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30 December 2015

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DYNAMIC RELATIONS BETWEEN CDS AND STOCK MARKETS IN EASTERN EUROPEAN COUNTRIES

Abstract. *This study examines whether there is a price discovery type relationship between CDS and stock market at the level of 5 Eastern European countries for the period 2004-2014. The analysis follows the pattern of the financial time series: testing the structural breaks, the stationarity, cointegration and subsequently the development of VAR models. The study finds out that before and after the crisis, the stock market has played a crucial role in the price discovery phenomenon while during the financial crisis period and of the sovereign debts there has been an inverse relationship and the CDS has influenced the stock market.*

Keywords*: CDS, stock market, cointegration, price discovery.*

JEL classification: G01, G12, G14, G15

1. Introduction

The derivative financial products and namely the the credit default swap (CDS) are considered the successful financial innovations of the last couple of years since the analysists, the population and the governments make decisions based on them. CDS represent a debt insurance agreement towards the possibility of a debtor to face insolvency, being listed on non-regulated markets. The CDS listings are spreads (interest differences) which affect the returns of the bonds and fluctuate on a daily basis. They can be influenced by many factors, from local or regional events to global trends and represent good indicators of the perception of financial markets on risk, influencing loan costs (Hull, 2004; Wang, 2012; Coudert, 2013).

This paper investigates the long-term equilibrium between two indicators: the credit default swap (CDS) and the stock exchange indices which characterize the evolution of the Stock Exchanges in the main 5 Eastern-European countries.

The majority of the empirical studies focus on the capital markets in developed countries and a high number of papers tackle the USA capital market (Bystrom, 2004; Fung, 2008; Norden, 2009; Narayan, 2014). Recently, following the increasing role they have in economy, the capital markets have become an interesting topic for less developed countries, such as those in the Eastern part of Europe. Still, until now we have not been able to identify a study concerning the analysis of the relationship between CDS and stock market for the Eastern-European countries.

In December 2007, the Eastern European indices reached the maximum levels for all the stock markets in the region; after September 2008, they began to dropp and finally dropped to nearly 50-70% of their value; from 2010, the markets began to return to their prevous values, but nowadays are not at the same level.

Before the financial crisis of 2008, the CDS levels to the governmental bonds had minimal historical values, of around 60–70 basis points; after the bankruptcy of the Lehman Brothers, these exploded by the beginning of 2009 at values above 400-450 points, at the peak of the global financial crisis when the emerging countries in the Central and Eastern Europe were struck by a wave of risk aversion; After the conclusion of the agreement with the International Monetary Fund, the European Commission and the World Bank, in March 2009, the CDS listings dropped dramatically for the East European countries, falling constantly to below 100 percentage points, close to the level it had before the crisis. Czech Republic and Poland presented the smallest CDS spreads, of 1.5-2.5 percentage points, being considered the safest countries in the region; Bulgaria and Romania were perceived as more riskier markets, requiring a 4-5% CDS; Hungary presented the highest CDS: 5.5-7%. Nevertheless, something which needs to be signaled is that even during the financial crisis, the CDS of Eastern European countries were much smaller than the huge CDS spreads of the countries which were the most affected by the sovereign debt crisis: 10.76 percentage points in the case of Ireland, 11.1 points for Portugal and 35.3 points for Greece respectively.

The relationship between CDS and stock market starts from the economic premise of the rationality of the economic agent: when the perception of country risk measured by the CDS is higher, then the stock market decreases, since on the stock markets an important part of the risk is represented by the country risk element (Abid, 2006; Coronado, 2012; Jemna et al, 2014). The necessary yet not sufficient condition for someone to invest in stocks is to have a good opinion of the country risk profile which is expressed by the CDS level or by the bond returns and currency of a country. The higher the country risk prime expressed by the CDS level of the state bonds is, the more motivated the foreign investors are to reduce the price of purchased assets; they ask for high returns that will justify the higher risk. The analysts that assess the stock exchange also take into consideration this risk. Thus, in the evaluation methods (such as DCF – discount cash-flow) the

country risk directly influences the cost of equity capital (also called the return requested by investors) that is used for the calculation of the discount rate of future cash-flows of the assessed company. The future cash sources of the company estimated by the analyst are divided to this rate and if the country risk is high the discount rate will be higher which will also reduce the estimated value of the company and implicitly the target price of stocks (Mayordomo, 2014). The country risk also indirectly influences the stock listings through the bank interests. Thus, the increase in the CDS level leads to the increase in interests on the inter-bank markets; higher interests for deposits make risky investments non-attractive such as those in stocks, reason for some investors to prefer to sell their stock exchange holdings and be satisfied with the savings account interest (Hammoudeh and Sarri, 2011; Lupu and Asandului, 2014).

Our paper improves the existing literature in the following manners: firstly, it analyzes for the first time the East European countries for a long period of time, when these countries went through profound changes, such as EU adherence and the 2008 financial crisis; secondly, we use a slightly different econometric methodology in comparison with the previous studies. Thus, the research starts with the identification of the structural breaks according to the Bai-Perron test and then we use VAR by sub-periods and, based on the computed coefficients, we set the price discovery phenomenon and thirdly, relying on the price discovery phenomenon between the two CDS and stock markets, we conclude that during the economic boom periods, the stock market has a decisive role while, during the crisis periods, the CDS market sets the price discovery phenomenon.

The paper is organized in the following manner. Section 2 presents the main studies existing in the reference literature, section 3 presents theoretically the main methods of time series analysis, CDS and stock exchange indices. Section 4 includes a short statistical description of the data series under analysis as well as the results obtained while section 5 contains the conclusions of the paper.

2. Literature review

Even if the reference literature comprises a multitude of studies analyzing the relationship between credit market and stock market at microeconomic level, (Merton, 1974) establishes that the value of a derivative financial asset should be correlated with the bankruptcy likelihood of the respective company), at macroeconomic level this relationship is weakly covered and the researchers have only started to tackle this topic in the recent years.

Gonzalo and Granger (1995) are the first authors who introduce the concept of price discovery between two markets. Their analysis starts from the American markets and sets the methodology of estimation of the influence of a market on the other one. Bystrom (2004) analyzes the relationship between the iTraxx index of the CDS and the capital market using the data series for some stock exchange indices in the European Union. For a sample of European sectorial

indices iTraxx CDS, the author discovers a negative relationship between the variables studied; moreover, the stock volatility is significantly correlated with the CDS spreads, while the increase (decrease) of spreads takes place at the same time as the increase (decrease) of stocks. Norden and Weber (2004) examine, using a VAR methodology, the daily and weekly relationship between CDS and stock market for a total of 58 companies in 2000-2002. The authors conclude that the stock market affects the CDS market. Chan and Fung (2008) uses the Merton type structural Model in the analysis of sovereign CDS and suggest a negative relationship between the swap spread on the credit default swap (CDS) and the stock exchange indices. Their analysis is performed for 7 countries in Asia, for the period starting from January 2001 until February 2007, and the authors find a strong negative correlation between the CDS spread and the stock exchange index for most of the Asian countries. Long-term equilibrium relationships are identified for China, Korea and Thailand and partial equilibrium ones for the other countries. The influence of the CDS markets on the stock exchange markets is strong for 5 of the 7 Asian countries, while for the other two the stock exchange indices influence the CDS markets. Pena and Forte (2009), using a VECM model, investigate the capital market in the USA and the CDS market and ascertain a significant mutual feedback between the two in terms of price and volatility, while the stock exchange market influence the CDS index in the process of price settlement. At the same time, according to their analysis, the CDS market has a much more significant role in the contagion process of volatility than the stock exchange market, and the authors reach the conclusion that the market players should find information on both markets when they are going to commit to trading and /or hedging financial operations.

At the European Union level, there are some studies that analyze the phenomenon of stock market-CDS transmission but these are focused on the developed countries. Corzo (2011) investigates the above mentioned relationship for 13 European countries during 2008-2011, using a VAR methodology. The authors reach the conclusion that the two markets share the price discovery phenomenon during the period analyzed: throughout the growth and recovery (2008-2009, 2011), the stock market plays a central role, while during the crisis periods (2010, the crisis of European sovereign debts), the CDS market holds a decisive role. Coronado (2011) studies the daily relationship between CDS and stock market for a total of 8 European countries for the period 2007-201, using a VAR and panel data models. The author concludes that in times of crisis, CDS market has a determinant role in price discovery.

From our knowledge, until the moment of our analysis, there is no study that analyzes the price discovery phenomenon on the Eastearn-European markets which makes our approach necessary and useful.

3. Data and methodology

Our econometric analysis belongs to the reference literature and is specific to the financial time series. The procedure implies four stages and it is used on a

large scale by the corresponding econometric studies. The first stage deals with the existence of structural breaks in the data series using the Bai-Perron test and in the case of discovery of structural breaks, dividing the series into sub-periods. The second stage implies the verification of the time series stationarity using the ADF test. During the third stage, we will perform Johansen cointegration tests which examine whether the long-term equilibrium relationship is valid for the two markets for the 5 countries. If the variables are cointegrated, a Vector autoregressive (VAR) is applied to calculate the coefficients needed for the price discovery mechanism. During the last stage, the price discovery phenomenon between the stock market and the CDS will be actually calculated in order to see if the market plays a central role.

In what follows we will present the 4 step methodology applied to our case, namely the price discovery between CDS and stock exchange markets.

Firstly, we will test the existence of structural breaks using the Bai Perron test. The structural breaks refer to the distribution of the parameters of time series which only have meaning within a model. For a better understanding of the structural break phenomenon we will present the theory on the simpliest dynamic model, OLS, for which the model with m m structural breaks is:

$y_t = x_t^{'}\beta_j + u_t$, with $i = \overline{1,...m}$ and (1)

$u_t^2=\sigma^2$ (2)

where u_t represents the series of residuals (which must be non-correlated) and β_j the parameters of the model.. The stationarity of a time series assumes that the parameters are constant in time; if they change in time (breakdate), a structural break appears.

The structural breaks (T_1, …T_m) are unknown and for $i = \overline{1,...m}$, we will have $\lambda = {}^{T_i}\!/_{T}$ with $0 < \lambda_1 < ... < \lambda_m < 1$.

Bai and Perron (2003) impose conditions for identifying the posibile structural breaks by delimitationing these in a confidence interval and in the same time the simple limits:

$$\lambda_e = \{(\lambda_1,...,\lambda_m); \left|\lambda_{i+1} - \lambda_i\right| \geq \varepsilon, \lambda_1 \geq \varepsilon, \lambda_m \geq 1 - \varepsilon\}$$

We will apply the Dickey-Fuller (ADF) test, intended to detect the DF-type non-stationarity that is the detection of the unit root. If Y_t has a unit root, then in the regression equation:

$$\Delta y_t = \alpha y_{t-1} + x_t^{'}\delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + ... + \beta_n \Delta y_{t-n} + \varepsilon_t \quad (3)$$

it is performed relatively to the coefficient of the term Y_{t-1}.

The considered hypotheses are:

H_0: $\alpha=0$, Y_t has a unit root, therefore it is non-stationary

H_1: $\alpha\neq0$, Y_t does not have a unit root, therefore it is stationary

If the absolute value of the ADF test is bigger than the critical value considered to be -3.4164, then the null hypothesis is accepted, which means that the time series is not stationary and the considered process is I(1).

The third stage supposes the long-term testing of the relationship between CDS and stock market using the Johansen Cointegration procedure. Firstly we will develop the following vector autoregressive model (VAR).

$$X_t = A_0 + A_1 X_{t-1} + A_2 X_{t-2} + ... + A_p X_{t-p} + \varepsilon_t \quad (4)$$

where,

X is a(2x1) vector of CDS and Stock market index,

A_0 is a (2x1) vector of intercept terms

A_i is a (2x1) vector of coefficient parameters

e_t is a (2x1) vector of the error type shocks, errors that can be correlated between them or not

Testing the Joahansen Cointegration between series will be based on the following equation:

$$\Delta X_t = \delta X_{t-1} + \sum_{i=1}^{n} R_i \Delta X_{t-1} + \varepsilon_t \quad (5)$$

The order of the resulting matrix is the most important in the analysis of cointegration: δX_{t-1} must be stationary so that there should be a cointegration relationship. If the two markets are cointegrated, the order of the matrix of the coefficients must be 1, and there should be 2x1 vectors α and β, where β represents the cointegration vector and α is the vector of the speed with which the respective parameters are adjusted.

The null and alternative hypothesis has the following form:

H_0: δ has the order 2, the two series CDS and stock market are not cointegrated

H_1: δ has the order 1, the two series CDS and stock market are cointegrated

After having tested the cointegration relationships, we will test the optimal lag length for a series of vector autoregressions of order 12 lags at the maximum, using the Akaike information criteria (AIC), Schwarz information criterion (SBIC), and the Hannan and Quinn information criterion (HQIC). If there are incongruities between tests, we will give priority to the Akaike information criterion test (AIC).

The last stage implies the estimation of a Vector autoregression (VAR) in order to establish the dynamic relationship between CDS and stock markets

$$CDS_t - \beta_i Stock - y_i = z_t = I(0) \quad (6)$$

which can be written:

$$\Delta CDS_t = a_1 + \alpha_1 z_{t-1} + \sum_{i=1}^{n} R_{1,j} \Delta CDS_{t-j} + \sum_{i=1}^{n} R_{1,j} \Delta Stock_{t-j} + \varepsilon_{1t}$$

$$\Delta Stock_t = a_2 + \alpha_2 z_{t-1} + \sum_{i=1}^{n} R_{2,j} \Delta CDS_{t-j} + \sum_{i=1}^{n} R_{2,j} \Delta Stock_{t-j} + \varepsilon_{2t} \quad (7)$$

The residuals of the first regression which represents the Johansen cointegration equation must be stationary so that the two series, CDS and stock market, should be cointegrated. The next two equations represent VAR. Of these two equations, two parameters are important: α_1 and α_2, specifically the parameters that measure the adjustment speed of a market to the other one. The two parameters are interpreted as estimators of the price discovery phenomenon, and when comparing them (value and sign) we can infer which of the CDS and stock market has a determining role.

Gonzalo and Granger (1995) propose the following estimator of the price discovery phenomenon, starting from the coefficients obtained through VAR. Thus, two estimators can be built, GG_{CDS} and GG_{Stock} that will comprise the coefficients determining each market's share to the price discovery phenomenon:

$$GG_{CDS} = \frac{\alpha_2}{-\alpha_1 + \alpha_2} \qquad GG_{Stock} = \frac{-\alpha_1}{-\alpha_1 + \alpha_2} \tag{8}$$

Since $GG_{Stock} + GG_{CDS} = 1$, we may reach the conclusion that stock market (CDS) has a decisive role in the price discovery process everytime GG_{Stock} is higher (or lower) than 0.5. This observation is based on the fact that the higher the speed in eliminating the price differences from the long-term equilibrium relationship, the higher the corresponding α and therefore the higher the price discovery estimator.

4. Empirical results

Within the empirical study, we will use the daily data of the stock exchange indices and CDS for 5 Central and East European countries: Bulgaria (Sofix), Czech Republic (PX), Hungary (BUX), Poland (WIG) and Romania (BET). The data analyzed are collected on a daily basis from Bloomberg and Datastream and cover the period 01.01.2005-30.04.2014; the values for the stock exchange indices are the closing ones and are expressed in the following way: the return of the stock exchange ($r = \ln(stockindex_t / stockindex_{t-1})$)

Our analysis procedure is the following one: we will apply the Bai-Perron test to identify the structural breaks and the analysis sub-periods, and then we will perform different descriptive statistics for those sub-periods as well as the ADF unit root test to establish the series stationarity and afterwards the Johansen cointegration procedure. If we discover that the series analyzed are cointegrated, a VAR test is applied, the equation coefficients are obtained and then the price discovery effect for the CDS and stock markets is calculated.

Taking into account that during the period under study the 2007-2009 financial crises occurred, we will estimate the existence of some structural breaks by using the Bai-Perron test. We set the maximum number of structural breaks at 5 and the shortest distance between two breaks is 50. Table no.1 shows the

estimation results of the Bai-Perron test for the five countries and the 10 time series, CDS and stock market respectively.

Table 1. The estimation results of the Bai-Perron test for Eastern European Countries

Country	***Break Test***	***F-statistic***	***Repartition***	***Break Test***	***F-statistic***	***Repartition***
Bulgaria	CDS			SOFIX		
	0 vs. 1 *	20.82960	9/13/2008	0 vs. 1 *	51.28666	10/08/2008
	1 vs. 2 *	9.906447	2/13/2010	1 vs. 2 *	9.282626	2/10/2010
	2 vs. 3	3.406906		2 vs. 3	1.044173	
Czech Republic	CDS			PX		
	0 vs. 1 *	8.805697	11/08/2008	0 vs. 1 *	9.690829	10/14/2008
	1 vs. 2 *	10.00837	4/25/2010	1 vs. 2 *	6.613539	5/10/2010
	2 vs. 3	4.534210		2 vs. 3	5.650682	
Hungary	CDS			BUX		
	0 vs. 1 *	31.32275	02/07/2008	0 vs. 1 *	15.86221	3/29/2008
	1 vs. 2 *	6.795706	6/04/2010	1 vs. 2 *	6.322976	8/14/2010
	2 vs. 3	2.187133		2 vs. 3	3.625594	
Poland	CDS			WIG		
	0 vs. 1 *	21.90455	11/14/2007	0 vs. 1 *	7.854316	10/16/2007
	1 vs. 2	5.924491		1 vs. 2	1.016581	
Romania	CDS			BET		
	0 vs. 1 *	9412.791	3/12/2007	0 vs. 1 *	8.459000	2/09/2007
	1 vs. 2 *	2584.061	9/05/2008	1 vs. 2 *	10.13805	10/18/2008
	2 vs. 3 *	1640.385	4/11/2011	2 vs. 3 *	7.371656	3/29/2011
	3 vs. 4	406.0316		3 vs. 4	1.597780	

Source: own calculation using Eviews7

As it can be noticed in table no. 1, all the time series for the countries analyzed present a number of structural breaks. From table no.1, we can observe that all the countries have a first structural break around the months of September and October of the year 2008, which signifies the contagion of these markets with the international markets, caused by the Lehman failure in the mid-September. The second structural break belongs to the post-crisis period, of recovery of markets and stock exchanges occurring during July 2010-October 2011, in relation to how fast the national markets succeeded to recover. The only country that has not known the economic crisis, Poland, owns a single structural break and this is in October 2007. Romania has three structural breaks: 2 correspond to the crisis period and recovery and the 3rd one happened in February-March 2007, during the EU adherence process.

Using these structural breaks, we will distribute the series analyzed in distinctive sub-periods namely: the boom period of the markets, previous to the

crisis (January 2005 – October 2008); the crisis period and contagion of markets (June 2008 – July 2010) and the last period of recovery and post-crisis adjustment of the markets (July 2010 – April 2014). Romania also has a growth period corresponding to the EU adherence (January 2005 – February 2007); while Poland only has two periods.

Table no.2 presents the descriptive statistics for the returns of CDS and of the stock exchange market. It can be observed that during the crisis periods, the returns of the stock exchange market are negative for all the series analyzed (with the exception of Poland), while during the growth periods the returns are positive. The sovereign CDS returns have the same features: positive values during growth and negative during crisis. At the same time, due to the strong variations between the daily values, the highest returns are found during the crisis period: Bulgaria 31%, Czech Republic 21%, Hungary 14%, Poland 26%, Romania 31%. As for the distribution, the time series are not normally distributed, having the highest values of the Jarque Bera test during the crisis period.

Table 2. Descriptive statistics for the returns of CDS and of the stock exchange market

Country	*Series*	*Mean*	*Maximum*	*Minimum*	*Std. Dev.*	*JB*
Bulgaria	CDS1	8.654	10.609	-123.831	16.941	3625.318
	CDS2	-4.252	9.703	-94.519	18.695	1489.282
	CDS3	3.886	6.232	-85.105	12.238	759.822
	SOFIX1	7.899	26.076	-29.598	4.873	897.411
	SOFIX2	-7.403	31.670	-49.335	8.119	1073.639
	SOFIX3	1.752	16.540	-19.531	3.930	270.785
Czech Republic	CDS1	5.332	11.293	-4.426	6.145	210.03
	CDS2	-2.331	4.088	-6.343	9.139	2691.308
	CDS3	2.247	8.546	-2.262	3.188	788.684
	PX1	7.420	11.731	-5.595	14.582	2592.923
	PX2	-4.641	21.169	-14.944	25.417	947.026
	PX3	1.019	7.517	-2.059	11.685	672.053
Hungary	CDS1	3.464	32.451	-20.547	47.964	1625.319
	CDS2	-2.319	5.024	-22.007	43.301	622.313
	CDS3	0.475	3.121	-10.184	28.457	1733.04
	BUX1	4.522	9.863	-25.449	13.882	35.929
	BUX2	0.502	14.085	-11.882	26.149	331.454
	BUX3	1.127	5.669	-7.523	34.884	196.726
Poland	CDS1	15.611	31.440	-18.587	42.499	2517.454
	CDS2	22.374	42.642	-6.665	46.601	111.25
	WIG1	12.318	15.650	-6.111	41.650	217.934
	WIG2	3.735	26.272	-17.955	13.796	852.329

Romania	CDS1	15.423	24.643	-17.879	271.131	1367.873
	CDS2	7.007	30.514	-15.789	47.206	989.838
	CDS3	-9.996	2.736	-20.239	41.193	1445.186
	CDS4	1.026	15.353	-10.603	24.442	827.545
	BET1	14.304	26.123	-11.221	16.446	814.121
	BET2	6.015	19.252	-7.286	38.054	106.148
	BET3	-2.790	31.127	-12.293	23.647	631.677
	BET4	3.167	16.333	-8.391	41.636	2286.427

Source: own calculation using Eviews7

The analysis of the stationarity of time series was launched by means of the Augmented Dickey-Fuller test. The results, described in Table no. 3, indicate the stationarity of the level values for all the series analyzed (series are I(0)). The results of the ADF test were verified by means of the LSL test. As with the previous test, an intercept and a trend variable were used as determining terms for the level values.

Table 3. Augmented Dickey-Fuller test statistic for the returns of CDS and Stock market series

Country	***Series***	***t-Statistic***	***Series***	***t-Statistic***
Bulgaria	CDS1	-23.49812	SOFIX1	-14.90727
	CDS2	-18.49959	SOFIX2	-10.00993
	CDS3	-17.73606	SOFIX3	-27.53043
Czech Republic	CDS1	-23.13388	PX1	-13.19390
	CDS2	-18.88050	PX2	-15.29533
	CDS3	-28.78034	PX3	-30.27264
Hungary	CDS1	-6.09229	BUX1	-15.73039
	CDS2	-16.64156	BUX2	-17.58220
	CDS3	-25.88001	BUX3	-10.85467
Poland	CDS1	-22.07894	WIG1	-15.33585
	CDS2	-34.93707	WIG2	-36.31101

Romania	CDS1	-9.02675	BET1	-5.03738
	CDS2	-19.74598	BET2	-18.90602
	CDS3	-20.27287	BET3	-24.27952
	CDS4	-23.13138	BET4	-24.16239

Source: own calculation using Eviews7

In the case of VAR analysis an important problem is the choice of lag number of the equations. In this study, the number of lags was chosen based on the Akaike Information Criterion (AIC). The results confirm those obtained through the Augmented Dickey-Fuller test. The test indicated a number of 2-3 lags for most of the countries during most of the sub-period; there have obviously been isolated cases of 7-8 lags but only for one period.

In Table no.4 the results of the cointegration test between the stock exchange indices and the CDS level are presented. The stationarity of the residual values of the cointegration equation, where INDEX is the dependent variable and CDS is the independent variable indicates the presence of a cointegration relationship between the two variables for all the East European countries analyzed. As it can be easily observed in the case of these countries, the stock exchange market is not very developed, the major impact on these markets being played by external speculators who are strongly influenced by the CDS value. For all the countries and sub-periods, there is at least one cointegration relationship between the CDS and the national stock exchange market.

Table 4. Johansen cointegration between CDS and Stock market in Eastern European Countries

Country	***Series***	***Hypothesized No. of CE(s)***	***Eigenvalue***	***Trace Statistic***	***Probability***
Bulgaria	CDS1 SOFIX1	None *	0.13	134.02	0.00
	CDS2 SOFIX2	None *	0.17	185.67	0.00
	CDS3 SOFIX3	None *	0.24	451.54	0.00
Czech Republic	CDS1 PX1	None *	0.17	187.15	0.00
	CDS2 PX2	None *	0.23	161.45	0.00
	CDS3 PX3	None *	0.26	524.90	0.00
Hungary	CDS1 BUX1	None *	0.29	558.03	0.00
	CDS2 BUX2	None *	0.34	321.29	0.00
	CDS3 BUX3	None *	0.25	331.21	0.00
Poland	CDS1 WIG1	None *	0.13	194.66	0.00
	CDS2 WIG2	None *	0.26	908.28	0.00
Romania	CDS1 BET1	None *	0.09	97.61	0.00
	CDS2 BET2	None *	0.23	204.12	0.00
	CDS3 BET3	None *	0.15	188.32	0.00
	CDS4 BET4	None *	0.25	405.93	0.00

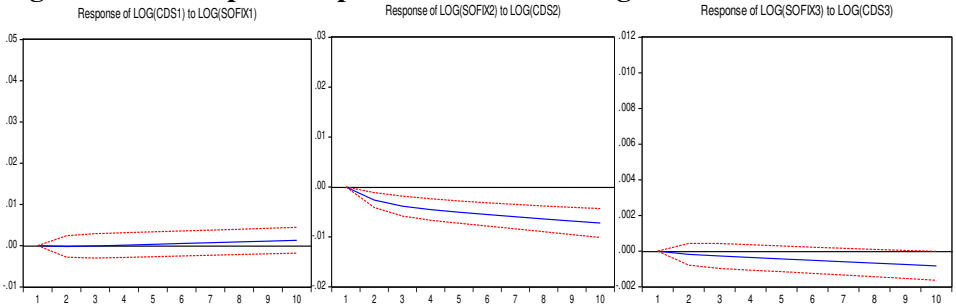
Note: The critical value for a 5% risk is 15.49

Starting from the premise of cointegration, the interactions between the two variables were studied by means of a VAR model. The model's parameters presented in Table no.6 suggest a significant influence of the CDS values on the stock exchange indices. In return, the impact of the stock exchange indices on the CDS is much weaker.

The impulse response function as an econometric technique was used to investigate the short-term impact (up to one year), caused by the autoregressive vector when it received some impulses. The impulse response function describes the response of errors to the endogenous variables, more precisely the future responses of the endogenous variables to the disturbing influence term.

For Bulgaria, the impulse response function for the period 1 show that variations of stock index have an immediate positive impact on CDS, which reaches a maximum in the second day (0.000311) and then decrease until the fourth day, when reaches zero, the effects non exhibiting into future. For the period 2 (crisis), and 3 (after crisis), IRF assume that variations CDS have immediate negative effect on stock, reaching minimum -0.00014 and -0.0007 in the day, then shock effects to fade and stock to recover in 3 or 4 days.

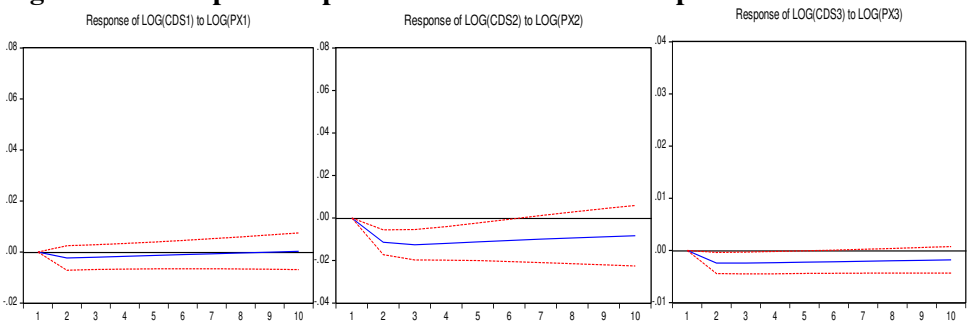
Figure 1. The impulse response function for Bulgaria



Source: own calculation using Eviews7

The impulse response function shows that the PX stock market index variations in the Czech Republic have a negative immediate effect on the CDS which reaches a maximum on the third day (-0.04) and it remains negative until the 10th day (-0.004). The impulse response function presents negative values for all the three periods, with small positive values for the period before the crisis.

Figure 2. The impulse response function for Czech Republic

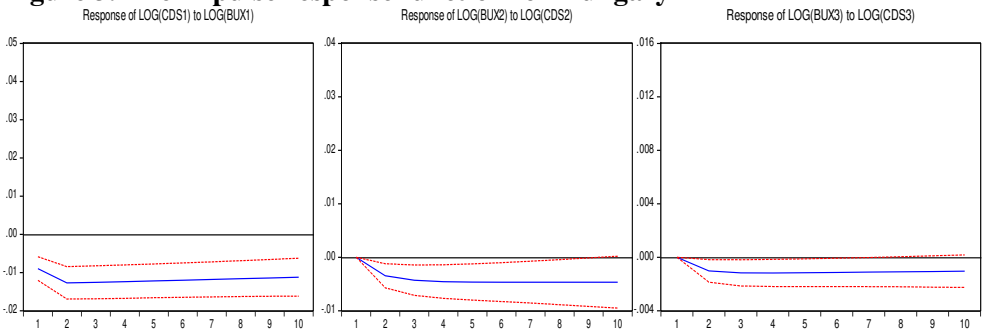


Source: own calculation using Eviews7

The variations of the stock market in Hungary during the period 1 lead to the decline of the CDS for all periods, when it reaches the minimum of -0.002, after which it has growth effects, and from the period 8 the impact is also positive;

during the period 5 the CDS variations lead to the continuous drop of the stock market. Also, in periods 2 (crisis) and 3 (post crisis), CDS variation leads initially to a decrease in the stock market until the 3rd day after declines continue occurring to dissipate shock.

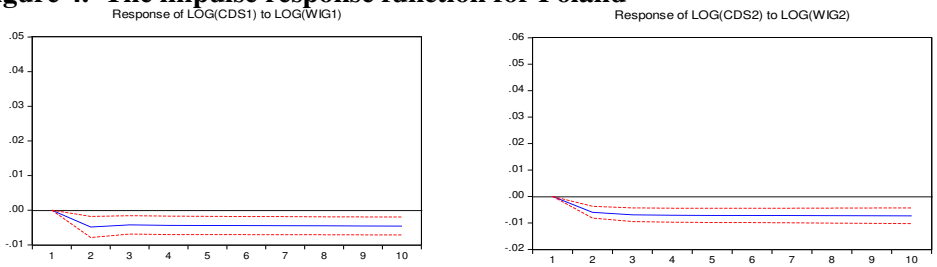
Figure 3. The impulse response function for Hungary



Source: own calculation using Eviews7

The impulse function for Poland shows that in period 1 and 2, the variations in stock markets induces a negative response into CDS (-0.01 for period 1 and -0.002 for period 2) after day 3 and remains negative for the whole period.

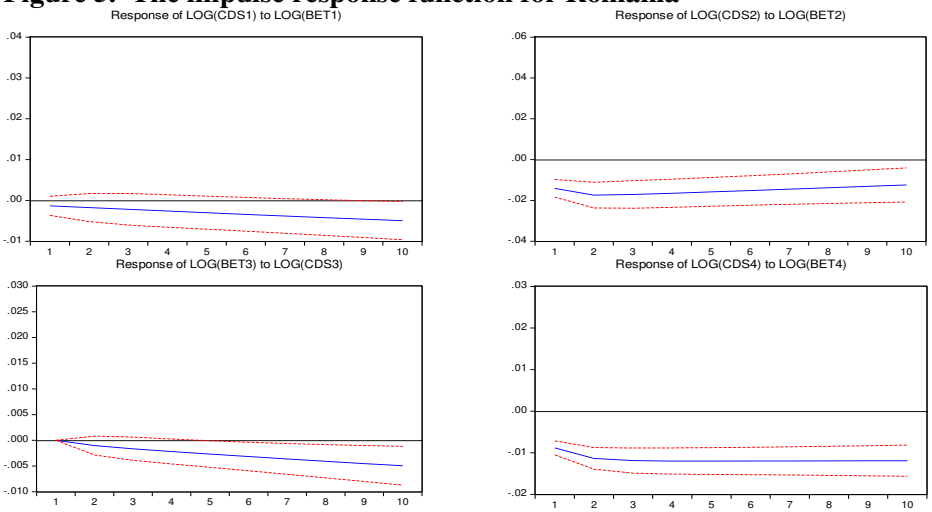
Figure 4. The impulse response function for Poland



Source: own calculation using Eviews7

The BET stock index variations in Romania during the periods 1-4 lead to continuous decreases of the CDS; during the period 4 the CDS variations initially lead to BET increases until the 2nd day, then to the decrease with a minimum of -0.00061 on the 4th day, and then again increases, so that on the 8th day it becomes positive again; during the period 5 there is initially a BET increase to 0.000296, until the 2nd day, then it drops the following day at a minimum of -0.00022, and afterwards an increase occurs reaching a positive value on the 4th day.

Figure 5. The impulse response function for Romania



Source: own calculation using Eviews7

Table 6. Price discovery in Eastern European countries (VAR Model – Substituted Coefficients)

		α_1	α_2	GG_{CDS}	GG_{stock}
Bulgaria	CDS1 SOFIX1	- 0.00657	0.00473	0.418	0.582
	CDS2 SOFIX2	- 0.01382	0.07000	0.835	0.165
	CDS3 SOFIX3	- 0.06472	0.08591	0.570	0.430
Czech Republic	CDS1 PX1	- 0.18805	0.01090	0.055	0.945
	CDS2 PX2	- 0.48083	0.02708	0.054	0.946
	CDS3 PX3	- 0.21416	0.03442	0.139	0.861
Hungary	CDS1 BUX1	- 0.32275	0.00512	0.016	0.984
	CDS2 BUX2	- 0.10656	0.18222	0.630	0.370
	CDS3 BUX3	- 0.03917	0.10385	0.726	0.274
Poland	CDS1 WIG1	- 0.41009	0.01437	0.034	0.966
	CDS2 WIG2	- 0.47730	0.01871	0.038	0.962
Romania	CDS1 BET1	-0.01530	0.00460	0.232	0.768
	CDS2 BET2	- 0.17514	0.03724	0.176	0.824
	CDS3 BET3	- 0.00702	0.02267	0.763	0.237
	CDS4 BET4	- 0.09708	0.06779	0.412	0.588

Source: own calculation using Eviews7

The results from the previous section suggest that while CDS and stock market may temporarily deviate one from another, in the end they are cointegrated on a long run. As a consequence, some questions arise: which of the two markets contributes the most to the price discovery process and which of them simply adjusts to the variations of the primary market. This information is extremely important for the evaluation of the information content of the CDS spreads and the East European stock market because the primary market provides the newest information regarding the evolution of the two markets and their changes. Taking into account that CDS and the stock market are cointegrated, we will analyze the role of the two markets in the price discovery process using the methodology introduced by Gonzalo and Granger (1995) and applied afterwards by Blanco et al. (2003), BCE (2004). In compliance with the method presented and aiming at determining the contribution of each market to the price discovery, the first step conducted was to estimate the VAR coefficients.

Based on these coefficients and the formula no.8, we may estimate which of the two markets has a decisive role in the price discovery phenomenon. If a country risk is primarily determined by the stock market, then the first market which will register a change will be the stock market and the CDS will adjust accordingly by incorporating the changes on the main market. Contrarily, if the CDS market has a determining role in the price discovery process, the changes occurred to the credit risk will be first of all incorporated on the CDS market, while the stock market will react with a delay and later on.

For the boom period, previous to the 2008 crisis, all Eastern European countries manifest a price discovery phenomenon from the stock market towards the CDS: during this period there was the so-called "exhilaration" of the stock market and the CDS liquidity never exceeded the investors' appetite for stocks. Since the financial crisis outburst, the CDS market has had a decisive role on the stocks: the Eastern European stock exchanges (exception making Poland) have declined during this period by 50-70% and CDS have started to increase; the stock exchange evolution does not have any connection with the results obtained by the listed companies, with the profits or cash-flow, it entirely depends on two things: the international investors' fear and the big market players' interests.

The 2008 financial crisis changed the meaning of the price discovery type phenomenon: the determining market becomes the CDS, being the first to incorporate the economic changes, transmitted afterwards by the stock market. It is to be noted that due to the political instability and the weak economic growth, Bulgaria and Hungary still preserve this feature.

The only country that has not entered the recession process, Poland, experiences a normal price discovery phenomenon: the stock market is the main market and leads in terms of influence the CDS market. Czech Republic and Romania, after the passing of the European sovereign debts and against the backdrop of the return of investors and good economic results, experience the come-back of the characteristics specific to the period before the 2008 crisis: the stock market consude in terms of price discovery the CDS market.

5. Conclusions

In this paper we studied the relationship between the CDS and the stock market using daily data for the period January 2004 – 30 April 2014. Starting from the characteristics of the national markets and using the Johansen cointegration method, we discovered that out of the analyzed East-European countries, two markets present significant negative correlations. Taking into account the methodology developed by the literature, we used VAR models in order to express the lead-lag type relationship between the CDS and the stock market.

For all the countries and sub-periods, the CDS and stock market are placed in a tight long-term cointegration relationship; on a short term though, there are numerous deviations among them due to the listing costs. During the period under analysis, the two markets move in tandem, usually in an inverse relationship: one's increase leads to the other's decrease.

According to the VAR models developed in the study and to the computation based on the Gonzalo and Granger methodology, there is a price discovery phenomenon at the level of all countries analyzed. For the period previous to the 2008 financial crisis, all Eastern European countries (Bulgaria, Czech Republic, Hungary, Poland and Romania) manifest the influence first of the stock market, the incorporation of the changes and subsequently there is a transmission towards the CDS market.

It needs to be specified that once within this vicious circle of the price discovery phenomenon determined by the CDS market, Hungary and Bulgaria have not come out until this day. The weak situation of the Bulgarian stock exchange has deeper roots, linked to the lack of structural reforms, in a fragile political context and to the weaknesses of this country's institutions. Hungary is in the same situation also due to the governmental policies that had a negative impact on the stock exchange investors: the unilateral denunciation of the agreements with IMF, the weak economic performance, the nationalization of certain important elements of the economy, the banks' obligation to recalculate the population's loans.

Romania and Czech Republic find themselves in a somewhat similar situation: after the 2008 financial crisis and the 2010 European sovereign debts, when the price discovery phenomenon was given by the CDS and manifested simultaneously with the decline in the national stock exchanges and the CDS increase, since 2011, the stock exchanges reclaim their important role within this mechanism. The reason for these changes in Romania and Czech Republic is the recovery of the global markets in the last years, the investors' growth interest in these markets, the better-than-expected economic results, the listing of some important economic operators on the national stock exchanges.

Poland, the only country that has not gone through the recession during this period, has known a price discovery phenomenon only from the stock market

towards the CDS because in this country there is a functional capital market with a sufficient number of transactions both on the primary market (IPO) and on the second market, a well-developed segment of pension funds and local investment funds. The Warsaw stock exchange has been the champion of listings in the recent years not only in the region but also in Europe, thus managing to provide opportunities to investors.

The results obtained in this study suggest that, as a general rule, the political decision makers should react to the stock exchange changes in order to control the sovereign CDS spreads of the respective countries. During the growth periods of the stock exchanges, the governments should focus on the adequate management of public debt so as to ensure the country's financial stability; during the crisis periods they should strive to ensure the business environment stability so as to have the lowest possible CDS country risk. Moreover, the other factors on the financial markets, the speculators, the hedgers and institutional investors should take into consideration the relationship between the CDS and the stock market in order to forecast the changes within the country risk and to adopt their appropriate strategies.

Acknowledgement

This work was financed by Alexandru Ioan Cuza University of Iași, Romania, through project "The analysis of the causal relationships between inflation, economic growth and their uncertainties on emerging economies", code GI-2014-11, Grants for Alexandru Ioan Cuza University of Iași, Romania young researchers.

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