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HOW DOES CREDIT DEFAULT SWAP PREMIUMS AFFECT THE TURKISH FINANCIAL MARKETS

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ABSTRACT

One of the most important risks of today's financial markets is credit risk. Credit risk is very important for investors investing in international markets, and therefore it is vital to manage credit risk correctly. Credit Default Swaps (CDS) are at the forefront of the most important financial products that ensure the elimination of credit risk. In this study, the relationship between 5-Year Turkey CDS premium, which is an important indicator for investors, Turkish Borsa Istanbul (BIST) 100 Index, USDTRY foreign exchange rates and 2-Year Turkish benchmark bonds interest rates are examined. For this purpose, econometric analysis was applied using CDS premium, BIST 100 index, USDTRY and 2-Year Turkish benchmark bonds interest rate data, which consists of 2921 daily observations from 10 March 2010 to 08 March 2022. Augmented Dickey-Fuller and Phillips-Perron root tests are used to determine the stationarity of the variables. Then, the Granger Causality test, Impulse-Response Function and Variance Decomposition Analysis are used. According to the results of the study; a bilateral causality relationship was determined between CDS premiums and BIST 100 index, USDTRY exchange rate and benchmark bond interest rates. According to the Impulse-Response functions analysis, a 1% increase in CDS premium prices increases the USDTRY rate and benchmark bond interest rates, while lowering the BIST 100 index.

Contribution/Originality: Due to the limited number of studies examining the effect of credit default premiums on Turkish financial markets, it is aimed to contribute to the finance literature with this study. For this purpose, the effects of credit default swap premiums on Turkish financial markets were examined by applying econometric analysis.

1. INTRODUCTION

One of the most important risks of today's financial markets is credit risk, it is vital to manage credit risk. Credit risk is of great importance not only for investors but also for borrowers in the credit market. The decrease in the interest rates paid as the cost of default risk increases the borrowing capabilities of countries and companies and enables them to borrow in larger amounts with lower interest rates from the markets. Lower interest rates and the possibility of borrowing in larger amounts lead to economic revival and help especially to find the capital needed by developing countries more easily. Being able to borrow easily from international markets when necessary is a driving force for economic growth and ensures that the economy grows at a higher level than expected. Being able to borrow easily from international markets when necessary is a driving force for economic growth and ensures that the economy grows at a higher level than expected.

Developing countries such as Turkey, which had difficulties in maintaining financial stability for many years due to the increasing liquidity in international markets, have been faced with an ever-increasing interest from foreign investors since 2000. Developing countries, which borrowed at high interest rates, had borrowed opportunities with cheaper interest rates until recently due to the development of credit default swap markets. Factors such as better risk pricing through credit default swaps and easier risk transfer when necessary attract more investors to developing countries and reduce borrowing costs.

The crises experienced in Far East Asia in 1997 and in Russia in 1998 caused uneasiness among investors who wanted to invest in developing countries, and accordingly, a decrease in capital inflows to developing countries. Investors, who want to benefit from the advantages of higher returns in developing countries compared to developed countries, use various more complex financial instruments to protect themselves against the negativities that may occur in developing countries during and after the crisis. As a result of a crisis that may occur, there is a rapid increase in the use of new financial instruments to protect investors against the inability of countries and companies to pay their debts and therefore bankruptcy. Credit Default Swaps (CDS), which constitute more than half of credit derivatives, are the leading derivative instruments used for hedging purposes. Credit default swaps began to be used in developing countries in 1996. The transaction volume of CDS in developing countries increased due to the Asian Crisis, the subsequent Russian Crisis, and Argentina's declaration of a moratorium on paying its debts.

In this study, the relationship and direction between 5-Year Turkey CDS premiums, which is one of the important indicators in international markets, and Turkey BIST 100 Index, USDTRY exchange rates and 2-Year benchmark Turkish bonds interest rate were examined.

2. LITERATURE

In this section, the literature examining the relationship between CDS premiums and financial products such as stocks, Eurobonds, and exchange rates is given.

Table 1. A review of the literature

Author(s)	Period	Purpose and Content of the Study	Method(s)	Results
Yenice and Hazar (2015)	April 2009 - April 2014	The relationship between the CDS rates of developing countries such as China, Brazil, Malaysia, Indonesia, Turkey and Argentina and the closing prices of their stock markets is examined.	Regresyon Anaysis	The highest correlation between closing prices of stocks and CDS premiums was found in Malaysia, while the lowest correlation was found in Indonesia. On the other hand, the relationship between Turkey's CDS premium and stock prices is moderate. The authors state that this may be due to the precautions taken as a result of frequently encountered financial crises.
Serdar (2018)	January 2009-November 2012	In the study, how the relationship between CDS rates and eurobond rates between 2009-2012 is examined and it is aimed to reveal which one is stronger as a leading indicator. Eight countries (Germany, Spain, France, Portugal, Italy, Ireland, Greece	Vector Autoregression (VAR) Granger Causality Test	According to the results, it was determined that the CDS premiums of France and Italy gave direction to the eurobond interest rate. According to the Granger causality test results, it was determined that the change in CDS premium for France, Italy and Turkey led to the change in Eurobond interest rates.

Author(s)	Period	Purpose and Content of the Study	Method(s)	Results
		and Turkey) were included in the study as examples.		
Değirmenci and Pabuçcu (2016)	2010-2015	Anayzed the relationship between CDS rates and BIST 100 index	Nonlinear Autoregressive Exogenous (NARX) Model and the Granger Causality Test	A bilateral Granger causality relationship was determined between CDS premiums and stock prices. At this point, how the results of any change in CDS premiums will be reflected on the stock market for investors or policymakers through the estimated model becomes predictable by using lagged values. With a different model to be estimated in the same way, it is possible to determine in advance how the changes in the BIST100 index will reflect on CDS premiums due to different reasons, and necessary measures can be taken for both cases. Therefore, it is possible to use models as an early warning mechanism.
Gyamerah (2019)	2007-2010	The study examines the relationship between CDS premiums and stocks in Australia. Korea, Hong Kong and Japan	VAR Analysis methods.	The CDS premiums of the four countries that are the subject of the study are affected by the stock returns and the return volatility of the stocks.
Ambukarasi and Devaki (2020)	2012-2017	The existence and direction of the relationship between CDS premiums, BIST-100 Index and exchange rates in the short and long term is the subject of the study.	Panel Data Analysis	According to the results of the analysis, while there is a bidirectional causality relationship between CDS premiums and BIST-100 Index, no causality relationship was found between exchange rates and BIST-100 Index.
Ambukarasi and Devaki (2020)	April 2015-March 2019	The relationship between the stock index prices of the Fragile Five countries and CDS premiums is examined. The most important feature of this study is that it is one of the pioneering studies examining the relationship between CDS premiums and Stock Indices of Fragile Five countries.	Granger Causality Test, Johansen Cointegration and Pearson Correlation analyses.	It has been determined that there is a causal relationship between stock prices and CDS premiums for Turkey and India among the fragile Five. In addition, a cointegration relationship between Turkey stock market index and CDS periods is also determined in the long term.
Krishna (2020)	2007-2018	The relationship between CDS premiums and stock index prices is investigated by using stock market index and CDS premium data for USA, England, France, Korea and Turkey.	Panel Causality and the Panel Cointegration Test analyses	The authors found that there is a long-run cointegration relationship between stock market indices and CDS premiums in countries other than the UK and the USA. In addition, considering the short-term period, it has been determined that there is a

Author(s)	Period	Purpose and Content of the Study	Method(s)	Results
				mutual causality relationship between stock indices and CDS premiums.
Tanyildizi and Yiğiter (2021)	2008-2018	Relationships between CDS premiums and VIX index, bond benchmark rates and BIST100 index were examined.	Autoregressive Distributed Lag (ARDL) Model, Pesaran Bond Test	As a result of the study, a statistically significant change is observed in commodity prices in the short term within the mentioned periods. It has been found that there is an inverse relationship with CDS premiums.
Gök and Kara (2021)	2005-2020	The relationship between CDS, interest rate and USDTRY has been examined	Granger Coherence Test	According to the test findings, causality was found between the variables, valid both in crisis and non-crisis periods, but showing heterogeneous features. In addition, a one-way causality finding valid only between the interest rate and the exchange rate was found in the time period including the COVID-19 period. The findings have important implications for both investors and policy makers.

When the literature for the period 2015-2021 in Table 1 is examined, differences are observed in the analysis methods used and the directions and strengths of the causal relationships obtained. The next section of the study will examine the case of Turkey.

3. EMPIRICAL METHODS

In this study, time series data including daily prices of 5-Year Turkey CDS Premium, Turkey Borsa Istanbul 100 Index, USDTRY Exchange Rates and Turkish 2-Year Benchmark Bonds variables were used and obtained from Bloomberg Data Services. The data of the study includes the period between March 10, 2010 - March 08, 2022 and 2921 days of observation. The data used in the study include the working days when all markets are traded. The empirical parts of the studies were analyzed with the Eviews 9 econometric program. Table 2 illustrates the variables of the study.

Table 2. Variables.

Variables in the Model	
CDS	5-Year Turkey CDS Premium
BIST100	Turkey Borsa Istanbul 100 Index
USDTRY	USDTRY Exchange Rates
BOND	Turkish 2-Year Benchmark Bonds

Figure 1 illustrates the daily movements of the study variables. Kernel density is shown on the left side of the graphs of the variables used in the study. According to kernel density, the density of 5-Year CDS premium rates is around 200, BIST100 index is around 800, USDTRY exchange rate is around 2.25 and 2-Year benchmark interest rate is around 9 % in 2921 observations.

Table 3 presents the statistical data of the variables used in the study. It is known that if the skewness and kurtosis values in a data group are in the range of (-1) and (+1), it is accepted that the distribution is normal.

According to Table 3 since skewness and kurtosis values of the variables are above (+1), it can be said that these variables are not normally distributed.

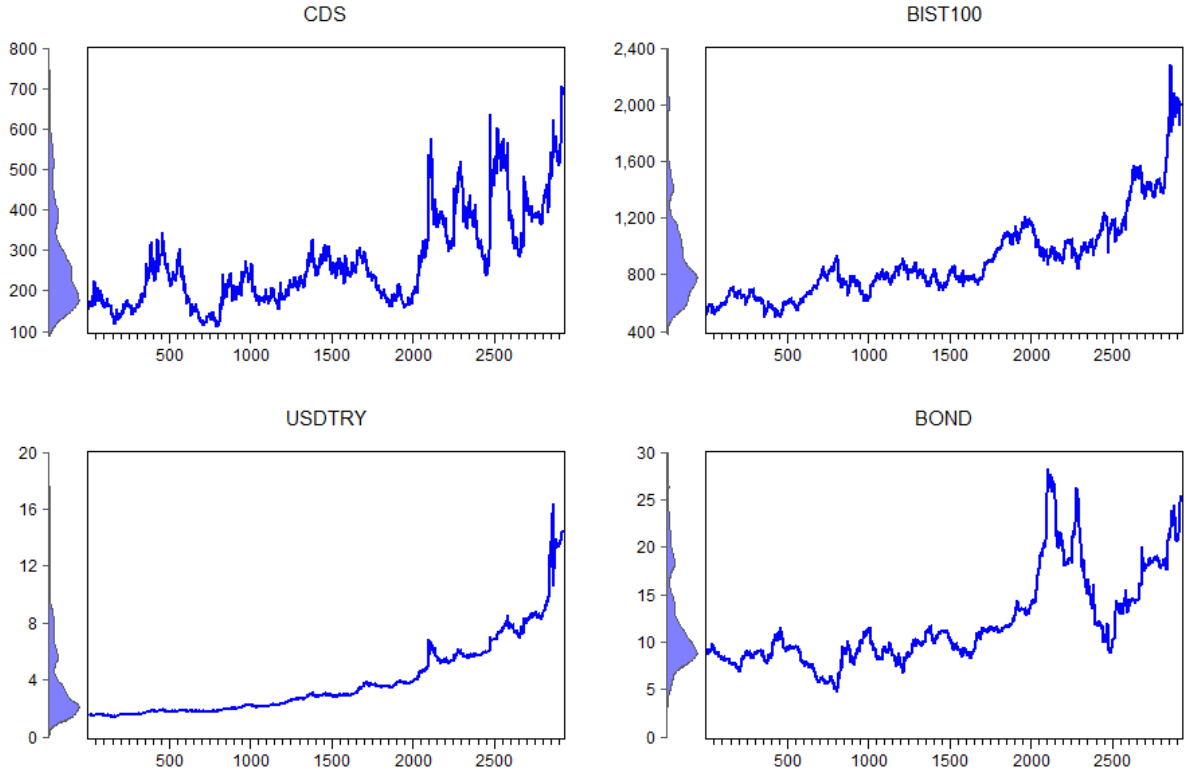

Figure 1. Daily values of variables

Table 3. Descriptive statistics.

Variables	CDS	BIST100	USDTRY	BOND
Mean	267.230	904.767	3.871	11.882
Median	239.981	819.320	2.915	10.190
Maximum	704.912	2278.550	16.410	28.270
Minimum	110.946	496.220	1.395	4.790
Std. Dev.	111.130	301.877	2.651	4.730
Skewness	1.066	1.517	1.634	1.238
Kurtosis	3.486	5.691	5.794	3.873
Jarque-Bera	582.490	2002.608	2250.093	840.006
Probability	0.000	0.000	0.000	0.000
Observation	2921	2921	2921	2921

Time series belonging to financial instruments such as currencies, stock indices, bond interest rates, etc. are generally not stationary and may contain unit root. Consequently, unit root test should be applied to these series and the series should be stationary. Therefore in this study, time series are analyazed using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests (Dickey & Fuller, 1979; Dickey & Fuller, 1981). Afterwards, the results compared with Mackinnon 5% critical values. The results of the analysis are tested against null and alternative hypotheses for stationarity, and after the test, it is determined whether the series is stationary (MacKinnon, 1996).

After the unit root test, Granger causality test will be applied. In practice, it may be found that the variables are not each other's Granger cause, two variables may both be found to be the Granger cause of each other, or there may be only one-way Granger cause of the two variables. In other words, there are 4 different possibilities in the bivariate case.

After the Granger causality test, impulse-response function analyzes and variance decomposition test will be applied in the study.

Impulse-response functions reflect the effect of a standard error shock in one of the random error terms on the present and future values of endogenous variables. By variance decomposition, which is the most influential variable on a macroeconomic size; Whether this variable, which is found to be effective, can be used as a policy tool is found by the action-response functions (Özgen & Güloglu, 2004). In other words, impulse-response analysis analyzes the effect of a random 'shock' that will occur in a variable on other variables in the system, and in this respect, it plays an important role in shaping economic policies. The Moving Average Vector (MAV) representation allows plotting the time path of the effects of shocks on the variables included in the Vector Autoregression (VAR) system in Sims (1980); Barışık and Kesikoğlu (2006).

While impulse-response analysis provides information about the duration and magnitude of the change in the variables, variance decomposition provides information about the rate at which the variables affect the change (Demirci, 2017). Variance decomposition reveals how much of the changes in the dependent variables are due to their own shocks and how much is due to the shocks of other variables. The shock that occurs in a variable will directly affect this variable, but will also affect other variables along with the dynamic structure of the Vector Autoregression/Vector Error Correction Model (VAR/VECM) system. With variance decomposition, the rate of explanation of the estimation error variance of the variable by its own shocks and the shocks of other variables is determined (Brooks, 2008).

4. EMPRICAL ANALYSES AND FINDINGS

4.1. Unit Root Test

In the stationarity tests of the series in which the ADF and PP unit root tests were applied, the fixed and constant trend models are examined separately both in level values and first differences. The results are given in Table 4.

Table 4. Stationary test statistics.

	Unit Root Test		ADF		PP	
Variables	**Trends**	**Levels**	**t-Statistics**	**Probability**	**t-Statistics**	**Probability**
CDS	Intercept	Level	-1.551	0.507	-3.323	0.062
		Difference 1	-28.429	0.000	-43.892	0.000
	Intercept & trend	Level	-1.194	0.679	-3.012	1.000
		Difference 1	-28.440	0.000	-43.895	0.000
BIST100	Intercept	Level	0.528	0. 987	0.869	0.995
		Difference 1	-34.623	0.000	-54.975	0.000
	Intercept & trend	Level	-1.269	0.894	-0.969	0.946
		Difference 1	-34.658	0.000	-55.006	0.000
USDTRY	Intercept	Level	3.411	1.000	3.977	1.000
		Difference 1	-11.752	0.000	-47.507	0.000
	Intercept & trend	Level	1.691	1.000	1.966	1.000
		Difference 1	-47.507	0.000	-47.833	0.000
BOND	Intercept	Level	-0.306	0. 921	-0.689	0.847
		Difference 1	-32.043	0.000	-48.642	0.000
	Intercept & trend	Level	-1.867	0.671	-2.263	0.128
		Difference 1	-32.071	0.000	-48.626	0.000

Figure 2 illustrates the graphical presentation of the variables after the first difference by applying the ADF and PP tests.

According to the unit root test results in the Table 4, unit root was determined in the unit root test of the variables 5-Year Turkish CDS premium, Turkish BIST 100 Index, USDTRY foreign exchange rates and 2-Year

Turkish benchmark bonds interest rates in the level degree. On the other hand, unit roots of the same variables are examined, it is concluded that they get rid of the unit root in the difference 1.

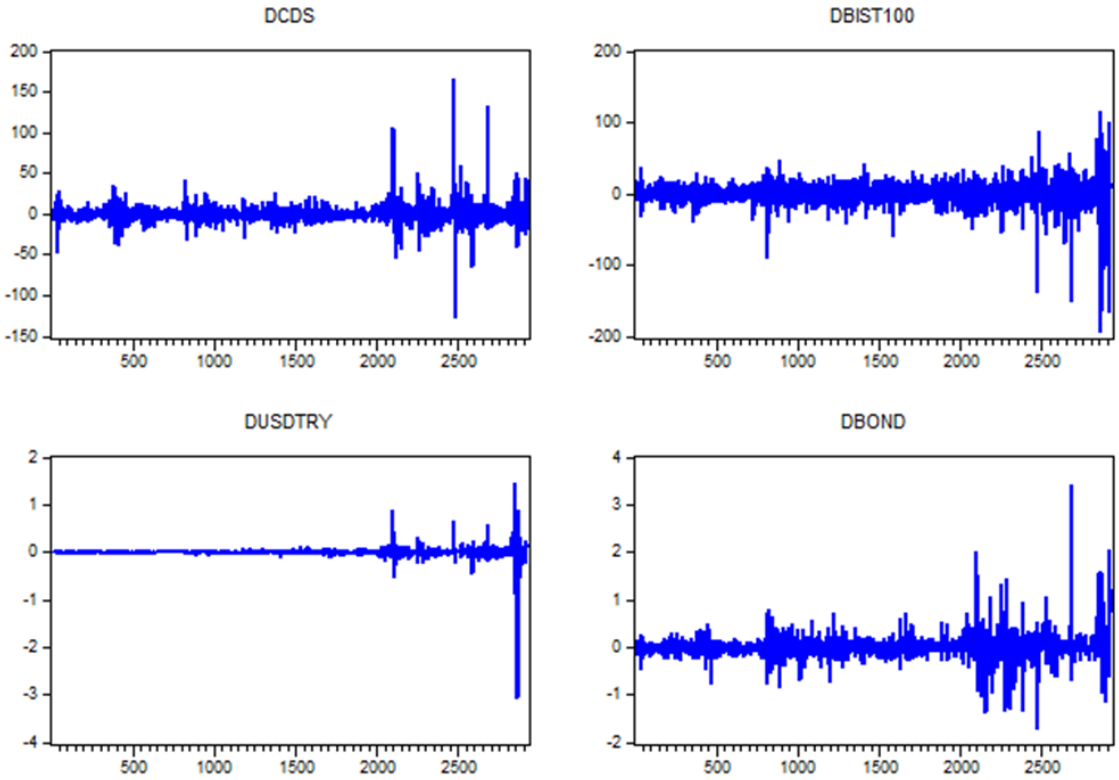

Figure 2. First differences of the daily values of the variables

The lag length of the series is estimated by VAR analysis. In the study, the lag length was determined as 8 according to the Akaike information criterion (AIC). Since the lowest AIC value is accepted as the best value, the lag coefficient will be used as 8 in the analysis. The table for determining the lag lengths are illustrated in Table 5.

Table 5. The lag length of the series.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-19203.16	NA	6.297	13.191	13.199	13.194
1	-18858.77	687.593	5.026	12.966	13.007	12.980
2	-18766.61	183.748	4.770	12.913	12.987*	12.940
3	-18709.03	114.664	4.635	12.885	12.992	12.923
4	-18658.74	99.989	4.527	12.861	13.001	12.912
5	-18600.04	116.555	4.397	12.832	13.004	12.894
6	-18526.85	145.108	4.227	12.793	12.998	12.867*
7	-18497.45	58.219	4.188	12.783	13.022	12.869
8	-18473.11	48.138*	4.165*	12.778*	13.049	12.875
9	-18497.45	58.215	4.188	12.783	13.022	12.875

Note: *The minimum values that determine the number of delays.

To test the stability of the VAR model, it can be seen in Figure 3 whether all characteristic polynomial roots are contained within the unit circle. The unit circle contains all its characteristic roots. Therefore, it can be said that there is no problem in terms of stability.

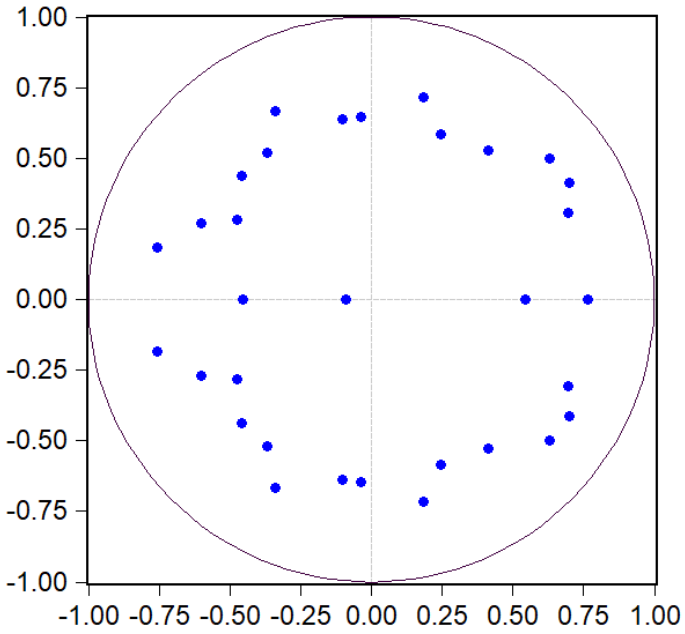

Figure 3. Inverse roots of AR charasteristic polynomial.

4.2. Granger Casuality Test

After unit root tests, Granger causality test is used. The test results are shown in Table 6.

Table 6. Statistical results of the models.

Dependent Variables	Independent Variables	Chi-sq	Probability
CDS	DBIST100	16.344	0.037
	DUSDTRY	79.589	0.000
	DBOND	54.958	0.000
BIST 100	DCDS	45.131	0.000
	DUSDTRY	166.429	0.000
	DBOND	13.090	0.108
USDTRY	DCDS	16.190	0.039
	DBIST100	262.268	0.000
	DBOND	37.253	0.000
BOND	DCDS	19.141	0.014
	DBIST100	11.560	0.171
	DUSDTRY	72.718	0.000

The test results obtained from the model data are given in Table 7. When the results are examined, Bilateral causality relationship was determined with 5-Year Turkey CDS Premium and BIST 100 index, USDTRY exchange rate, Turkish 2-year benchmark bonds.

Table 7. Summarized results of causality analyses.

Independent Variables	Granger direction	Dependent variables
CDS	↔	BIST100
	↔	USDTRY
	↔	BOND

The stability of VAR model is required to construct a valid Impulse Response Function and Variance Decomposition analysis. The shock effects of all CDS premium on volatility in other market returns can be analyzed by using the Impulse Response Function over 10 days are illustrated in Figure 4.

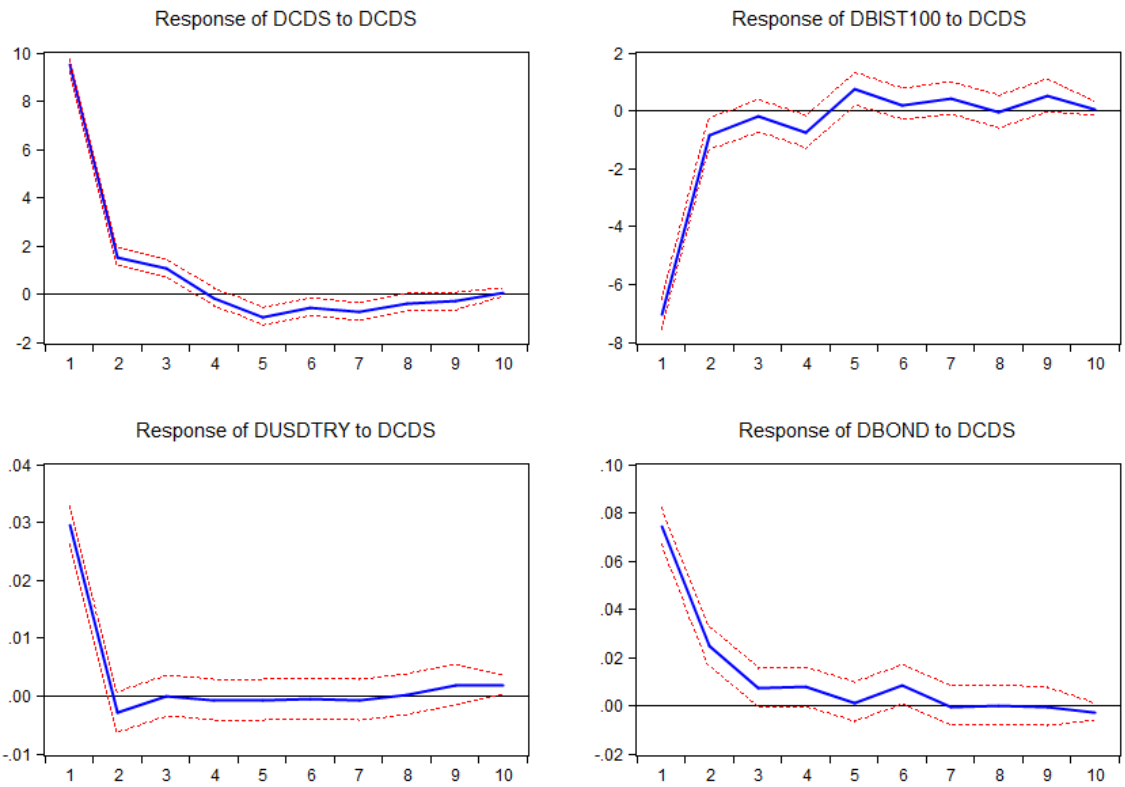

Figure 4. Impulse-response function of CDS

In all four graphs, transition effect rates are on the vertical axis and the number of days after the shock on the horizontal axis. The first graph shows the effect of CDS premiums within itself. The second graph shows the response of the BIST100 index to CDS premiums. The negative response of the BIST 100 index on the first day has been decreasing since the second day and has been flat since the fourth day. The third chart shows the USDTRY exchange rate's response to CDS premiums. The positive response of the USDTRY exchange rate on the first day is flat on the second day. The fourth chart shows the response of benchmark bond interest rates to CDS premiums. The positive response of benchmark bond interest rates on the first day becomes flat after the fifth day.

According to the model, the shock of CDS premiums is estimated according to the past period values of all endogenous variables and the current period values of the production gap and exchange rate. The reactions of the USDTRY exchange rate and benchmark bond interest rates to a 1% increase in CDS premium prices are positive as expected. In addition to this result, the response of the BIST 100 index is negative as expected.

Table 8, which includes the results of variance decomposition analysis for national price indices, The change in the volatility of the CDS premium is largely explained by itself, with a rate of 95.17% at the end of the tenth month. The part announced by the BIST 100 index corresponds to 0.18%, the part announced by the USDTRY exchange rate corresponds to 2.42% and the part announced by the bond interest rates corresponds to 2.22%. The CDS premium can explain the BIST 100 index at a high rate from the first period. While it had the power to influence 23.32% in the first period, it continues this power without losing it until the end of the 10th period. At the end of the 10th period, it explains 22.41% of BIST 100 index. While The CDS premium explains the USDTRY exchange rate by 10.82% in the first period, it has the same explanatory power of 9.58% in the 10th period. While the CDS premium explains the change in bond interest rates by 12.24% in the first period, it has the same explanatory power of 12.92% in the 10th period. These results show that the CDS premium has a high explanatory power to explain the changes in the BIST 100 index, USDTRY exchange rate and bond interest rates. All these results are consistent with the results the analysis of the impulse-response functions.

Table 8. Variace decomposition results.

Period	CDS	BIST 100	USDTRY	BOND
1	100.000	0.000	0.000	0.000
2	97.718	0.115	2.158	0.007
3	97.437	0.113	2.127	0.320
4	97.052	0.118	2.364	0.463
5	96.585	0.117	2.338	0.958
6	96.483	0.138	2.366	1.011
7	95.717	0.136	2.393	1.752
8	95.301	0.180	2.412	2.106
9	95.197	0.188	2.407	2.207
10	95.170	0.1883	2.420	2.221
Period	**CDS**	**BIST 100**	**USDTRY**	**BOND**
1	23.321	76.678	0.000	0.000
2	23.139	75.284	1.572	0.003
3	22.423	74.665	2.828	0.082
4	22.510	74.181	3.121	0.185
5	22.641	73.845	3.271	0.241
6	22.585	73.833	3.340	0.240
7	22.456	73.173	3.927	0.442
8	22.407	73.011	4.131	0.449
9	22.428	72.741	4.371	0.457
10	22.414	72.749	4.369	0.466
Period	**CDS**	**BIST 100**	**USDTRY**	**BOND**
1	10.822	0.632	88.542	0.000
2	10.121	6.364	83.322	0.191
3	10.097	6.349	83.320	0.232
4	9.930	7.604	81.880	0.584
5	9.923	7.648	81.787	0.639
6	9.763	7.969	81.477	0.790
7	9.647	8.803	80.767	0.785
8	9.587	8.955	80.547	0.908
9	9.567	9.199	80.291	0.942
10	9.583	9.180	80.294	0.941
Period	**CDS**	**BIST 100**	**USDTRY**	**BOND**
1	12.240	4.668	0.264	82.826
2	13.084	4.599	1.981	80.334
3	12.954	4.711	2.606	79.727
4	12.986	4.693	2.739	79.581
5	12.965	4.839	2.756	79.437
6	13.064	4.973	2.820	79.142
7	13.032	4.962	2.913	79.091
8	12.972	5.040	3.116	78.870
9	12.917	5.018	3.437	78.626
10	12.921	5.014	3.434	78.629

5. CONCLUSIONS

Short-term capital movements, which increased in parallel with technological developments towards the end of the 1990s, focused their eyes on international markets and caused rapid fund inflows to the financial instruments of these countries, especially as a result of the high returns of developing countries. After the short-term high earnings appetite of these funds, many crises occurred in developing countries between 1997-2001. Investors who want to take precautions against a crisis buy protection for themselves by purchasing credit default swaps.

Credit default swaps are formed as a result of mutual agreements between the protection seller and the protection buyer with a time period and swap premium determined between them, in order to compensate for the

loss that may arise from the reference asset such as the loan or bond-bill that is the subject of the swap. They are over-the-counter market products, since they are mutually agreed upon between the parties and do not take place in an exchange, and they are not traded in organized exchanges except for credit default swap indices.

In today's financial world, approximately half of credit swaps in terms of transaction volume are credit default swaps. A credit default swap is a type of contract that allows the credit default risk to be transferred. While the protection buyer pays a certain premium amount to the swap seller over the written value of the contract, the swap seller is obliged to compensate the swap buyer for the loss in case of a default in the reference asset.

In this study, the data were obtained from the daily values of the 5-Year Turkish CDS premium, Turkish BIST 100 Index, USDTRY foreign exchange rates and 2-Year Turkish benchmark bonds interest rates between 10 March 2010 and 08 March 2022. According to the result of the Granger casuality test, bilateral causality relationship was determined from CDS premiums to BIST 100 index, US Dollar exchange rate and benchmark bond interest rates. And according to the impulse-response analysis; the change in the BIST 100 index, USDTRY exchange rate and bond interest rates can be explained by the CDS premium. These results are consistent with the results of the impulse-response functions analysis.

According to the results of the variance decomposition analysis, the changes in the BIST 100 index, USDTRY exchange rate and benchmark bond interest rates can be explained by the CDS premium and it is shown that it has high explanatory power in explaining.

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Authors' Contributions: Both authors contributed equally to the conception and design of the study.

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