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CREDIT DEFAULT SWAPS – CHARACTERISTICS AND INTERRELATIONS WITH EUROPEAN CAPITAL MARKETS

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The recent financial crisis in Europe has an interesting development. It appeared as a bank phenomenon in the private sector, spilled in the public and turned into European debt crisis. Although, credit default swaps represent a fraction of derivatives markets, their significance and liquidity has increased significantly especially for developed countries. The main purpose of this article is to establish whether the degree of information efficiency, related to the interrelation between CDS market and developed capital markets is more significant than in the countries with undeveloped capital market. The major research methods used in this work are correlation analysis and Granger Causality Test.

Keywords: *financial crisis, credit default swaps, developed capital markets, undeveloped capital markets, emerging markets, Granger Causality Test, correlation.*

Introduction. The occurrence of the global financial crisis and its reflection on the European financial markets raises a lot of questions and discussions concerning its spreading and mechanism of operation. Why and what was the cause of the latest financial crisis which Alan Greenspan described as "a loan tsunami happening once every hundred years" are fundamental questions regarding capital markets, corporate finances, financial management and various economic sectors. With the coming of the Great Recession the topic of the Credit Default Swaps became more and more popular. Analysis topic were the issues related to how far they could assess the risk adequately, their ability to "foresee" the forthcoming crisis and the period of financial destabilization or the impact on the capital markets of developed countries. The development of the crisis provokes a significant increase in the values of credit default swaps, as a result of the aforementioned a great number of economists, investors and politicians try to disclose which market incorporates the information related to credit risk more quickly. For that purpose they examine: the

relation between the market of sovereign credit default swaps (CDS) which represent measurers of bankruptcy risk of the respective country and capital markets which are a reflection of the prosperity of the respective country.

The aim of this paper is using econometric modelling of the CDS return to establish whether the degree of information efficiency, related to the interrelation between CDS market and developed capital markets is more significant than in the countries with undeveloped capital market.

For the execution of this objective the following tasks are set:

– Critical review of existing approaches for establishing interrelation between the two financial markets, presenting the consequences of its presence and reflecting the empirically established forms of interaction between them;

– Presenting the category of return when reflecting and econometric modelling it;

– Econometric analysis of financial timelines of data, reflecting the values of examined CDS and stock market indexes on the grounds of the following time period – 03.03.2003 – 30.06.2016 – encloses pre-crisis period 2003-2006; crisis period 2007-2012 – encloses the development of the financial crisis 2007-2009 and the subsequent debt crisis 2012-2012; post-crisis period 2013-2013;

– Systematizing empirical evidence for confirmation / rejection of the research hypothesis. Analysis of obtained data by applying correlation test, Granger Causality Test regarding correlation degree and direction of cause and effect connection between the two types of the financial crisis at capital markets ;

– Summary and analysis of empirical results, synthesis of conclusions regarding the object and the subject of the study;

Analysis of recent researches and publications.

The CDS market is the most quickly developing market of credit derivatives during the last decade (ISDA Research Notes, 2013). Swaps come into being with parallel and "back-to-back" loans in the seventies, they are the first tool created for transformation of fixed interests in floating and vice versa (Simeonov, 2005).

A good number of authors study the relation between capital markets and those of credit default swaps. Most researches analyzing the dynamics of default swaps observe dependencies in separate large corporations. The lower scientific interest towards the CDS dynamics may be due to the fact that some of the CDS markets have low liquidity (Corzo et al., 2012).One of the first scientific researches of the connection between sovereign CDS and stock market indexes belongs to Coronado where he draws the conclusion that capital markets determine the behavior of CDS markets and have a key role during the incorporation of new information. The connection between the two variables is stronger with countries with high risk spread (Coronado et al, 2011). There are many researches supporting this thesis, namely those of Norden and Weber (2004), Pena and Forte (2009). After them other authors think that the direction of interaction and the degree of correlation between the two financial markets depend on various factors such as: time; high or low degree of credit risk of a government or a corporation (Fung et al. (2008), Coudert and Gex, 2010). One of those authors proving the changing cooperation is Corzo (Corzo et al, 2012). He reveals the change upon the dominating role of financial markets during different

periods of time. He takes into consideration the fact that CDS are a determining factor at economics with high bankruptcy risk. The information impact and researching transmission mechanism of the credit risk at different markets and throughout separate periods of time is a factor that will help us understand the relative efficiency of markets – developed and developing as well as how changed can be their functioning upon changing market conditions (Avino, 2011). In support of Avino's statements, Baciu (Baciu, 2014) examines deviations of the efficiency in 20 European stock exchange markets for the period of 15 years. The results indicate that developed markets are closed to the efficiency than developing markets. One of the distinctive lines between the efficient and inefficient markets is the speed of incorporation of information in the market prices.

Financial crises are preceded by periods in which investors avoid risk. Coudert and Gex (Coudert, Gex, 2006) test the possibility whether the main indexes for risk measurement are able to predict the occurrence of a crisis. They think that the "risk appetite" decreases before crisis. They still mark that the reverse reaction is possible. Crisis may be preceded by a period of strong "risk appetite" during which investors are too optimistic and in this way they create "speculative balloons" at prices of risk assets. The recent mortgage crisis started with the collapse of Bear Stearns is an example of such reaction. The results of their research state that indicators related to risk avoidance foresee the coming of stock exchange crisis.

The model of Merton (Merton, 1974) discloses the interaction between the prices of shares and bonds by showing the presence of positive correlation between them. It also states that if the value of the assets of a specific company drops below the nominal value of its debt it falls into an insolvency. Later this model is further developed by Chan-Lau and Kim (Chan- Lau, Kim, 2004) as they accept that sovereign bonds are equivalent of the corporate debt. Financial crises are a phenomenon which is determined by the behavior of investors (Akerlof, Shiller, 2009) by geographic and political characteristics. Accepting CDS as a measurer of investment expectations regarding the development of capital markets we review them as explanatory variable when defining the financial crisis.

Methodology. The study aims to follow the degree of information efficiency related to the ability of the CDS to predict the occurrence of financial crisis at developed capital markets and it is clearer than in the countries with emerging and developing capital market and takes into consideration the significance and effect of specific factor – financial crisis of the year 2007. Subject of the study are the following countries: *France (CAC 40), Germany (DAX), UK (FTSE 100), Belgium (BEL-20), Bulgaria (SOFIX), Romania (BET), Greece (ATHEX20), Portugal (PSI-20), Ireland (ISEQ- 20), Italy (FTSEMIB) and Spain (IBEX35).* The selection of the aforementioned countries is based on the following criteria: countries with developed capital market which values of CDS during the crisis of 2007 do not undergo significant changes (Great Britain, Germany, France and Belgium); countries with relatively emerging markets which CDS spread values increase immediately after the beginning of the crisis but during debt crisis starts a process of constant decrease of their values (Bulgaria, Romania); countries with emerging markets which values of the CDS spread reach peak values – distressed countries (Greece, Portugal, Ireland, Italy and Spain) (see table 1). For the purpose of this research is used a database of the respective CDS

values for the period 2003-2016 published respectively in the information bulletins of Deutschebank. Reviewed is the data of probability of default on the grounds of 5-year CDS spreads, due to the fact that 5-year-old CDS are the most liquid (Goldman Sachs CDS 101 FICC, 2009) with *Recovery Rate=40 %.*[1]

Table 1. **List of countries included in the three analyzed groups**

Countries with developed capital market:	Countries of relatively emerging capital markets	Countries of the Eurozone called distressedcountries
Great Britain	Bulgaria	Portugal
Germany	Romania	Ireland
France	-	Italy
Belgium	-	Greece
-	-	Spain

Data used during this research enclose:

– ***Day time values*** of examined stock market indexes and CDS for the period 03.03.2003-01.07.2016 and return based on them according to the formula $r_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$, where

r_t - return rate in the observation; $\ln\left(\frac{P_t}{P_{t-1}}\right)$ is measurement for return rate; ***Pt*** and ***Pt-1*** are respectively the values of the index for the periods **t** and **t-1**. The use of natural logarithm of price ratios is suitable from financial and mathematical aspect for they cannot be negative and therefore and log normally distributed. Calculating the return this way we examine the gradual change of values of indexes and values of CDS for two subsequent periods t and t-1 and not their specific values. The reviewed period is divided in to three sub-periods with the following duration: Period 1 encloses 03.03.2003-29.12.2006; Period 2- 02.01.2007-28.12.2012 (covers the development of the financial crisis – 2007-2009 and the subsequent debt crisis 2010-2012); Period 3 – 03.01.2013-30.06.2016. 37543 observations are used in total. The periods can be distributed as pre-crisis (period 1), crisis (period 2), post-crisis (period 3). Period 1 is characterized by clearly expressed ascending trend of growth in values of the two examined variables. Period 2 starts in 2007 due to the wish to cover the initial indications of emerging destabilization, the drop in the trust of investors as well as the complete collapse which followed. During this period of time a peak is

[1]CDS spread = Pd * (1-Rr)
Pd- probabilityofdefault
Rr - recovery rate

reached in the increase of the CDS values which on its own is accompanied by a simultaneous collapse of capital markets.

The use of dynamic financial lines reflecting the daily values of examined variables as well as dividing the observed period in three sub-periods is used as first part of the empirical research with the purpose of disclosing main characteristics of the financial markets of the three groups of studied countries. Revealing direct interactions between the values of return of researched stock market indexes and CDS may be reached through registration of correlation between them. Through correlation coefficient we check whether the value of the CDS with lag t reflects information which is already contained in the value of the stock exchange index with lag t-1.

The correlation between the two variables may be determined as a measurer of the degree of intensity of their mutual fluctuations. The presence of correlation may be accepted as interdependency between the CDS and stock market indexes. It is important to underline that the strong correlation connection is not equivalent to the cause-effect connection. In his study "Time Series Analysis" Hamilton states the following mathematical expression between the two variables X and Y:

$$Corr(X,Y) = \frac{Cov(X,Y)}{\sqrt{Var(X)Var(Y)}}$$

As we mentioned above the purpose of the correlation analysis is to establish whether CDS incorporate information which is no longer up-to-date for capital markets, i.e. we examine the dependency between the values of CDS with lag t in what interrelation are they with those of the stock market indexes with lag t-1. The strength of the correlation coefficients is tested at 62 and lag (3 months) and 124 lag (6 months).

Subsequent stage of empirical research is to establish whether a time series may help us predict the changes in another time series, i.e. whether a specific action causes specific, measurable consequences (Stock and Watson, 2003). For that purpose we use the results of Granger Causality Test. With the help of Granger test we establish the direction of granger relation between the two variables, i.e. we will check whether CDS are in granger connection to stock market indexes and vice versa, i.e. after we have tested the power of correlation we will determine the cause-effect relation and direction of interaction. It is performed for every two variables with respective values with lag t of each of the examined countries for various periods of time.

Results and discussions:

For the purpose of this research a stationarity test of the dynamic financial data lines is performed as well as the separate panels where:

- The researched returns of stock market indexes and CDS indicate stationartity;
- ***Correlation***

Based on values of correlation registered and presented in table 2 we can draw the following conclusions detemined towards every period of research.

For pre-crisis Period 1

– For all researched stock market indexes there are relatively high values of correlation with the respective CDS. Exception as reaction of the market trends of researched countries are the Belgian BEL 20, the Bulgarian SOFIX and the Irish ISEQ 20, demonstrating comparatively low values of correlation. The highest value of interdependence is reached by the Romanian BET which correlation ratio has value 0.823804 and the lowest the Belgian BEL 20 – 0.019156. This tendency of development of correlation coefficient of the countries mentioned above is confirmed at 62 lag and 124 lag. Relatively high values of correlation indicate good information efficiency between the two indicators respectively between the two type of financial markets – stock and CDS, i.e. the information contained in the stock market indexes leads to significant impact on the value of CDS as well as vice versa. On the other hand low values of correlation coefficients of CDS with BEL, SOFIX and ISEQ 20 disclose us relative independence which the two markets have.

– During the pre-crisis period we can clearly report the distinction between countries with developed capital market, such with developing and emerging, i.e in the pre-crisis condition characterizing with stable development of financial markets the entire available risk information is acccumulated by both types of researched markets to an equal extent as the power of synchronization in this process cannot be categorically determined based on developed-developing market.

For crisis Period 2

– For all researched stock market researches of the group of countries with developed capital markets (Germany, France, Great Britain) with the exception of Belgium is observed a decrease in the value of correlation raiton. Identical behavior is disclosed by the countries with relatively emerging capital markets, namely Bulgaria and Romania as the sharpest drop we observe at the cooperation between CDS-BET, namely of the value of correlation ratio of 0.823804 to 0.399489. In the crsis conditions CDS and the researched indexes of the respective countries with emerging capital markets indicate greater extent of synrchronization in the dynamic with the developed markets.

– We shall put a stress on the presentation in the crisis period of the Eurozone countries which unite under the notion “distressed countries”. They indicate interrelation and dynamics which is contradictory to other two groups of researched financial markets. We find an increase in the values of correlation coefficients as the highest value is reached by Spain in the amount of 0.708947.

– Based on correlation ratios for Period 2 decrease of the synchronization degree is observed, i.e. the two markets with different speed report the new crisis information. Reviewing the markets of CDS and stock markets as different risk measurers we report available different speed of incorporation of crisis information in the values of the measurers of the two markets, namely one of them reports the risk quicker than the other one.

For post-crisis Period 3

– It is observed that from the three examined periods namely in the post-crisis Period 3 highest values of correlation are observed between CDS and the researched stock indexes

of countries with developed capital markets (Germany, France, Great Britain and Belgium). At all examined correlation couples of this group of countries relatively high increase of correlation ratios is registered, i.e. we may claim that the dependencies established in the pre-crisis period are kept. The countries with relatively emerging capital markets, namely Bulgaria and Romania reveal identical behavior. The strongest is the dependency in Germany (0,851714), followed by Romania (0,806635), France (0,767933), Great Britain (0,698329), Belgium (0,616624) and Bulgaria (0,596545).

– During the post-crisis recovery at the countries of the European Union that were mostly affected by the financial crisis of 2007 and the debt crisis after that we report significant decrease of correlation ratios. They have values between -0.007713 (Ireland) to 0.185312 (Portugal). Besides the registered decrease we shall mark the change in the sign of the correlation ratio in the following couples CDS-ISEQ20, CDS-IBEX35, CDS-FTSEMIB which indicates for extremely week, reversely proportionate dependency between the two variables.

– Summarizing the results of period 3 based on correlation ratios we may draw the following conclusions – in the conditions of post-crisis recovery relatively emerging capital markets show behavior which discloses similarity with the countries with developed and effective markets (Tsenkov, 2012). "Distressed countries" of the Eurozone are in contrast with the aforementioned statement as they keep their behavior of period 2, namely disclose opposite market trend of those of developed economies and show strong decrease in the correlation degree.

4.2 Granger Causality Test

Based on the registered and presented in tables 3, 4, 5 results of the Granger Test we may draw the following conclusions determined according to every testing period:

For pre-crisis Period 1

– For most of the researched countries absence of Granger relation is observed between the respective CDS and stock market indexes. Exceptions are only the variables for Germany and Italy. There is observed synchronization in the trends of capital markets and the market of CDS 62 lags (approximately three-month period) as forming effect have the stock market indexes. We shall mark that this impact for a continuous period of time (124 lags – approximately equal to six-month time lag) keeps its constant effect only at developed and effective financial market such as the one in Germany.

– In support of the conclusions of the correlaton analysis for the same period of research we again do not find any significant differences between countries with developed capital market, such with developing and emerging, i.e. in period of relatively stable financial condition at equal other conditions we can report clearly dominating impact of CDS on capital markets of developed countries or lack of such in those of other two groups of researched countries, exception of which the capital market in Germany is.

For crisis Period 2

– For all examined stock market indexes of the group of countries with developed capital markets (Germany, France, Great Britain) with the exception of Belgium we may observe an information impact of stock exchange indexes on the CDS market with lags 62 which is in support of the researches of Coronado (Coronado et al, 2011)., Norden and

Weber, Pena and Forte (Norden and Weber, 2004; Pena and Forte, 2009). This Granger relation is unstable, i.e. it loses its operation at 124 lags for the following developed countries: France and Great Britain. The aforementioned is not valid for the German capital market where it is demonstrated permanency in its impact and in the period of financial crisis continues to be effective over the information contents of values of CDS with unchanged other conditions. Identical behavior at 124 lags for the Belgian BEL 20 is observed. Only during this period 2 of the results of Granger test we register market trend at Belgian financial markets showing synchronization with the dynamics of developed countries.

– We shall put a stress on the presentation in the crisis period of countries from the Eurozone which are united under the notion "distressed countries". They show interrelation and dynamic which suggest cooperation between the two types of examined markets different than the one with the effective and developed econmies. At 62 lags for Italy and Portugal characteristic is ineraction with the following direction CDS-FTSEMIB and CDS-PSI 20. In Greece and Ireland the interration between capital markets and CDS markets is bilateral, i.e. the relation of CDS support the determined movement of changes in stock market indexes as well as vice versa. The aforementioned impact is unstable with the increase of the time lags (at 124 lags) and loses its statistical significance. The only examined couple of variable IBEX 35-CDS keeps its Granger relation with 62 as well as with 124 lags.

– During the financial destabilization and economic instability due to the crisis of 2007 the countries of the group of relatively emerging markets, namely Bulgaria and Romania do not disclose market trends similar to any of the other examined groups of countries. This may be due to the fact that accepting CDS as a measurer of investor's expectations regarding development of capital markets do not report the fluctuations of the stock market due to their low market capitalization as a measurer of the significance of the economy of a certain country as whole: capitalization of BSE is only 8% of GDP of the country while the one of Romania is 10% of the GDP.

For post-crisis Period 3

• It is noticeable that of the three examined periods namely in the post-crisis period 3 at 62 lags two-way Granger connection is observed between the CDS and stock market indexes for the following countries:

– Germany : CDS ⟷ DAX;
– France: CDS ⟷ CAC 40;
– Great Britain: CDS ⟷ FTSE;
– Bulgaria: CDS ⟷ SOFIX;

In this period 3 at 62 lags for the first time we registrer synchronization in the behavior between the market trend in Bulgaria and the one of the developed capital countries. The Romanian BET and the Irish ISEQ have determining impact on the changes of information contained in their respective CDS.

– For the reviewed Period 3 at 124 lags the bilateral Granger connection at developed countries is interrupted and remains unilateral with a change of the information impact, namely in post-crisis period information impact on effective capital markets have the CDS (Germany, France and Great Britain), exception of which the Belgian derivative market is.

– Summarizing the results of period 3 on the grounds of the result of the Granger Test

performed we may draw the following conclusions – in the conditions of post-crisis recovery of CDS they increase their information impact on capital markets, i.e. the crisis turns the CDS into an important financial tool especially for developed economies upon unchanged other conditions. The financial crisis turns the changes in values of CDS in a "primary" indicator for the stock market that present is upcoming risk. If the swaps "sense" risk in the contemporary conditions, it will be obligatory reflected by the stock market. We may say that swaps play their role but keeping in mind the lack of significant Granger connections in pre-crisis period we may say that this position is mostly a reaction of caution at developed capital markets or we witness "more nervous" reflection of newly-come negative information signals.

Conclusions and further research directions

Summarizing the conclusions of the correlation analysis and the one of Granger the test of Period 1, 2 and 3 (figure 1) we draw the conclusion that the interaction between the CDS and stock market indexes of reviewed countries is strongly variable and unstable for different periods of time. The aforementioned conclusions support this thesis of Coronado (Coronado et al, 2012) who claims that after 2010 capital markets lose their leading position regarding to determined changes on CDS during the same year start to put a stress on the crisis and the state debt which additionally contributes to the increase of the significance of CDS. Based on the aforementioned conclusions we may make the following summaries:

– Regardless of the enhanced degree of synchronization between the two financial markets in the pre-crisis period there are no significant Granger connections through which to disclose information impact of one market on the other. Exceptions are Germany and Italy where Granger connection is observed with direction of operation of capital markets to these of CDS.

– After coming of the financial crisis in the stage of its development forming and exceeding incorporation of the information is observed which predicts future financial risk, of capital markets of developed countries. Contrary impact we find with countries having reached highest risk spread during the crisis namely exceeding synchronization in reflecting the negative new information signals and proactive ifnormation efficiency at he market of CDS and capital such.

– Not accidentally after coming of the financial crisis and the subsequent debt one more and more talking is about CDS and their significance. After analysis of the results of correlation ratios and examined Granger connections we may state that the crisis transforms CDS in financial tool which reacts sensitively towards negative information flows. In such a "nervous" way react the financial markets of developed countries (Germany, France and Great Britain for trimester as well as six-month time period). This is why fluctuations in their value may be accepted as "forerunner" of subsequent risk.

For the future research first and main place shall be for the testing of those dependencies when grouping of larger number of countries of Central and Eastern Europe in order to establish whether in the entire region characterizing the developed capital markets CDS have also no statistical significance. Second, in-depth inspection of information efficiency of the two financial markets.

VI. Appendices:

Table 2. **Expresses the correlation coefficients between CDS(t) and the stock indices (t-1); CDS and the stock indexes at 62lags; CDS and the stock indexes at 124 lags**

Country	*Corr*	*Pre-crisis period*	*Crisis period*	*Post-crisis period*
Germany	Corr CDS(t) - DAX(t-1)	-0,602326	-0,177283	0,851714
	CDS- DAX (62 lags)	-0,478513	-0,142871	0,746513
	CDS- DAX (124 lags)	-0,30853	-0,103143	0,718624
France	Corr CDS(t) - CAC40(t-1)	-0,636152	-0,585869	0,767933
	CDS - CAC40 (62 lags)	-0,573461	-0,472053	0,701682
	CDS - CAC40 (124 lags)	-0,528642	-0,438052	0,681463
Great Britain	Corr CDS(t) – FTSE(t-1)	0,672877	0,131691	0,698329
	CDS- FTSE (62 lags)	0,618526	0,254831	0,657391
	CDS- FTSE (124 lags)	0,503671	0,186024	0,596041
Belgium	Corr CDS(t) – BEL(t-1)	0,019156	0,047270	0,616624
	CDS- BEL (62 lags)	0,010472	0,038251	0,584631
	CDS- BEL (124 lags)	0,010781	0,026871	0,495683
Bulgaria	Corr CDS(t) – SOFIX(t-1)	0,279237	0,267504	0,596545
	CDS- SOFIX (62 lags)	0,257301	0,204683	0,548206
	CDS- SOFIX (124 lags)	0,198473	0,146071	0,493581
Romania	Corr CDS(t) – BET(t-1)	0,823804	0,399489	0,806635
	CDS- BET (62 lags)	0,792146	0,318752	0,824751
	CDS- BET (124 lags)	0,738521	0,297186	0,806327
Greece	Corr CDS(t) – ATHEX(t-1)	-0,510172	-0,644006	0,018125
	CDS- ATHEX (62 lags)	0,573261	0,613025	0,824751
	CDS- ATHEX (124 lags)	0,497206	0,586356	0,806327
Ireland	Corr CDS(t) – ISEQ(t-1)	-0,303276	0,530209	-0,007713
	CDS- ISEQ (62 lags)	-0,375287	0,430271	-0,000461
	CDS- ISEQ (124 lags)	-0,357261	0,410362	-0,002835
Spain	Corr CDS(t) – IBEX 35(t-1)	-0,579916	-0,708947	-0,090093
	CDS- IBEX 35 (62 lags)	-0,536824	-0,681953	-0,072351
	CDS- IBEX 35 (124 lags)	-0,518357	-0,614527	-0,063582
Italy	Corr CDS(t) – FTSEMIB(t-1)	-0,359015	-0,594383	-0,141165
	CDS- FTSEMIB (62 lags)	-0,314825	-0,481952	-0,138751
	CDS- FTSEMIB (124 lags)	-0,518357	-0,583681	-0,126835
Portugal	Corr CDS(t) - PSI 20(t-1)	0,347201	0,647503	0,185312
	CDS- PSI 20 (62 lags)	-0,001652	0,038251	-0,001037
	CDS- PSI 20 (124 lags)	-0,002853	0,045831	-0,001529

Table 3.1. **Granger casuality test results for pre-crisis period (Period 1) for 62 lags**

Null Hypothesis:	62 lags (3 м)	F-Statistic	Prob.	Conclusion
DAX does not Granger Cause CDS	62 lags	3.26321	0.0388	There is Granger Causality
CDS does not Granger Cause DAX	62 lags	0.27512	0.7596	No Granger Causality
CDS does not Granger Cause CAC40	62 lags	0.75489	0.4703	No Granger Causality
CAC40 does not Granger Cause CDS	62 lags	2.66882	0.0698	No Granger Causality
FTSE does not Granger Cause CDS	62 lags	2.34776	0.0961	No Granger Causality
CDS does not Granger Cause FTSE	62 lags	1.71132	0.1812	No Granger Causality
BEL20 does not Granger Cause CDS	62 lags	0.43678	0.6462	No Granger Causality
CDS does not Granger Cause BEL20	62 lags	0.25661	0.7737	No Granger Causality
SOFIX does not Granger Cause CDS	62 lags	0.80024	0.7736	No Granger Causality
CDS does not Granger Cause SOFIX	62 lags	1.07051	0.3647	No Granger Causality
BET does not Granger Cause CDS	62 lags	4.29656	0.0139	There is Granger Causality
CDS does not Granger Cause BET	62 lags	0.23057	0.7941	No Granger Causality
ATHEX20 does not Granger Cause CDS	62 lags	1.76641	0.1715	No Granger Causality
CDS does not Granger Cause ATHEX20	62 lags	0.32717	0.7210	No Granger Causality
CDS does not Granger Cause ISEQ	62 lags	0.50541	0.9904	No Granger Causality
ISEQ does not Granger Cause CDS	62 lags	1.20935	0.1983	No Granger Causality
CDS does not Granger Cause IBEX35	62 lags	0.25814	0.7726	No Granger Causality
IBEX35 does not Granger Cause CDS	62 lags	1.71160	0.1813	No Granger Causality
FTSEMIB does not Granger Cause CDS	62 lags	4.61456	0.0101	There is Granger Causality
CDS does not Granger Cause FTSEMIB	62 lags	0.83021	0.4362	No Granger Causality
PSI20 does not Granger Cause CDS	62 lags	1.53806	0.6824	No Granger Causality
CDS does not Granger Cause PSI20	62 lags	0.67235	0.7591	No Granger Causality

Table 3.2: Granger casuality test results for pre-crisis period (Period 1) for 124 lags (6m):

Null Hypothesis:	124 lags (6м)	F-Statistic	Prob.	Conclusion
DAX does not Granger Cause CDS	124 lags	2.85761	0.0228	There is Granger Causality
CDS does not Granger Cause DAX	124 lags	0.18943	0.9439	No Granger Causality
CDS does not Granger Cause CAC40	124 lags	0.17734	0.63246	No Granger Causality
CAC40 does not Granger Cause CDS	124 lags	1.26504	0.3293	No Granger Causality
FTSE does not Granger Cause CDS	124 lags	1.06980	0.3702	No Granger Causality
CDS does not Granger Cause FTSE	124 lags	1.02678	0.3923	No Granger Causality
BEL20 does not Granger Cause CDS	124 lags	0.40569	0.8046	No Granger Causality
CDS does not Granger Cause BEL20	124 lags	0.15605	0.9603	No Granger Causality
SOFIX does not Granger Cause CDS	124 lags	0.67227	0.9747	No Granger Causality
CDS does not Granger Cause SOFIX	124 lags	0.85079	0.7857	No Granger Causality
BET does not Granger Cause CDS	124 lags	1.76279	0.0004	No Granger Causality
CDS does not Granger Cause BET	124 lags	0.94277	0.6046	No Granger Causality
ATHEX20 does not Granger Cause CDS	124 lags	1.01757	0.3971	No Granger Causality
CDS does not Granger Cause ATHEX20	124 lags	0.53679	0.7087	No Granger Causality
CDS does not Granger Cause ISEQ	124 lags	0.52319	0.9992	No Granger Causality
ISEQ does not Granger Cause CDS	124 lags	1.16020	0.1898	No Granger Causality
CDS does not Granger Cause IBEX35	124 lags	0.85694	0.7754	No Granger Causality
IBEX35 does not Granger Cause CDS	124 lags	0.58263	0.9958	No Granger Causality
FTSEMIB does not Granger Cause CDS	124 lags	0.80988	0.8519	No Granger Causality
CDS does not Granger Cause FTSEMIB	124 lags	1.15670	0.1972	No Granger Causality
PSI20 does not Granger Cause CDS	124 lags	1.52607	0.3824	No Granger Causality
CDS does not Granger Cause PSI20	124 lags	0.86103	0.0184	No Granger Causality

Table 4.1. **Granger casuality test results for crisis period (Period 2) for 62 lags (3m)**

Null Hypothesis:	62 lags (3м)	F-Statistic	Prob.	Conclusion
CDS does not Granger Cause DAX	62 lags	1.62833	0.1968	No Granger Causality
DAX does not Granger Cause CDS	62 lags	3.56273	0.0287	There is Granger Causality
CAC40 does not Granger Cause CDS	62 lags	3.72489	0.0244	There is Granger Causality
CDS does not Granger Cause CAC40	62 lags	1.92241	0.1468	No Granger Causality
CDS does not Granger Cause FTSE	62 lags	2.92763	0.0540	No Granger Causality
FTSE does not Granger Cause CDS	62 lags	3.79185	0.4533	There is Granger Causality
BEL20 does not Granger Cause CDS	62 lags	0.09151	0.9128	No Granger Causality
CDS does not Granger Cause BEL20	62 lags	1.81604	0.1777	No Granger Causality
CDS does not Granger Cause SOFIX	62 lags	0.62488	0.5355	No Granger Causality
SOFIX does not Granger Cause CDS	62 lags	1.62391	0.1977	No Granger Causality
BET does not Granger Cause CDS	62 lags	0.42439	0.9977	No Granger Causality
CDS does not Granger Cause BET	62 lags	0.73884	0.8498	No Granger Causality
ATHEX20 does not Granger Cause CDS	62 lags	2.68313	9.E-05	There is Granger Causality
CDS does not Granger Cause ATHEX20	62 lags	2.43276	0.0004	There is Granger Causality
CDS does not Granger Cause ISEQ	62 lags	4.97909	0.0070	There is Granger Causality
ISEQ does not Granger Cause CDS	62 lags	2.08352	0.3388	There is Granger Causality
CDS does not Granger Cause IBEX35	62 lags	1.66205	0.1903	No Granger Causality
IBEX35 does not Granger Cause CDS	62 lags	3.82834	0.0221	There is Granger Causality
FTSEMIB does not Granger Cause CDS	62 lags	0.03917	0.9616	No Granger Causality
CDS does not Granger Cause FTSEMIB	62 lags	3.22081	0.0403	There is Granger Causality
PSI20 does not Granger Cause CDS	62 lags	1.68204	0.2915	No Granger Causality
CDS does not Granger Cause PSI20	62 lags	4.91524	0.0042	There is Granger

Table 4.2. **Granger casuality test results for crisis period (Period 2) for 124 lags (6m)**

Null Hypothesis:	124 lags (6м)	F-Statistic	Prob.	Conclusion
CDS does not Granger Cause DAX	124 lags	1.48429	0.2048	No Granger Causality
DAX does not Granger Cause CDS	124 lags	2.86427	0.0224	There is Granger
CAC40 does not Granger Cause CDS	124 lags	1.38106	0.0496	No Granger Causality
CDS does not Granger Cause CAC40	124 lags	0.82617	0.7531	No Granger Causality
CDS does not Granger Cause FTSE	124 lags	1.06980	0.3702	No Granger Causality
FTSE does not Granger Cause CDS	124 lags	1.53597	0.1895	No Granger Causality
BEL20 does not Granger Cause CDS	124 lags	3.64673	0.0159	There is Granger
CDS does not Granger Cause BEL20	124 lags	1.65925	0.1864	No Granger Causality
CDS does not Granger Cause SOFIX	124 lags	0.83017	0.8247	No Granger Causality
SOFIX does not Granger Cause CDS	124 lags	0.69334	0.9670	No Granger Causality
BET does not Granger Cause CDS	124 lags	0.64162	0.9866	No Granger Causality
CDS does not Granger Cause BET	124 lags	0.58639	0.9959	No Granger Causality
ATHEX20 does not Granger Cause CDS	124 lags	1.62902	0.0021	No Granger Causality
CDS does not Granger Cause ATHEX20	124 lags	1.36731	0.0352	No Granger Causality
CDS does not Granger Cause ISEQ	124 lags	1.45730	0.0008	No Granger Causality
ISEQ does not Granger Cause CDS	124 lags	0.82538	0.9347	No Granger Causality
CDS does not Granger Cause IBEX35	124 lags	0.86592	0.6785	No Granger Causality
IBEX35 does not Granger Cause CDS	124 lags	2.10965	0.0004	There is Granger
FTSEMIB does not Granger Cause CDS	124 lags	0.58340	0.9957	No Granger Causality
CDS does not Granger Cause FTSEMIB	124 lags	1.36533	0.0358	No Granger Causality
PSI20 does not Granger Cause CDS	124 lags	1.48209	0.0008	No Granger Causality
CDS does not Granger Cause PSI20	124 lags	1.76015	0.5176	No Granger Causality

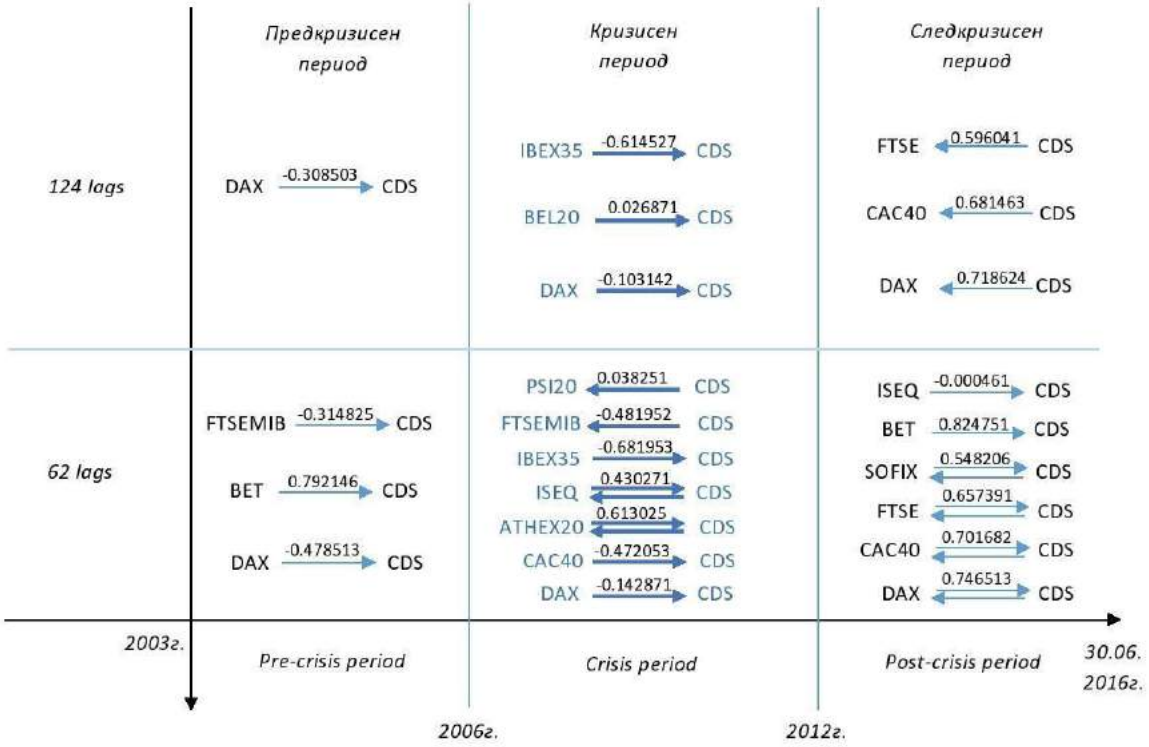
Table 5.1. **Granger casuality test results for post-crisis period (Period 3) for 62 lags (3m)**

Null Hypothesis:	62 lags	F-Statistic	Prob.	Conclusion
CDS does not Granger Cause DAX	62 lags	2.17041	0.0145	There is Granger
DAX does not Granger Cause CDS	62 lags	6.14285	0.0022	There is Granger
CAC40 does not Granger Cause CDS	62 lags	5.82120	0.0401	There is Granger
CDS does not Granger Cause CAC40	62 lags	4.56450	0.0106	There is Granger
FTSE does not Granger Cause CDS	62 lags	3.78279	0.0373	There is Granger
CDS does not Granger Cause FTSE	62 lags	4.96930	0.0071	There is Granger
BEL20 does not Granger Cause CDS	62 lags	2.61600	0.5472	No Granger Causality
CDS does not Granger Cause BEL20	62 lags	2.41392	0.0898	No Granger Causality
CDS does not Granger Cause SOFIX	62 lags	4.75686	0.0087	There is Granger
SOFIX does not Granger Cause CDS	62 lags	4.42575	0.0121	There is Granger
BET does not Granger Cause CDS	62 lags	3.23783	0.0395	There is Granger
CDS does not Granger Cause BET	62 lags	1.04954	0.3504	No Granger Causality
CDS does not Granger Cause ATHEX20	62 lags	0.48561	0.9925	No Granger Causality
ATHEX20 does not Granger Cause CDS	62 lags	1.00117	0.4657	No Granger Causality
ISEQ does not Granger Cause CDS	62 lags	4.41731	0.0122	There is Granger
CDS does not Granger Cause ISEQ	62 lags	2.37393	0.0935	No Granger Causality
CDS does not Granger Cause IBEX35	62 lags	1.86786	0.1548	No Granger Causality
IBEX35 does not Granger Cause CDS	62 lags	0.93892	0.3913	No Granger Causality
CDS does not Granger Cause FTSEMIB	62 lags	1.20472	0.2041	No Granger Causality
FTSEMIB does not Granger Cause CDS	62 lags	1.36286	0.0891	No Granger Causality
PSI20 does not Granger Cause CDS	62 lags	1.69015	0.0259	No Granger Causality
CDS does not Granger Cause PSI20	62 lags	1.35842	0.8435	No Granger Causality

Table 5.2. **Granger casuality test results for post-crisis period (Period 3) for124 lags (6m):**

Null Hypothesis:	124 lags	F-Statistic	Prob.	Conclusion
CDS does not Granger Cause DAX	124 lags	3.23014	0.0168	There is Granger
DAX does not Granger Cause CDS	124 lags	3.02924	0.2961	No Granger Causality
CAC40 does not Granger Cause CDS	124 lags	0.56267	0.6898	No Granger Causality
CDS does not Granger Cause CAC40	124 lags	2.56495	0.0367	There is Granger
FTSE does not Granger Cause CDS	124 lags	0.85936	0.4877	No Granger Causality
CDS does not Granger Cause FTSE	124 lags	3.12625	0.0142	There is Granger
BEL20 does not Granger Cause CDS	124 lags	1.86856	0.1135	No Granger Causality
CDS does not Granger Cause BEL20	124 lags	1.86835	0.1135	No Granger Causality
CDS does not Granger Cause SOFIX	124 lags	1.06474	0.3436	No Granger Causality
SOFIX does not Granger Cause CDS	124 lags	1.09502	0.2875	No Granger Causality
BET does not Granger Cause CDS	124 lags	1.03116	0.4113	No Granger Causality
CDS does not Granger Cause BET	124 lags	1.26674	0.0802	No Granger Causality
CDS does not Granger Cause ATHEX20	124 lags	0.84304	0.8053	No Granger Causality
ATHEX20 does not Granger Cause CDS	124 lags	0.95105	0.5869	No Granger Causality
ISEQ does not Granger Cause CDS	124 lags	1.08307	0.3088	No Granger Causality
CDS does not Granger Cause ISEQ	124 lags	0.89766	0.7022	No Granger Causality
CDS does not Granger Cause IBEX35	124 lags	1.17001	0.1767	No Granger Causality
IBEX35 does not Granger Cause CDS	124 lags	1.15304	0.1990	No Granger Causality
CDS does not Granger Cause FTSEMIB	124 lags	0.91935	0.6565	No Granger Causality
FTSEMIB does not Granger Cause CDS	124 lags	0.98881	0.5030	No Granger Causality
PSI20 does not Granger Cause CDS	124 lags	1.25974	0.0584	No Granger Causality
CDS does not Granger Cause PSI20	124 lags	2.58136	0.8913	No Granger Causality

Figure 1. **Summary graphical representation of the results of correlation and Granger test**



Source: author's systematization

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