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Linkages and Efficiency Between iTraxx Europe and Financial Market Dynamics in South-East Europe Capital Markets in Post-crisis Period

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ABSTRACT

We examine the market efficiency and the linkages between financial market dynamics and iTraxx Europe of the equity markets of South East Europe (SEE). Therefore, this study aims to answer whether there exists a difference between the stock market performance of the developed and emerging SEE capital markets. This paper employs generalized autoregressive conditional heteroskedasticity model and Granger causality test. We use the returns of iTraxx Europe and the daily returns of five SEE stock market indices – Bulgaria, Croatia, Slovenia, Turkey and Romania over the period after the financial crisis of 2008. The results reveal that SEE capital markets except Bulgaria and Slovenia aren't efficient in the context of the efficient market hypothesis. Moreover, the iTraxx Europe affects the financial market dynamics of SEE stock indices. The analysis shows that the Itraxx Europe Granger-cause stock market returns with less significant causal relations from stock market returns to iTraxx Europe.

Keywords: Market Efficiency, iTraxx Europe, Capital Markets.
JEL Classifications: C32, E27, G14, G15

1. INTRODUCTION

Efficient market hypothesis (EMH) and the random walk hypothesis have been major issues in finance for the past 50 years. The term efficiency is used to characterize a market in which relevant information is impounded into the price of financial assets. Practically, this means that the stock markets indices are unpredictable. According to the EMH market prices fully reflect all available information. On the other hand, 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. With the coming of the great recession the topic of the credit default swaps (CDS) became more and more popular. The development of the crisis provoked a significant increase in the values of CDS market, 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 CDS which represent measurers of bankruptcy risk of the respective firm or corporation and capital markets which are a reflection of the prosperity of the respective country. We will attempt to answer the following questions: How efficient are capital markets actually?; Can iTraxx Europe index be used to forecast the dynamics and movements of stock indices?

Consequently, this study focuses on the market efficiency and the linkages between the dynamics of stock market returns and iTraxx Europe index in five capital markets of South East Europe (SEE). We can divide the stock exchanges of SEE into two groups in the context of their development, using the stock market capitalization as a criterion. The first group contains the emerging markets – Bulgaria, Romania and Slovenia and the second one – developed markets – Croatia and Turkey (Tables 1 and 2). The data range is from 2008 to 2015. The indices under examination are five SEE indices: The Bulgarian SOFIX, the Romanian BET, the Croatian CROBEX, the Slovenian SBI TOP and the Turkish BIST100. We use daily returns to examine the market efficiency and analyze the impact of iTraxx Europe index on the stock exchange performance, applying an appropriate

Table 1: Market capitalization of SEE capital markets for 2011

SEE capital markets	Market capitalization (US$)
Country	2011 (billion)
Bulgaria	8,253.25 US$
Croatia	22,558.38 US$
Romania	14,023.92 US$
Slovenia	6,325.86 US$
Turkey	197,074.46 US$

The total market capitalization of each capital market is for 2011 (approximately in the middle of the examined period 2008-2015). Source: The websites of the SEE stock exchanges. SEE: South East Europe

Table 2: Developing and developed capital markets (according to the market capitalization)

Developing SEE capital markets	Developed SEE capital markets
Bulgaria	Turkey
Slovenia	Croatia
Romania	

Median market capitalization is US $ 14,023.92 billion. Source: Authors' calculations. SEE: South East Europe

generalized autoregressive conditional heteroskedasticity (GARCH) model.

The paper is organized in the following way. The first section initiates with the introduction. Section 2 summarizes the literature review. Section 3 discusses the data and the research methods employed. Section 4 shows the main estimation results. The final section provides summary and conclusions.

2. LITERATURE REVIEW

A good number of authors study the relation between capital markets and those of CDS. Most researches analyzing the dynamics of default swaps observe dependencies in separate large corporations. In our research we use the most widely traded of the CDS indices, namely iTraxx Europe indices composed of the most liquid 125 CDS referencing European investment grade credits. It allows investors to transfer credit risk in a more efficient manner.

In this paper we discuss the relationship between the iTraxx CDS index market and the stock markets. The co-movements between these two financial markets is vital for arbitrageurs in the CDS market so the relationship between Credit Default Swap market and other asset markets has attracted increasing attention, especially since the last financial crisis form 2007 to 2008.

The standard Merton' model (1974) and the later paper of Hall and Miles (1990) disclose that default probability is a simple function of the stock price volatility. Also, financial theory reveals that indices in an efficient stock market must reflect the default probability of firms. CDS indices and bond spreads are considered to be measures of credit risk and the relationship between these two financial markets at corporate level, has been extensively explored by Norden and Weber (2004), Blanco et al. (2004), Zhu (2006) and Forte and Peña (2009). Based on the Merton's model (1974), Norden and Weber (2004), Forte and Peña (2009) have researched the relationship between CDSs and stock market indexes where they draw the conclusion that capital markets determine the behavior of CDS markets and have a key role during the incorporation of new information. Longstaff et al. (2003) investigate the US stock market and they found that both CDS market and stock market have informational lead role over bond market. Norden and Weber (2004) have explored the European financial markets and found that the CDS spread fluctuations are negatively correlated with stock returns. Bystrom (2005) has studied the relationship between corporate equity prices and CDS spreads and found evidence which focuses that firm specific information is embedded into stock prices before it is embedded into CDS spreads. The connection between the iTraxx CDS index market and the stock markets is stronger for countries with high risk spread (Coronado et al., 2012). 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 relationship is Corzo (Corzo et al., 2012). She reveals the change upon the dominating role of financial markets during different periods of time. Taken into consideration is the fact that CDS is a determining factor at economics with high bankruptcy risk.

As a final step, we study the relationship between the different European CDSs after and during the crisis. Several studies (e.g., Fontana and Scheicher, 2010; Dieckmann and Plank, 2011; Ang and Longstaff, 2011 or Gündüz and Kaya, 2012) have shown that there is a high level of synchronicity in the movements of credit spreads due to systemic risk. Similarly Bystrom (2005) analyses the association between the performance of a CDS iTraxx index and stock market returns during the period 2004-2005 and concludes that stock market returns Granger cause CDS spread changes, but the reverse does not occur. Based on this, we suggest the existence of relationship between the iTraxx and stock market indices of pairs of European countries.

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 change can be their functioning upon changing market conditions (Avino et al., 2011). In support of Avino's statements, 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 (Tsenkov, 2015).

Aga and Kocaman (2011) test the weak form of efficiency for return index-20 in Istanbul Stock Exchange (ISE) for the period 1986-2005. They lead to the conclusion that there is a weak form of efficiency in ISE, which means that the market is weakly efficient if the current time cannot be explained with the past values. Investigating calendar anomalies for five SEE stock markets (Bulgaria, Croatia, Greece, Romania and Turkey) during the period

2000-2008, Georgantopoulos et al. (2011) find evidence for the existence of three calendar effects (day of the week, turn of the month, time of the month) in both mean and volatility equations for Greece and Turkey, which is consistent to the findings of previous studies. On the other hand, the effects for the three emerging SEE markets are limited and exist only in volatility. Samitas et al. (2011) study long-run relationships among five Balkan emerging stock markets (Turkey, Romania, Bulgaria, Croatia, and Serbia), the US and three developed European markets (UK, Germany and Greece) during the period 2000-2006. The results indicate that both domestic and external factors affect the Balkan stock markets, shaping their long-run equilibrium. Overall, they show evidence in favor of significant long-run relations between the Balkan emerging markets within the region and globally. Armeanu and Cioaca (2014) test the EMH in the case of Romania for 01.01.2002-15.05.2014 using four methods, including GARCH model. They find out that the Romanian capital market is not weak-form efficient. Dragota and Oprea (2014) investigate the Romanian stock market's informational efficiency and find out that the predictability of returns suggest that the Romanian stock market has a low level of efficiency. Furthermore, the impact of new information is more intense before and after its release. The Syriopoulos and Roumpis (2009) researches show that the Balkan stock markets are seen to exhibit time-varying correlations as a peer group, although the correlations with the mature markets remain relatively modest.

3. METHODOLOGY AND DATA

In this paper, we analyze the market efficiency and the relation between the iTraxx CDS index market and five stock markets of SEE – Bulgaria, Croatia, Slovenia, Turkey and Romania. We can divide the stock exchanges of SEE into two groups in the context of their development, using the stock market capitalization as a criterion. The first group contains the emerging markets – Bulgaria, Romania and Slovenia and the second one – developed markets – Croatia and Turkey (Tables 1 and 2). Daily closing prices of eleven SEE market indices were available on the stock exchanges' websites of the investigated countries. The data range is from 2008 to 2015. We should divide the analysis into two separated parts – in the first one we will examine if the capital markets are characterized with market efficiency in the context of the EMH and in the second one – if the iTraxx Europe index is related to the financial capitals dynamics, respectively. The both parts of the analysis will be made by the daily returns (r_t) formulated below by using daily closing prices of the stock markets of the countries:

$$r_t = \log\left(\frac{P_t}{P_{t-1}}\right) \tag{1}$$

Where P_t and P_{t-1} are the closing value of the market index at the current day and previous day, respectively. (Table 3).

Analyzing the SEE capital markets we use the GARCH model for testing the market efficiency. On the other hand, we use this model to examine the impact of iTraxx Europe index on the stock market dynamics. The selection of values p and q for used models is based on testing different combinations of values by applying the Akaike information criteria (AIC) test. The output combinations of parameters p and q are determined by the maximum value of 2 for both parameters and thus tested are the following combinations: (1,1), (2,1), (1,2) and (2,2). The selection procedure tries to find a combination of the two parameters that leads to more successful modeling of the studied data. The appropriate model has been chosen for each index (using the AIC values of each model, Table 4).

However studying the relationship between stock market returns and iTraxx Europe index in the second part of the analysis, we will apply GARCH model and Granger causality test. The data used in this study consists of daily closing quotes for iTraxx CDS Europe indexes. The index is with 5-years maturity and is denominated in Euro. All index quotes are available by the International Index Company. Using daily data, we point out a potential problem caused by the presence of nonsynchronous trading effect. We deal with this effect which is induced by different number of observations in the analyzed series. To address this problem, we propose a data- matching process. To achieve synchronicity and compatibility between daily returns data of the explored South Eastern Europe indices and daily returns data of iTraxx Europe indices, from the observations of daily returns of the benchmark CDS indices – iTraxx Europe have been removed the values for the days that were not trading (holiday) for the relevant SEE capital market. Also for the days that have been trading for the capital markets in SEE, but not for iTraxx Europe, we use data for the last trading day of iTraxx Europe indices. We describe the data- matching process, we proposed, because due to nonsynchronous trading effects, the results that we receive if we have skipped it may lead to substantially different conclusions (Baumöhl and Vÿrost, 2010).

Higher order GARCH models, denoted GARCH (q, p) can be estimated by choosing either q or p > 1 where q is the order of the autoregressive GARCH terms and p is the order of the moving average ARCH terms.

The representation of the GARCH (q, p) variance is:

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 + \sum_{i=1}^{p} \beta_i \varepsilon_{t-i}^2 \tag{2}$$

3.1. Granger Causality

Correlation does not necessarily imply causation in any meaningful sense of that word. The econometric graveyard is full of magnificent correlations, which are simply spurious or meaningless. Interesting examples include a positive correlation between teachers' salaries and the consumption of alcohol and a superb positive correlation between the death rate in the UK and the proportion of marriages solemnized in the Church of England. Economists debate correlations which are less obviously meaningless.

The Granger (1969) approach to the question of whether x causes y is to see how much of the current y can be explained by past values of y and then to see whether adding lagged values of x can

Table 3: Analyzed stock exchanges, indices and a number of observations

Country	Stock exchange	Index	Period under examination	Number of observations
Bulgaria	Bulgarian stock exchange	SOFIX	25.02.2009-04.11.2015	1653
Romania	Bucharest stock exchange	BET	26.02.2009-04.11.2015	1684
Croatia	Zagreb stock exchange	CROBEX	10.03.2009-04.11.2015	1663
Slovenia	Ljubljana stock exchange	SBI TOP	24.12.2008-04.11.2015	1718
Turkey	Borsa Istanbul	BIST100	21.11.2008-04.11.2015	1746

Source: Authors' calculations

Table 4: The appropriate GARCH model of the GARCH-family models for each index, applying to examine the market efficiency

Indices	The appropriate GARCH model
SOFIX	GARCH $(1,1)_{-t}$
BET	GARCH $(1,2)_{-t}$
SBI TOP	GARCH $(1,1)_{-t}$
BIST100	GARCH $(1,1)_{-t}$
CROBEX	GARCH $(1,1)_{-t}$

Source: Authors' calculations. GARCH: Generalized autoregressive conditional heteroskedasticity

improve the explanation. y is said to be Granger-caused by x if x helps in the prediction of y, or equivalently if the coefficients on the lagged x's are statistically significant. Note that two-way causation is frequently the case; x Granger causes y and y Granger causes x.

It is important to note that the statement "x Granger causes y" does not imply that y is the effect or the result of x. Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term.

E-Views runs bivariate regressions of the form:

$$y_t=\alpha_0+\alpha_1 y_{t-1}+\ldots+\alpha_1 y_{t-1}+\beta_1 x_{t-1}+\ldots+\beta_1 x_{t-1}+\varepsilon_t \tag{3}$$

$$xt=\alpha_0+\alpha_1 x_{t-1}+\ldots+\alpha_1 x_{t-1}+\beta_1 y_{t-1}+\ldots+\beta_1 y_{t-1}+u_t \tag{4}$$

For all possible pairs of (x, y) series in the group.

3.2. Augmented Dickey–Fuller (ADF) Test

The ADF test constructs a parametric correction for higher-order correlation by assuming that the y series follows an AR (p) process and adding p lagged difference terms of the dependent variable y to the right-hand side of the test regression:

$$\Delta y_t = \alpha y_{t-1} + x_t^{'}\delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + \ldots + \beta_p \Delta y_{t-p} + v_t \tag{5}$$

4. EMPIRICAL RESULTS

4.1. Stationary

Before analyzing the linkages between SEE stock indices and iTraxx Europe index, the ADF test are applied to examine the stationary properties of the iTraxx Europe series and return series. The null hypothesis of ADF test is that the series has a unit root (non-stationary process). It can be seen from the Table 5, the series are stationary at their first difference. So it is said that they are integrated in the order one.

4.2. Market Efficiency

Table 6 presents the values of coefficient of persistence of the SEE indices for the post-crisis period. The coefficients of persistence range from 0.926833 (SBI TOP) to 0.989287 (CROBEX) for the examined period. We should make important remark here that the Slovenian index SBI TOP has the lowest value of the coefficient of persistence which lead us to the conclusion that this index is the most efficient one of the group. On contrast, the coefficient of persistence for the Croatian index CROBEX has the highest value (0.989287) register that this index is the most inefficient one. With this in mind, the analyzed indices can be divided into two groups according to the values of the coefficient of persistence (below or above the arithmetic mean 0.96). Within the first group are indices SBI TOP and SOFIX which value of coefficient of persistence is <0.96 implies that shocks decay with time. The second group contains indices CROBEX, BET and BIST100 with a coefficient of persistence >0.96 represents the change in the response of shocks to volatility persistence, implies that the response of volatility increases with time. To put it another way, the SEE indices from the first group are relatively high efficient while the rest - with relatively low market efficiency. Here, we can make an assumption that these capital markets don't have homogenous and synchronous behavior during the post crisis period of recovery. What is more, the division into two groups due to the level of market efficiency cannot be made on the basis developed – developing markets of the region.

Summarizing the results above for the post-crisis period, we can conclude that the examined indices are not characterized with market efficiency according to the EMH. In the group of relatively low efficient markets are Croatia, Romania and Turkey because of the high values of the coefficient of persistence indicating that market information has large effect on the volatility. Respectively, within second group are relatively high efficient markets – Bulgaria and Slovenia. All things considered, it seems reasonable to assume that these SEE capital markets aren't efficient in the context of EMH. What is more they don't have homogenous and synchronous market dynamics after the crisis. However the examined financial markets cannot be separated into groups according the basis developed-developing markets.

4.3. Linkages between Stock Indices and iTraxx Europe Index

4.3.1. The impact of the iTraxx Europe index on the capital market dynamics

The Table 7 shows the values of the iTraxx Europe index in the equation of GARCH (p, q) model. We should note that for three of the examined indices there are statistically significant values at 5% of the iTraxx Europe. Moreover, the absolute values of the iTraxx Europe index range from 0.064954 (SOFIX) to

0.232885 (BIST100). Remarkably, the highest value of iTraxx Europe is registered for BIST100, indicating that this index has a relatively significant influence on the dynamics of developing Turkish capital market. Here, we should specify that the other statistically significant iTraxx Europe index are calculated only for the emerging SEE capital markets – Bulgarian (−0.064954) and Slovenian (0.088761). One of the possible explanation of the registered insignificant values of iTraxx Europe for the defined from us as developed Croatian market is that this data is already included in the pricing decisions of the market agents. Here we can make a conclusion that the iTraxx Europe index has influence on the capital market dynamics of Bulgaria, Slovenia and Turkey therefore on the prices of financial assets.

Table 5: Estimating results of ADF test

Country/indices	Parameters	Stock index return	iTraxx Europe
Bulgaria	ADF statistic	−17.64608	−29.77233
	Critical values (%)		
	1	−3.434142	−3.434109
	5	−2.863102	−2.863087
	10	−2.567649	−2.567641
	P value	0.0000	0.0000
Croatia	ADF statistic	−19.08251	−38.19688
	Critical values (%)		
	1	−3.434123	−3.434083
	5	−2.863093	−2.863076
	10	−2.567645	−2.567635
	P value	0.0000	0.0000
Romania	ADF statistic	−20.51754	−38.38557
	Critical values (%)		
	1	−3.434066	−3.434034
	5	−2.863068	−2.863054
	10	−2.567631	−2.567623
	P value	0.0000	0.0000
Slovenia	ADF statistic	−20.01663	−38.73776
	Critical values (%)		
	1	−3.433998	−3.433957
	5	−2.863038	−2.863020
	10	−2.567615	−2.567605
	P value	0.0000	0.0000
Turkey	ADF statistic	−20.51754	−39.04375
	Critical values (%)		
	1	−3.434066	−3.433897
	5	−2.863068	−2.862993
	10	−2.567631	−2.567591
	P value	0.0000	0.0000

All of the stock index returns and iTraxx Europe, respectively are stationary at 1st difference. Source: Authors' calculations. ADF: Augmented dickey–Fuller

All things considered, we find evidence that the iTraxx Europe index has predictive capability, connecting with the financial market dynamics of the emerging and developed SEE capital markets. The iTraxx Europe index has influence on the capital market dynamics of developing markets of Bulgaria and Slovenia and respectively developed Turkish market, therefore on the prices of financial assets.

Furthermore the coefficient of persistence of SOFIX demonstrates the highest degree of fluctuation after we have included the daily returns of iTraxx Europe indices as an explanatory variable. The result reveals the following fluctuation - from 0.946435 to 1.344777 - which is the largest increase in the coefficient of persistence for all SEE indices. This can be interpreted on a base of EMH, that the fluctuations of iTraxx Europe indices increase their absolute values from (0.962880) to (0.964471) for Turkish capital market- and from (0.926833) to (0.927011) for the Slovenian one. We observe an increase in the coefficients of persistence again, but with a lower amendment than the Bulgarian SOFIX- the increase for Turkish capital market is (0.001589) and for the Slovenian one is (0.000178) in absolute values. The results from GARC modeling of daily returns of the observed variables reveal that during post- crisis period the turn on of iTraxx Europe Indices as an explanatory variable for the capital markets from SEE, especially for Bulgaria, Slovenia and Turkey decreases their information efficiency. So we can determine that the process of information transaction and incorporation is reduced, especially for Bulgaria.

4.3.2. Relationship between the returns of stock market indices and the returns of iTraxx Europe index

The researching transmission mechanism of credit risk at different markets is a factor that allows us to make difference between the

Table 6: Estimating results of GARCH model on the stock market indices

Variable	SOFIX	CROBEX	BET	SBI TOP	BIST100
The most appropriate GARCH model	GARCH $(1,1)_{-t}$	GARCH $(1,1)_{-t}$	GARCH $(1,2)_{-t}$	GARCH $(1,1)_{-t}$	GARCH $(1,1)_{-t}$
Mean equation					
Ø (Constant)	1.94E-06	−0.000101	0.000525	−0.000161	0.001218
DUM (P value)	(0.9916)	(0.4839)	(0.0101)	(0.4157)	(0.0001)
Variance equation					
ω (Constant)	7.16E-06	6.01E-07	4.51E-06	8.30E-06	8.64E-06
(P value)	(0.0000)	(0.0062)	(0.0004)	(0.0001)	(0.0005)
ARCH (1)	0.235893	0.061052	0.183072	0.176159	0.067432
(P value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
ARCH (2)					
(P value)					
GARCH (1)	0.710542	0.928035	0.297778	0.750574	0.895448
(P value)	(0.0000)	(0.0000)	(0.0521)	(0.0000)	(0.0000)
GARCH (2)			0.496834		
(P value)			(0.0003)		
Coefficient of persistence	0.946435	0.989287	0.977684	0.926833	0.962880

Source: Authors' calculations. GARCH: Generalized autoregressive conditional heteroskedasticity various levels of market efficiency for developed and developing countries. In our research the aforementioned mechanism is revealed by Granger causality test. To determine the number of lags in our model, Akaike and Schwarz information criteria are applied; in our sample a lag of 4 is selected according to these criteria for all of the researched cases. Analyzing Granger causality test results on the returns of daily series indicates that causality exists in both directions: The returns of stock market indices granger cause the return of iTraxx Europe indices and vice versa. In the post- crisis period we observe significant relationship between both variables for all of the researched countries at 4 lags (Table 8).

1. It is noticeable that of the examined post- crisis period at 4 lags, we observe one way casual determining informational influence of stock markets over the iTraxx Europe of the following countries: Bulgaria and Croatia. In our paper Croatian capital market is characterized as a developed one, but the Granger Causality results are identical to the Bulgarian ones: SOFIX granger causes iTraxx Europe; CROBEX granger causes iTraxx Europe, so we have to make a remark that according to the aforementioned results, at 4 lags during the post- crisis period capital markets may be a leading factor for credit default swap markets. This result is in line with the studies of Bystrom (2008) and Fung et al. (2008) which have shown that information is firstly embedded in stock markets and then transported into the market of credit default swap.
2. On the other hand for the Romanian BET, the relationship between both series possesses an opposite deterministic influence, compared to the ones in Bulgaria and Croatia. In Romania we reveal that iTraxx granger causes BET at 4 lags in the post- crisis period. iTraxx is a financial tool which reacts sensitively towards negative or positive information flows. These information flows are deterministic for the dynamics of the stock market indices. If we concern the Granger Causality test results to EMH, we should classify Romania capital market as more effective than Bulgarian and Croatian ones, so it means that the Romanian stock market may be classified as an efficient during the post- crises period. What we should emphasize is the fact that the existing relation "iTraxx Europe- stock markets" for Romania, may classify it as more developed than Bulgaria and Croatia. The raising degree of market completeness, related to the transmission mechanism of informational flows from iTraxx Europe to capital markets, may be accepted as an acknowledgment of EMH. In the conditions of post-crisis recovery the Granger

Table 7: Estimating results of GARCH models for the influence of the iTraxx Europe on the capital market dynamics

Variable	SOFIX	CROBEX	BET	SBI TOP	BIST100
The most appropriate GARCH model	GARCH $(1,1)_{-t}$	GARCH $(1,1)_{-t}$	GARCH $(1,2)_{-t}$	GARCH $(1,1)_{-t}$	GARCH $(1,1)_{-t}$
Mean equation					
Ø (Constant)	2.68E-05	−0.000108	0.000515	−0.000194	0.001083
DUM (P value)	(0.8848)	(0.4542)	(0.0121)	(0.3241)	(0.0006)
Variance equation					
ω (Constant)	7.09E-06	6.00E-07	4.52E-06	8.27E-06	8.33E-06
(P value)	(0.0000)	(0.0062)	(0.0004)	(0.0001)	(0.0007)
iTraxx Europe (P value)	−0.064954	0.012117	0.032169	0.088761	0.232885
	(0.0447)	(0.6835)	(0.4444)	(0.0107)	(0.0000)
ARCH (1)	0.237692	0.060969	0.183278	0.176220	0.068835
(P value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
ARCH (2)					
(P value)					
GARCH (1)	1.107085 (0.0000)	0.928162	0.294088	0.750791	0.895636
(P value)		(0.0000)	(0.0522)	(0.0000)	(0.0000)
GARCH (2)			0.500308		
(P value)			(0.0002)		
Coefficient of persistence	1.344777	0.989131	0.977674	0.927011	0.964471

Source: Authors' calculations. GARCH: Generalized autoregressive conditional heteroskedasticity

Table 8: Granger causality test results for establishing the informational influence and relationship between the returns of stock market indices and the returns of iTraxx Europe index (4 lags)

Country	Null hypothesis	F-statistic	P value	Decision
Bulgaria	SOFIX does not Granger cause ITRAXX	2.71053	0.0287	ITRAXX←SOFIX
	ITRAXX does not Granger cause SOFIX	0.42411	0.7913	
Croatia	CROBEX does not Granger cause ITRAXX	7.68635	4.E-06	ITRAXX←CROBEX
	ITRAXX does not Granger cause CROBEX	2.13462	0.0742	
Romania	BET does not Granger cause ITRAXX	2.29720	0.0570	ITRAXX→BET
	ITRAXX does not Granger cause BET	8.48452	9.E-07	
Slovenia	SBI TOP does not Granger cause ITRAXX	2.85876	0.0224	ITRAXX↔SBI TOP
	ITRAXX does not Granger cause SBI TOP	4.61031	0.0011	
Turkey	BIST100 does not Granger cause ITRAXX	8.24810	1.E-06	ITRAXX↔BIST100
	ITRAXX does not Granger cause BIST100	4.92874	0.0006	

Null hypothesis rejection at 5% significance level and acceptance of the alternative hypothesis which determine informational influence of the relevant variable. Source: Authors' calculations

Causality Test results reveal that the changes in values of iTraxx is an important indicator for the stock market that present upcoming risk. If the swaps "sense" risk in the contemporary conditions, it will be obligatory reflected by the price valuating at the stock market of Romania.

3. In Slovenia- a country with a developing capital market- and Turkey- a country, considered by us as a developed one, the iteration between both explored financial markets is bilateral i.e. capital markets granger cause iTraxx Europe and vice versa. In a post- crisis period this bilateral relationship is important for risk managers using CDS indices as a tool for hedging purposes. This link allows investors to transfer and operate with credit risk in a more efficient manner. When we explore bilateral relationship between both of the series, it means that they influence one another. For Turkey and Slovenia we observe information interaction with absence of dominating deterministic influence from stock markets to iTraxx and vice versa, so according to EMH we may classify them as effective.

5. CONCLUSION

The emerging capital markets in Romania and the developed Turkish and Croatian market can be defined with inefficiency according to the EMH during the post-crisis period. Only developing Bulgarian and Slovenian stock markets are characterized with efficiency due to the low values of the coefficient of persistence. All things considered, it is reasonable to assume that SEE capital markets aren't efficient in the context of EMH. These results are consistent with the findings of Ivanov et al. (2012). They investigate the market efficiency of seven emerging East-European stock exchanges (Serbia, Romania, Turkey, Croatia, Russia, Ukraine, and Bulgaria) in respect of long-range dependence. The authors establish that for all of the examined indices there is clearly an indication for deviation from Random walk hypothesis and thus the studied markets manifest inefficiency.

Moreover, the iTraxx Europe index has predictive capability, connecting with the financial market dynamics of the emerging and developed SEE capital markets. The iTraxx Europe index has influence on the capital market dynamics of developing markets of Bulgaria and Slovenia and respectively developed Turkish market, therefore on the prices of financial assets. In the post- crisis period the market impulses of iTraxx Europe determine in a higher degree the dynamics of the return of BIST 100 compared to other studied SEE indices- especially for Bulgarian SOFIX and the Slovenian SBI TOP. The inclusion in the model of return on Bulgarian, Turkish and Slovenian indices of iTraxx Europe as a variable, leads to amendment in their information efficiency. Decreased information efficiency of Bulgarian, Turkish and Slovenian indices reveals that in the post-crisis period market dynamics of the three indices is not strongly determined by the dynamics of iTraxx Europe and do not follow similar post-crisis market trend in general. Even though the dynamics of the return of iTraxx Europe has the most determinative influence over Turkish BIST 100, Bulgarian SOFIX demonstrates stronger reaction to the upcoming information from credit default swap market in particular- iTrax Europe indices in order to reduce its information efficiency. The more moderate reaction of SBI TOP and BIST 100, compared to SOFIX, related to the information influence of daily returns of iTraxx Europe may be explained by the bilateral causal relationship between both markets. The researching transmission mechanism of credit risk is observed from stock market indices to iTraxx Europe indices and vice versa. For Bulgaria and Croatia the causal relations are from stock market returns to Itraxx Europe. For the Romanian BET the informational flows from credit default swap market are in casual relationship with its capital market which may classify Romanian capital market as more developed and efficient than the Bulgarian and Croatian ones. In Slovenia and Turkey the iteration between both explored financial markets is bilateral, according to EMH in post- crisis period we may classify them as effective either.

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