CDS} and γ_{CDS}>0 and $\beta_{CDS} + \gamma_{CDS}$<1. In here, the coefficients of γ_i and $\delta_i$the estimated models show the mean and volatility spillover effect, respectively. In order to check whether the mean and volatility spillover effects are statistically significant, the Wald test is used.

According to Table 4 shows significant and same directional mean spillover effect from FRGL, TR_INT, and VIX. Accordingly, a unit increase in TR_INT leads to an increase in CDS of 17.8927 units. Similarly, a unit increase in VIX leads to an increase in CDS of 2.5830 units. The unconditional spillover model shows no significant mean-spillover effect from the CPI, US_INT, and TED to the sovereign CDS.

Table 4. Mean Spillover Effect

	CPI	FRGL	TR_INT	US_INT	TED	VIX
CDS	-1.0979	1.2227	17.8927	-0.0377	49.4363	2.5830
	(0.3261)	(0.0429**)	(0.0000***)	(0.8041)	(0.2651)	(0.0000***)

Note: p-values are denoted in parentheses. ***, **, * represents the level of significance at 0.01, 0.05, and 0.10 respectively.

Table 5 shows the results of the volatility spillover effect. The volatility of CDS spreads is affected by the shocks in TR_INT at a 5 percent statistical significance level. The shocks in other variables have no significant effect on CDS volatility.

Table 5. Volatility Spillover Effect

	CPI	FRGL	TR_INT	US_INT	TED	VIX
CDS	0.6483	0.8357	4.9182	0.0369	-54.6118	-0.0018
	(0.5926)	(0.3427)	(0.0397**)	(0.8111)	(0.1737)	(0.9964)

Note: p-values are denoted in parentheses. ***, **, * represents the level of significance at 0.01, 0.05, and 0.10 respectively.

Table 6 provides the robust joint Wald test of no spillover effects from independent variables such as H0 Hypothesis: no spillover effects from CPI to CDS. According to the results, the null hypothesis of no spillover effects of TR_INT and VIX have been rejected for CDS under a 1 percent significance level.

Table 6. The Result of Wald Test

	CPI	**FRGL**	**TR_INT**	**US_INT**	**TED**	**VIX**
CDS	1.2703	2.5240	26.2046	0.0654	1.6999	16.4631
	(0.2857)	(0.0858*)	(0.0000***)	(0.9367)	(0.1885)	(0.0000***)

Note: p-values are denoted in parentheses. ***, **, * represents the level of significance at 0.01, 0.05, and 0.10 respectively.

4.2. Asymmetric Spillover Model

This section covers the analysis of asymmetric spillovers from CPI, FRAGILE, TRINT, USINT, TED, and VIX to CDS. The asymmetric spillover effect is that a negative shock on these independent variables is has a stronger impact on the CDS'difference than a positive shock. γ_{1i} and $\gamma_{2i}$are positive and negative mean spillover effects from independent variables; $\delta_{1i}$and δ_{2i} (i= CPI, FRAGIL, TRINT, USINT, TED, and VIX) are positive and negative shocks from independent variables.

Table 7 shows the results of the asymmetric volatility spillover effects. The evidence is found while there is the existence of asymmetric response of positive from FRGL, TR_INT, and VIX, it is the existence of asymmetric response of negative asymmetric only from TR_INT. The CDS spreads reacts more strongly to a decrease in TR_INT than to an increase of the same size in the TR_INT. In terms of the asymmetric volatility spillover effect, the effect caused by the shocks in TR_INT is about 12 times the effect caused by the shocks in VIX.

Table 7. Asymmetric Spillover Effect

		CPI	**FRGL**	**TR_INT**	**US_INT**	**TED**	**VIX**
CDS	γ_{1i}	-0.1503	2.2976	13.3736	0.0182	72.8518	2.2659
		(0.9423)	(0.0503**)	(0.0000***)	(0.9338)	(0.2625)	(0.0000***)
	γ_{2i}	-2.1579	1.1490	21.3141	0.1232	23.1019	1.0639
		(0.0977*)	(0.0908*)	(0.0002***)	(0.5950)	(0.7193)	(0.1035)
	δ_{1i}	1.8103	-0.3776	17.8141	-0.0249	35.5806	1.3978
		(0.3138)	(0.6890)	(0.0000***)	(0.9442)	(0.5703)	(0.0007***)
	δ_{2i}	-0.4857	0.7453	-19.1895	0.0023	-78.948	-1.7205
		(0.6249)	(0.2991)	(0.0000***)	(0.9919)	(0.1969)	(0.0093***)

Note: p-values are denoted in parentheses. ***, **, * represents the level of significance at 0.01, 0.05, and 0.10 respectively.

The Wald test gives further evidence of the significance of the information variables included in the conditional spillover model to explain the mean and volatility spillover from national – global variables in the sovereign CDS spreads. Table 8 reports the results of the robust Wald test for the asymmetric spillover model. The robust joint Wald test supports the existence of asymmetries to TR_INT and VIX shocks so the null hypothesis of no asymmetries is strongly rejected. While there is a mean asymmetric spillover effect from FRG to CDS spreads, there is no volatility asymmetric spillover effect.

Table 8. Asymmetric Spillover Model Wald Test

		CPI	**FRGL**	**TR_INT**	**US_INT**	**TED**	**VIX**
CDS	Mean	2.7063	5.8198	28.8834	0.1978	0.9861	17.3532
	Prob	(0.0730*)	(0.0044***)	(0.0000***)	(0.8209)	(0.3776)	(0.0000***)
	Vol	0.6131	0.6088	25.9982	0.0026	0.8349	7.9847
	Prob	(0.5442)	(0.5465)	(0.0000***)	(0.9974)	(0.4377)	(0.0007***)

Note: p-values are denoted in parentheses. ***, **, * represents the level of significance at 0.01, 0.05, and 0.10 respectively.

The evidence is found there interestingly is the existence of symmetric and asymmetric mean spillover effect response of positive from external fragility to sovereign CDS spreads. Whereas, the expected relationship was negative. There is a possible explanation in literature for that: fear of floating. As mentioned above, fear of floating can be expected as the sudden stop or return in capital movements cause high and sudden exchange rate increases in a situation where there are basic sin and debt dollarization in the economy. Fear of floating can be defined as the developing countries to not want excessive volatility in the value of their currencies (Calvo and Reinhart, 2002). Foreign exchange sales interventions aimed at reining the excessive exchange rate increase of central banks can be consistent with the inflation targeting regime and can be effective in preventing the economy from falling into "bad balance" (Calvo, 2006). Accordingly, international reserves can play a shock-absorbing role in the face of the shock-increasing effects of the floating exchange rate regime under financial fragilities (Özmen ve Yalçın, 2007). Foreign exchange sales due to fear of fluctuations cause a decrease in international reserves. As a result of this intervention, domestic interest rates may be expected to increase due to the decrease in the amount of national money in the market. Consequently, the increase in interest rates may also lead to an increase in the country's risk premium (Blanchard, 2004; Başçı, Özel and Sarıkaya, 2007; Özatay, Özmen and Şahinbeyoğlu, 2009; Kadria and Aissa, 2016). The results of the Granger causality test conducted in this study also support this interpretation (national interest rate is the Granger cause of the sovereign CDS spreads).

5. CONCLUSION

This research paper explores the relevance of the spillover and volatility effects from national and global variables to the sovereign CDS spreads for Turkey. It uses external fragility, inflation index, domestic interest rate as a proxy for national variables; TED spread, global risk-free interest rate, VIX as a proxy for global variables. In the study, the econometric analysis is applied in two parts. In the first part, a preliminary analysis is performed to analyze the causal relationships between global and national variables determined by sovereign CDS spreads for Turkey through the Granger Causality Test. In the second part, the effect of the same variables on the volatility of the sovereign CDS spreads is investigated by the methodology of symmetric and asymmetric relationship Ng (2000) and Christiansen (2007).

The result of Granger causality test shows that while there is a bidirectional causality relationship between external fragility and sovereign CDS spreads, there is a unidirectional causality relationship from national interest rates and VIX to sovereign CDS spreads.

The evidence shows that both national and global shocks are relevant for Turkey' sovereign CDS spreads volatility, but, contrary to the results of Varlık and Varlık (2017), and Fender et al., (2012) paper, national factors tend to have a greater impact. Furthermore, the results point out that for there exists strong evidence of domestic interest rate, external fragility, global risk aversion mean and volatility spillover effects, but weak evidence of inflation index, global risk-free interest rate, TED spread mean and volatility spillover effects are found for the sovereign CDS spreads. The results suggest the existence of mean asymmetric effects for the external fragility, domestic interest rate, VIX aforementioned. Furthermore, it is found sovereign CDS spreads to react more sharply to domestic interest rates and VIX bad news than a positive shock of equal size.

External fragility affects the sovereign CDS spreads is compatible with the study of Aizenman et al., (2013b). The evidence is found there is the existence of symmetric and asymmetric mean spillover effect response of positive from external fragility to sovereign CDS spreads. Whereas, the expected relationship was negative. There is a possible explanation for that: fear of floating. As a result of the intervention of the central bank to the market due to the fear of floating, an increase in interest rates is generally perceived as an upsurge in default risk due to a high debt burden, and thus leads to a rise in the risk premium (Blanchard, 2004; Başçı et al., 2007; Özatay et al., 2009; Hilscher and Nosbusch 2010; Kadria and Aissa, 2016).

These findings are important for both government and domestic agents such as financial institutions, households, firms. Generally, both uncertainties in global conditions and the relatively high need for external borrowing of Turkey necessitates a multi-faceted policy-making and management process. Because, a macroeconomic structure, which is faced with a spiral of interest rate and exchange rate and which lost its international competitive power, may lead to a financial crisis. As a short-time solution, policymakers can be stopped the explosion of the debt ratio with temporary capital controls or can be restricted on panicked capital flight. For a sustainable economic system, especially this paper emphasizes that macroeconomic policies should be aimed towards addressing the imbalances,

lowering inflation, and strengthening sources of liquidity such as international reserves. All these factors for economic development should be implemented within a plan, together with comprehensive structural reforms.

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Appendix 1. Results of Stationarity Tests

Augmented Dickey-Fuller (ADF) Test						
Variables	Level		First Difference♣		Second Difference	
	t-stat	p-value	t-stat	p-value	t-stat	p-value
CDS	0.640537	0.8531	-10.02399	0.0000***		
CPI	0.867599	0.8954	0.579894	0.9886	-7.122248	0.0000***
FRAGILE	-2.735745	0.0713*	-10.30574	0.0000***		
TRINT	1.827544	0.9835	-7.791199	0.0000***		
USINT	7.765876	1.0000	-2.908301	0.0477**		
TED	-1.104109	0.2432	-7.856687	0.0000***		
VIX	-1.355586	0.1617	-12.70329	0.0000***		

♣includes intercept

***, **, * represents the level of significance at 0.01, 0.05, and 0.10 respectively.

Phillips - Perron (PP) Test				
Variables	Level		First Difference	
	t-stat	p-value	t-stat	p-value
CDS	0.632602	0.8515	-10.02792	0.0000***
CPI	7.147367	1.0000	-3.085917	0.0306**
FRAGILE	-2.715528	0.0746*	-10.44059	0.0000***
TRINT	1.953017	0.9877	-7.821931	0.0000***
USINT	6.764214	1.0000	-6.856108	0.000.***
TED	-0.989093	0.2875	-7.588202	0.0000***
VIX	-1.281103	0.1836	-22.97153	0.0000***

♣includes intercept

***, **, * represents the level of significance at 0.01, 0.05, and 0.10 respectively.

Appendix 2. Lag order selection criteria for VAR Model

VAR Lag Order Selection Criteria
Endogenous variables: DCDS DD_CPI DFRAGIL DTRINT DUSINT DTED DVIX
Exogenous variables: C
Sample: 2009M08 2018M09
Included observations: 104

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1732.245	NA	791655.2	33.44702	33.62500*	33.51912
1	-1649.107	153.4859	411475.7	32.79051	34.21442	33.36738*
2	**-1593.073**	**95.90403***	**363773.6***	**32.65525***	**35.32507**	**33.73687**
3	-1556.177	58.18171	473677.8	32.88802	36.80375	34.47440
4	-1515.933	58.04378	595677.1	33.05641	38.21806	35.14755

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Appendix 3. Results of VAR Model

Dependent Variable: DCDS
Method: Least Squares (Gauss-Newton / Marquardt steps)
Sample (adjusted): 2009M12 2018M09
Included observations: 106 after adjustments
DCDS = C(1)*DCDS(-1) + C(2)*DCDS(-2) + C(3)*DD_CPI(-1) + C(4)
*DD_CPI(-2) + C(5)*DFRAGIL(-1) + C(6)*DFRAGIL(-2) + C(7)
*DTRINT(-1) + C(8)*DTRINT(-2) + C(9)*DUSINT(-1) + C(10)
*DUSINT(-2) + C(11)*DTED(-1) + C(12)*DTED(-2) + C(13)*DVIX(-1)
+ C(14)*DVIX(-2) + C(15)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.294295	0.100081	-2.940565	0.0042
C(2)	-0.107696	0.076011	-1.416838	0.1599
C(3)	-0.938409	0.887010	-1.057946	0.2929
C(4)	-0.655154	0.941453	-0.695897	0.4883
C(5)	1.148410	0.514339	2.232789	0.0280
C(6)	-0.529614	0.510626	-1.037185	0.3024
C(7)	21.12565	2.592762	8.147932	0.0000
C(8)	8.004282	3.383398	2.365752	0.0201
C(9)	-0.118098	0.147637	-0.799924	0.4258
C(10)	0.063962	0.145092	0.440838	0.6604
C(11)	-0.140656	43.89519	-0.003204	0.9975
C(12)	78.60765	43.55844	1.804648	0.0744
C(13)	2.975303	0.504371	5.899041	0.0000
C(14)	1.302496	0.581599	2.239510	0.0276
C(15)	0.767744	2.157482	0.355852	0.7228
R-squared	**0.613218**	Mean dependent var		2.643302
Adjusted R-squared	0.553713	S.D. dependent var		29.91595
S.E. of regression	19.98527	Akaike info criterion		8.958307
Sum squared resid	36346.41	Schwarz criterion		9.335209
Log likelihood	-459.7903	Hannan-Quinn criter.		9.111068
F-statistic	10.30532	Durbin-Watson stat		1.950358
Prob(F-statistic)	**0.000000**			