ASSOCIATION AND INTERDEPENDENCY AMONG THE STOCK MARKETS OF SEVERAL FORMER YUGOSLAV COUNTRIES

Abstract

The article explores the long- and short-run association among the capital markets of several countries that emerged from the collapse of former Yugoslavia, as well as their dependency with one of the mature European markets. Two econometric techniques have been used to explore the inter-market linkages and the mutual influence among the markets. The Johansen cointegration framework applied to five markets pointed to the existence of one cointegrating vector, but the results could not be validated through standard tests. The Vector Autoregressive model revealed certain causal dependencies among the markets. These relationships should be understood as chronological ordering of the market trends, rather than as real spillovers of information or capital among the countries. These conclusions should teach the investors that they should closely follow the trends in the leading markets in order to provide themselves with timely information related to the composition of their portfolios.

Keywords: stock markets, volatility, cointegration, interdependency, portfolio.

JEL classification: G11, G12, G14, G15

1. Introduction

This research has been motivated by the creation of a joint trading platform by the stock exchanges (SE) of three Balkan countries (Bulgaria, Croatia and Macedonia), with two other countries joining additionally (Serbia and Slovenia). The inter-county trading should provide the investors from these countries with an opportunity to diversify their portfolios at a regional level. However, from experience we know that there are some interlinkages among the involved markets, while international diversification makes sense only if the markets are mutually not highly correlated. If the local markets are closely related, the benefits from international diversification become questionable.

The basic goal of this study is to determine the extent to which the markets of five former Yugoslav countries are interrelated. The countries are selected on the basis of their mutual past and the existing close economic relations (Bulgaria is not a former Yugoslav country). We expect that the findings related to level of association among the markets could help the investors determine if the international diversification limited to this region could prove beneficial. Further, we want to identify the potential causal relationships of these markets with some mature markets that could serve the investors as a guide to predict the trends in the market movements and adjust their investing strategies accordingly.

For this purpose, the most representative market indices of five countries are used as proxies for their overall trends. The first insight into the possible association among the markets is provided by the pairwise correlations based on their daily and weekly returns. In addition, cointegration analysis is applied in order to determine the long-run association and the short-run dependencies between the markets. Finally, a Vector Autoregressive model (VAR) is used to determine the possible causalities between the markets.

The rest of the paper is organized as follows. In the second part, we provide a survey of the most relevant literature in the field, related to the emerging markets. The third section is intended to give the reader a basic insight into the analyzed markets, so it contains a brief description of the stock markets and their mutual relationships. The fourth part is the crucial segment, covering the most important econometric techniques applied, such as cointegration analysis and VAR. The last section summarizes the conclusions and their implications.

2. Review of relevant literature

As a result of the globalization, the financial markets of various countries show increasingly common trends which tend to intensify during periods of financial crises. One possible reason for these co-movements lies in the economic fundamentals of different countries, which move in the same direction as a result of the economic globalization. The other explanation is that the co-movements evolve regardless of economic fundamentals, i.e. the positive (negative) trends from one market are transmitted to another, either as a result of the transfer of investable funds or due to some kind of behavioural bias or both.

Samitas et al. (2006) confirm the existence of a long-run relationship among several stock markets from the Balkan countries and the more mature markets the markets. Syriopulos (2007), through cointegration analysis, proves the existence of long-run linkages between the emerging Central European markets and those of US and Germany, but finds that the introduction of the euro has had no impact on these relationships.

Égert and Kocenda (2007) focus on three Central and Eastern European (CEE) markets and three Western European markets. Applying pair-wise cointegration tests on the basis of high frequency data, they find no long-run relationship among any of the market pairs, but the VAR and Granger causality tests verify the existence of some short-run dependencies. Syllignakis and Kouretas (2010) using recursive cointegration analysis find that the convergence between the CEE markets and the markets of the developed countries has increased as a result of the process of accession of these countries to the European Union. A similar conclusion is reached by Gilmore et al. (2008) in the cointegration analysis of the Czech, Polish and Hungarian stock markets with those of Germany and the UK. Kenourgios and Samitas (2011) explore the long-run relationship between five Balkan emerging stock markets, the US and three European developed markets in the period 2000-2009. Using regime-switching cointegration tests, they find evidence in support of the long-run cointegration among the Balkan markets and globally.

Dajčman and Festić (2012) use a dynamic conditional correlation GARCH analysis and find that there are interdependencies between the Slovenian stock market and some European stock markets and that these interdependencies have increased through time, with the financial crisis having a positive impact on this correlation. Horvath and Petrovski (2012) explore the co-movements between the markets of the Central and Southern European countries and those of Western Europe. Using a multivariate GARCH model, they conclude that the Central European markets are integrated with those of Western Europe, but it is not the case with the Southern European markets. Okičić (2014) uses a broader selection of stock market indices from the Central and Eastern Europe to explore the linkages and the spillover effects between them.

The general conclusion is that the interdependencies are the strongest among the developed markets, while the causality usualy follows the direction from developed towards less developed markets. (Berument and Ince, 2005; Samitas et al., 2006; Ye, 2014).

3. Overview of the analyzed markets and basic relationships among them

After a two-decade period of independent development, it seems that the stock exchanges of several post-transition economies in the Balkans got to realize that they should find a way of co-operation and integration as a means of increasing their turnover and liquidity. The aforementioned trading platform and the common past of the former Yugoslav countries inspired us to examine the degree of interrlationships that exist among their stock markets, as well as the directions of the possible interdependencies. Our study involves the stock exchanges in Ljubljana (Slovenia), Zagreb (Croatia), Belgrade (Serbia), Sarajevo (Bosnia and Herzegovina, BiH) and Skopje (Macedonia). Through the study, we want to determine if any co-movements exist within these markets and to what extent they could influence the diversification opportunities that the investors in these markets have from the regional diversification of their portfolios.

For better understanding of these markets, we provide a basic description that captures their crucial characteristics and the trends of their development during the last decade. Table 1 contains the basic statistical data of the analyzed markets.

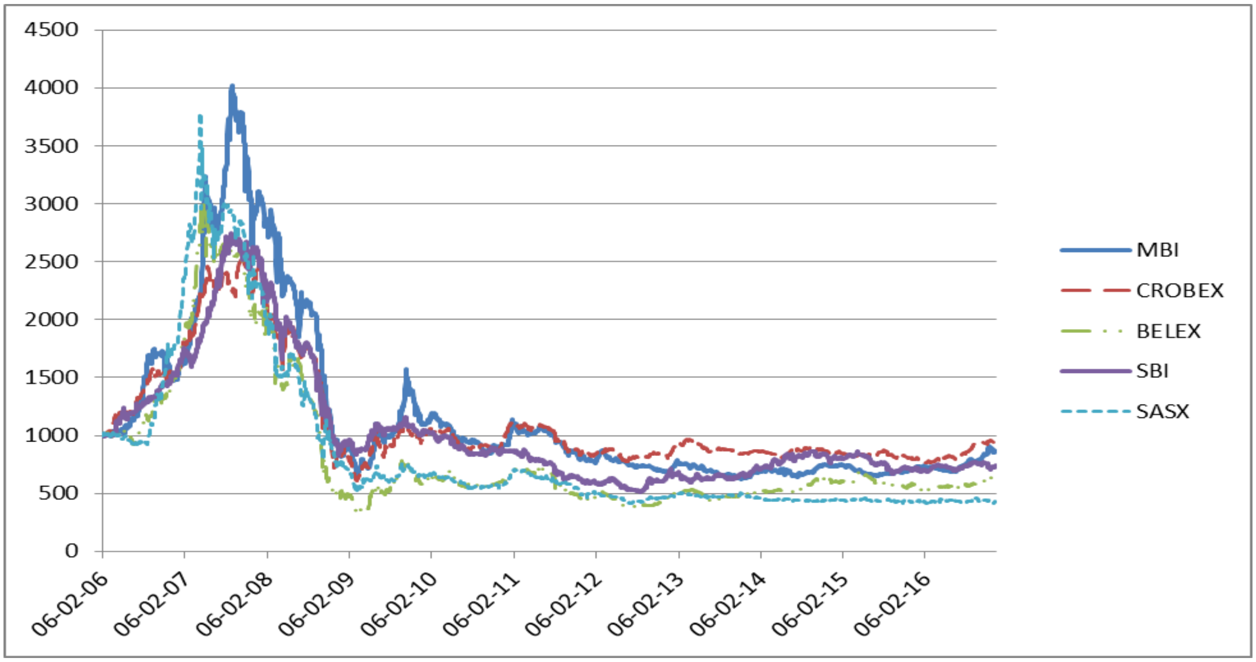
Table 1. Basic data for the national stock exchanges (2015, end of year or total)

	Slovenia - Ljubljana SE (LJSE)	Croatia – Zagreb SE (ZSE)	BiH - Sarajevo SE (SASE)	Serbia - Belgrade SE (BELEX)	Macedonia – Macedonian SE (MSE)
Number of listed companies (first market)	9	27	1	4	30
Number of companies trading on the standard market	11	135	30	4	114
Stock market capitalization – equity segment (in mil. euros)	5,523	16,949	2,911	2,745	1,667
Total market capitalization / GDP	12.33%	36.23%	12.2%	8.73%	18.36%
Total market turnover (in mil. euros)	393	468	624	186	43
Turnover of equities (in mil. euros)	334	396	164	142	32
Annual change in the main stock index (2015/2014)	-11.22%	-3.2%	-2.2%	-3.44%	-0.59%

Sources: Zagreb SE (Periodic Trading Reports), Macedonian SE (Annual Bulletin 2015), Bulgarian SE (Trading Data), Ljubljana SE (Annual Statistical Report 2015), Belgrade SE (Annual Report 2015), World Bank Statistics.

These figures show permanent decline from their all-time highs recorded in 2007. At that time, the total market turnover, the market capitalization and the indices reached unprecedented levels, which the investors are still awaiting to repeat.

Figure 1 depicts the movement of the market indices over the entire analyzed period. It clearly shows the dramatic swings of the stock markets in the period 2005-2008 and the calm period afterwards.



(Legend: SASX-index of the Sarajevo SE; MBI-MSE; CROBEX-ZSE; BELEX-BELEX; SBI-LJSE)
Sources: Zagreb SE, Macedonian SE, Bulgarian SE, Ljubljana SE, Belgrade SE, World Bank Statistics.

Figure 1. Stock market indices (base set at 1.000 on 6.2.2006)

The chart visually proves the similar paths that these markets have followed during the last decade. In the following table, we provide a simple statistical illustration of the observed relationships.

Table 2. Contemporaneous correlations between the stock exchange indices

2006-2016					
	Daily returns			**Weekly returns**	
	LJSE	ZSE	SASX	BEL	MSE
LJSE		0.47	0.27	0.36	0.28
ZSE	0.07		0.39	0.47	0.37
SASX	-0.02	0.12		0.41	0.32
BEL	0.02	0.27	0.20		0.40
MSE	0.05	0.16	0.15	0.24	

2006-2009					
	Daily returns			**Weekly returns**	
	LJSE	ZSE	SASX	BEL	MSE
LJSE		0.54	0.34	0.43	0.35
ZSE	0.09		0.44	0.52	0.40
SASX	-0.01	0.15		0.47	0.37

BEL	0.02	0.32	0.23		0.46
MSE	0.06	0.15	0.18	0.24	

Source: Author's calculations

The lower left corner (shaded area) shows correlations based on daily returns. The upper right corner shows the correlations based on weekly returns.

Table 2 is based on the daily and weekly returns of the most relevant stock market indices in the observed markets. Having in mind the obvious difference in terms of market liquidity and the overall market trends between the 2006-2009 period and the years afterwards, the data are shown separately for the first subperiod and the entire 2006-2016 period. One can easily conclude that the correlations between the markets are positive in almost all pair-wise combinations. This is especially true for the weakly returns, which exhibit correlations in the range 0.27-0.54. Therefore, the first impression is that these markets are interrelated and that there might be some spillover effects among them.

However, the correlation coefficients are not a perfect measure of the inter-market association. They are contemporaneous measures and they cannot capture the possible time lags, i.e. the spillover of effects among the exchanges. To attain successful diversification of their portfolios, the investors need to know if there is a long-term association between the markets. In order to explore the longer-term relationships and different types of causality among the markets, we need to apply some more sophisticated techniques, such as cointegration and VAR analysis.

4. Data and methodology

4.1. Testing for cointegration

Cointegration is a contemporary technique used to determine if there are any long-term relationships between two or more time series of data. If the analyzed markets are found to be cointegrated, it would mean that there is a higher degree of integration among them, and therefore, in the long run, they provide less diversification benefits than markets which are not.

In this section, we first want to check if there are any cointegrationg vectors amon the analyzed markets. For this purpose, we use the weekly returns of the analyzed stock indices, for the period 6.2.2006-31.12.2016.[1] Other studies use higher frequency data (daily, hourly, etc.), while our reason for using weekly values is that the frequency of data used should depend on the assessment of the speed at which information is transmitted among the markets (Černy and Koblas, 2008). The level of liquidity in these markets supports the use of weekly data, rather than daily or hourly index values. As usual in financial studies, the index returns are calculated using the logged weekly closing values of the stock indices in two consecutive weeks:

$$R_{it} = ln\ (I_{it} / I_{it-1}) * 100$$

[1] The values of the Sarajevo Stock Exchange index – SASE ar available as of 3.2.2016, which limits the length of our time series.

where R_{it} is the weekly return of stock market index *i* in week *t* and I_{it} is the closing value of stock market index *i* in week *t*. In the case of non-working days, the index value in the last working day was used.

First, we apply the Augmented Dickey-Fuller (ADF) test to check if the time series are stationary. The test has shown that the variables are not stationary at their log levels, but they are all stationary in their first differences, so that we can proceed with the cointegration analysis. Next, using all five indices at the same time, we apply the Johansen cointegration test, which is supposed to show if there is a linear combination of the indices which is stationary, i.e. to show if the five markets are bound by some association in the long run. For this purpose, we need to determine the optimal lag level. According to the Akaike Information Criterion (AIC), 2 periods is the optimal time lag, while the Schwarz criterion suggested a lag of 0 periods. Since the goal is to determine the inter-market dependency and a prolonged transmission of impacts, I decided to use a two-period time lag.

Applying a two-period time lag, the Johansen cointegration test showed that there is a cointegration among the five markets. Both the trace test and the maximum eigenvalue test (table 3) confirmed the existence of two cointegrating vectors, or, in other words, the null hypothesis of no cointegrating vectors has been rejected at the 1% level of significance by both tests.

Table 3: Results of Johansen's Co-integration Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.068602	90.46958	69.81889	0.0005
At most 1 *	0.052825	50.24465	47.85613	0.0293
At most 2	0.024089	19.52722	29.79707	0.4555
At most 3	0.007673	5.726174	15.49471	0.7276
At most 4	0.002412	1.366575	3.841466	0.2424

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.068602	40.22493	33.87687	0.0077
At most 1 *	0.052825	30.71743	27.58434	0.0191
At most 2	0.024089	13.80105	21.13162	0.3816
At most 3	0.007673	4.359598	14.26460	0.8196
At most 4	0.002412	1.366575	3.841466	0.2424

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Author's calculations

These results suggest that a long-run relationship should exist among the five stock exchanges, which could prevent investors to obtain long-term benefits as a result of the regional diversification. However, the existence of long-run association does not preclude the short-run deviations from the general trend, which could provide the investors with the opportunity to make short-term gains. The existence of any short-term relationships is examined by using a Vector Error Correction Model (VECM). We apply the Maximum Likelihood approach developed by Johansen (1988).

The main information that we want to derive from the VECM is the error correction coefficient which is expected to be negative and significant, indicating whether the disequilibrium is being corrected for.

Table 4. Cointegrating vector equation and VECM coefficients

Error Correction:	D(LLJU)	D(LCRO)	D(LSASE)	D(LBEL)	D(LMBI)
CointEq1	-0.012334	-0.021448	0.000365	0.007147	-0.000332
	(0.00469)	(0.00504)	(0.00613)	(0.00624)	(0.00570)
	[-2.63013]	[-4.25779]	[0.05955]	[1.14577]	[-0.05820]
CointEq2	-0.035652	-0.081171	0.012464	0.049499	0.023984
	(0.01993)	(0.02141)	(0.02606)	(0.02651)	(0.02423)
	[-1.78902]	[-3.79198]	[0.47831]	[1.86743]	[0.98987]

Source: Author's calculations

The table shows that the error correction coefficients in the case of the Slovenian (in the first) and the Croatian (in both models) markets are negative and significant, which is a necessary condition for a functional VECM. It shows the speed of adjustment of the markets towards a long-run equilibrium and the negative sign means that the disequilibrium is being corrected for in the coming periods.

However, before proceeding with the Wald test to determine if the lagged coefficients for each of the markets used as independent variables in the VECM are jointly zero, we run checks of validity of the VECM using a number of standardized tests. These tests included: the Breusch-Godfrey LM test to examine the existence of serial correlation in the residuals, the Breusch-Pagan-Godfrey test of the hetheroscedasticity of the residuals and the Jarque-Berra test for normality. The results of these tests did not confirm the validity of the obtained model coeficients and the outcomes of the cointegration testing. In such cases the theory recommends the use of a Vector Autoregressive model which would enable us to determine if there is any causality among the analyzed stock indices.

4.2. VAR estimation results

A VAR model using the weekly returns on the five observed indices was developed. In order to identify the possible links of these with the mature markets, the geographically closest market was added to the analysis, the Vienna Stock Exchange, i.e. its market index - ATX. Some causal relationships were expected to be revealed among the analyzed markets and also between them and the mature markets, having in mind the impact that these markets have had on the Balkan exchanges in the past through the transfer of information, flow of investable funds and probably as a result of certain behavioural biases.

For this purpose, I use a six-equation vector autoregressive model that incorporates the six stock exchange indices of all the analyzed markets as dependent variables. The VAR equation applied is as follows:

$$X_t = f_0 + \sum_{j=1}^{L} f_{1j} X_{t-j} + u_t \tag{2}$$

where X_t is a vector that represents the weekly returns on the stock indices, L is the number of lags and u_t is a vector of residuals.

The first step in the development of a VAR model is to determine the optimal number of lags. For this purpose, we apply the standard lag order selection criteria need. The Schwartz and the Hannan-Queen criteria result in an optimum of zero lags, while the outome of the Akaike Informartion Criterion and the Final Prediction Error suggests that four lags should be used (the table of results is not given, available at request). Having in mind the nature of the VAR model, a four week lag will be applied.

A VAR model with 6 endogenous variables produces extensive output, which is given in table 5. As mentioned, the variables of the model are the weekly stock market returns: AUST, SLOV, CROA, BIH, SERB, MACE (the abbreviations are self-explanatory). Since the ordering of the variables in a VAR model is important, to preserve neutrality, the markets are orderred geographically, moving from west to the east. The bold numbers refer to the statistically significant coeficients.

Table 5. VAR model coefficients

	RVIE	RLJU	RCRO	RSASE	RBEL	RMBI
RVIE(-1)	-0.011804	**0.075782**	**0.081205**	-0.036107	**0.095927**	0.018281
	(0.05301)	**(0.03642)**	**(0.03937)**	(0.04793)	**(0.04836)**	(0.04353)
	[-0.22268]	**[2.08078]**	**[2.06250]**	[-0.75328]	**[1.98355]**	[0.41996]
RVIE(-2)	0.021533	0.053422	0.075809	0.023227	**0.096237**	**-0.097930**
	(0.05323)	(0.03657)	(0.03954)	(0.04813)	**(0.04856)**	**(0.04371)**
	[0.40452]	[1.46069]	[1.91738]	[0.48254]	**[1.98161]**	**[-2.24023]**
RVIE(-3)	-0.062743	-0.057612	-0.070757	-0.029466	-0.022679	**-0.150414**
	(0.05381)	(0.03697)	(0.03997)	(0.04866)	(0.04909)	**(0.04419)**
	[-1.16606]	[-1.55839]	[-1.77043]	[-0.60560]	[-0.46199]	**[-3.40401]**
RVIE(-4)	0.069290	-0.048341	0.005199	0.009994	0.022225	**-0.097331**
	(0.05313)	(0.03650)	(0.03946)	(0.04804)	(0.04847)	**(0.04363)**
	[1.30420]	[-1.32432]	[0.13174]	[0.20803]	[0.45852]	**[-2.23084]**
RLJU(-1)	-0.083962	-0.089105	0.015564	0.149958	-0.004366	0.077886
	(0.07335)	(0.05039)	(0.05448)	(0.06632)	(0.06692)	(0.06023)
	[-1.14474]	[-1.76819]	[0.28569]	[2.26102]	[-0.06524]	[1.29309]
RLJU(-2)	-0.083664	-0.014081	-0.028089	-0.147832	-0.073693	0.087305
	(0.07355)	(0.05054)	(0.05463)	(0.06651)	(0.06711)	(0.06040)

	[-1.13746]	[-0.27863]	[-0.51415]	[-2.22268]	[-1.09817]	[1.44538]
RLJU(-3)	0.010445	**0.116635**	**0.123163**	0.080232	0.066746	0.033416
	(0.07397)	**(0.05082)**	**(0.05494)**	(0.06688)	(0.06748)	(0.06074)
	[0.14122]	**[2.29506]**	**[2.24179]**	[1.19955]	[0.98908]	[0.55013]
RLJU(-4)	0.078549	0.011435	-0.021299	0.023719	-0.009703	0.070469
	(0.07423)	(0.05100)	(0.05514)	(0.06712)	(0.06772)	(0.06096)
	[1.05817]	[0.22420]	[-0.38630]	[0.35336]	[-0.14328]	[1.15599]
RCRO(-1)	-0.062565	-0.018361	-0.026683	0.099175	**0.202327**	0.044535
	(0.07688)	(0.05282)	(0.05711)	(0.06952)	**(0.07014)**	(0.06314)
	[-0.81375]	[-0.34758]	[-0.46724]	[1.42651]	**[2.88442]**	[0.70535]
RCRO(-2)	0.018138	0.003372	0.074337	-0.029012	0.079146	0.020264
	(0.07708)	(0.05296)	(0.05725)	(0.06970)	(0.07032)	(0.06330)
	[0.23533]	[0.06368]	[1.29847]	[-0.41626]	[1.12551]	[0.32014]
RCRO(-3)	-0.015292	-0.035392	-0.020154	0.029308	-0.051512	**0.129947**
	(0.07579)	(0.05208)	(0.05630)	(0.06854)	(0.06915)	**(0.06224)**
	[-0.20176]	[-0.67963]	[-0.35799]	[0.42762]	[-0.74493]	**[2.08770]**
RCRO(-4)	-0.099944	**0.110866**	0.023408	0.077180	0.123370	0.106653
	(0.07611)	**(0.05230)**	(0.05653)	(0.06883)	(0.06944)	(0.06251)
	[-1.31310]	**[2.12001]**	[0.41405]	[1.12137]	[1.77660]	[1.70630]
RSASE(-1)	0.020442	-0.004785	-0.005348	-0.049684	0.025827	**-0.125307**
	(0.05311)	(0.03649)	(0.03945)	(0.04802)	(0.04845)	**(0.04361)**
	[0.38491]	[-0.13113]	[-0.13558]	[-1.03460]	[0.53305]	**[-2.87320]**
RSASE(-2)	**0.111211**	**0.087217**	0.045104	0.037772	0.089541	0.003529
	(0.05364)	**(0.03686)**	(0.03984)	(0.04851)	(0.04894)	(0.04405)
	[2.07322]	**[2.36646]**	[1.13204]	[0.77872]	[1.82963]	[0.08010]
RSASE(-3)	**0.117339**	**0.101416**	0.041639	0.108905	0.099822	0.079672
	(0.05324)	**(0.03658)**	(0.03954)	(0.04814)	(0.04857)	(0.04372)
	[2.20398]	**[2.77252]**	[1.05296]	[2.26214]	[2.05510]	[1.82227]
RSASE(-4)	**-0.177828**	**-0.156061**	**-0.156009**	-0.079421	-0.001780	**-0.169758**
	(0.05318)	**(0.03654)**	**(0.03950)**	(0.04809)	(0.04852)	**(0.04367)**
	[-3.34406]	**[-4.27138]**	**[-3.94978]**	[-1.65165]	[-0.03669]	**[-3.88727]**
RBEL(-1)	0.086006	0.058220	0.027297	**0.145920**	-0.007131	**0.142007**
	(0.05716)	(0.03927)	(0.04245)	**(0.05168)**	(0.05215)	**(0.04694)**
	[1.50473]	[1.48252]	[0.64299]	**[2.82327]**	[-0.13675]	**[3.02538]**
RBEL(-2)	0.094093	0.023252	0.088792	-0.025807	-0.041642	**0.149763**
	(0.05738)	(0.03942)	(0.04262)	(0.05188)	(0.05235)	**(0.04712)**
	[1.63993]	[0.58983]	[2.08350]	[-0.49742]	[-0.79550]	**[3.17846]**
RBEL(-3)	-0.022090	0.017312	0.073907	0.067904	**0.151539**	**0.157789**
	(0.05758)	(0.03956)	(0.04277)	(0.05207)	**(0.05254)**	**(0.04729)**
	[-0.38362]	[0.43757]	[1.72795]	[1.30407]	**[2.88446]**	**[3.33668]**
RBEL(-4)	-0.025479	0.040602	-0.001826	-0.083124	0.029748	0.089570
	(0.05681)	(0.03903)	(0.04220)	(0.05137)	(0.05183)	(0.04666)
	[-0.44846]	[1.04015]	[-0.04327]	[-1.61802]	[0.57391]	[1.91979]
RMBI(-1)	-0.009401	-0.002891	0.036016	-0.068507	-0.028914	-0.028353
	(0.05863)	(0.04028)	(0.04355)	(0.05302)	(0.05349)	(0.04815)
	[-0.16035]	[-0.07177]	[0.82705]	[-1.29222]	[-0.54056]	[-0.58890]
RMBI(-2)	0.012352	0.033366	**0.089127**	**0.151860**	-0.000339	0.054251
	(0.05746)	(0.03948)	**(0.04268)**	**(0.05196)**	(0.05242)	(0.04719)
	[0.21497]	[0.84516]	**[2.08828]**	**[2.92266]**	[-0.00647]	[1.14967]
RMBI(-3)	0.069365	0.021591	-0.014920	-0.021810	0.024998	-0.000581

	(0.05673)	(0.03898)	(0.04214)	(0.05130)	(0.05176)	(0.04659)
	[1.22272]	[0.55395]	[-0.35409]	[-0.42517]	[0.48299]	[-0.01247]
RMBI(-4)	0.017875	0.017656	-0.063788	-0.043339	-0.041027	-0.042232
	(0.05626)	(0.03866)	(0.04179)	(0.05088)	(0.05133)	(0.04620)
	[0.31771]	[0.45675]	[-1.52639]	[-0.85185]	[-0.79926]	[-0.91404]
C	-0.000515	-0.000336	1.88E-05	-0.001274	-0.000147	-0.000269
	(0.00158)	(0.00108)	(0.00117)	(0.00143)	(0.00144)	(0.00130)
	[-0.32665]	[-0.30943]	[0.01605]	[-0.89275]	[-0.10180]	[-0.20748]

We see from the table that the Macedonian SE is a recipient of impacts from Austria (2-, 3- and 4-week time lag), Croatia (3 week), Serbia (1, 2 and 3 weeks) and Bosnia and Herzegovina. The Croatian market is influenced by the Austrian and Slovenian markets, while the Serbian market recieves impacts from Austria, Slovenia and Croatia, etc.

In addition, we run the Granger causality tests with a four period time lag and the results of these tests are presented in table 6 below. The figures in the table represent the respective Chi-square test results.

Table 6. Granger causality tests (Chi-squares)

	AUST	SLOV	CROA	BIH	SERB	MACE
AUST		10.76**	11.64**	1.34	7.95*	18.97***
SLOV	3.37		5.93	13.23**	2.43	5.14
CROA	2.40	5.33		3.59	12.90**	7.57
BIH	21.08***	33.10***	18.80***		7.39	26.68***
SERB	5.20	3.91	6.90	11.33**		29.19***
MACE	1.72	1.33	7.09	11.05**	1.12	

The values show if a variable given in a particular row Granger causes the variable in the respective column. The asteriscs depict: ***-significance at 1% level, **-significance at 5% level, *-significance at 10% level.

Source: Author's calculations

The results show that the BiH market has the strongest influence on all the other markets, but we are very sceptical regarding this outcome. The impact of the Vienna stock exchange is important and very logical. The remaining markets seem to behave very logically – the trends are transferred from west to east. At this point, it should be noted that Granger causality does not mean that there is an association between two markets, but simply that the changes in one market chronologically precede the changes on the other market.

5. Conclusions

The correlation coefficients between the analyzed markets suggest that there is some kind of association among them that could undermine the benefits of regional portfolio diversification. The cointegration test is intended to determine if there are any long-run relationships among the markets, and although its initial outcome was positive, the additional tests were unable to prove the validity of this conclusion. Therefore, our first finding is that the investors in the region could still benefit from the diversification of their portfolios on a regional basis. The correlations between the markets show that they have a tendency to diminish compared to their pre-crisis levels, further increasing the potential for diversification benefits. Although they do not move together, the VAR model has shown that the markets are still interdependent and that there should be some level of lead-lag relationships among them. The Granger causality tests have shown that the mature markets have an impact on the markets of the former Yugoslav countries and that the trends move from west to east. The only unexpected outcome is the impact of the Sarajevo stock exchange on the other markets, which is doubtful and probably an accidental result rather than a real causality. The robustness of the resultss has been confirmed when this exchange was ommited and the conclusions for the other markets were exactly the same as previously found.

The implications of these findings are manifold. They spread over several areas and stakeholders: investors, capital market institutions, governments, etc. For the investors it is important to know that they could benefit from reduction of diversifiable risk through the expansion of their holdings accross the markets in the neighbouring countries. Also, the paper provides them with information related to the direction of the transfer of influences among the markets, so that they could predict the changes and make appropriate adjustments to their portfolios. For the policymakers, they should become more aware that the national capital markets are globally integrated and not isolated as thought before, so that they are prone to the transfer of financial crises as well. Finally, further research should focus on extending the analysis to other South-Eastern European markets, but also it could be enhanced by including other exogenous variables in the model to control for their possible impact on the identified relationships.

REFERENCES:

Berument, H. & O. Ince (2005). Effect of S&P500'S return on emerging markets: Turkish Experience. *Applied Financial Economics Letters*, 1, 59–64

Černy, A. & M. Koblas (2008). "Stock market integration and the speed of information transmission". *Czech Journal of Economics and Finance* 58, pp. 2–20.

Égert, B. & E. Kočenda (2007). "Time-Varying Comovements in Developed and Emerging European Stock Markets: Evidence from Intraday Data." *William Davidson Institute University of Michigan Working Paper* 861-07.

Gilmore, C., B. Lucey & G. McManus (2008). "The Dynamics of Central European Equity Market Integration". *Quarterly Review of Economics and Finance*, 48 (3), 605-622.

Dajčman, S. & M. Festić (2012). "Interdependence between the Slovenian and European Stock Markets – a DCC-GARCH Analysis". *Economic Research - Ekonomska istraživanja*, Vol. 25, No. 2, pp.379-396.

Horvath, R. & D. Petrovski (2013). "International Stock Market Integration: Central and South Eastern Europe Compared." *Economic Systems*, 37(1): 81-91.

Johansen, S. (1988). "Statistical analysis of cointegration vectors", *Journal of Economic Dynamics and Control*, 12, pp.231-254.

Kenourgios, D. & A. Samitas (2011). "Equity market integration in emerging Balkan markets". *Research in International Business and Finance*, vol. 25(3), pp. 296-307.

Okičić, J. (2014). “An Empirical Analysis of Stock Returns and Volatility: the Case of Stock Markets from Central and Eastern Europe”. *South East European Journal of Economics and Business*, Volume 9 (1), pp. 7-15, DOI: 10.2478/jeb-2014-0005

Samitas, A., D. Kenourgios & N. Paltalidis (2006). “Short and long run parametric dynamics in the Balkans stock markets”. *International Journal of Business, Management and Economics*, Vol. 2, No. 8, pp. 5-20

Syllignakis, M. & G. Kouretas (2010). “German, US and Central and Eastern European Stock Market Integration”. *Open Economies Review*, vol. 21, issue 4, pp. 607-628

Syriopoulos T. (2007). “Dynamic linkages between emerging European and developed stock markets: Has the EMU any impact?”. *International Review of Financial Analysis*, Vol. 16 (1), pp. 41–60

Syriopoulos, T. & E. Roumpis **(**2009). “Dynamic Correlations and Volatility Effects in the Balkans Equity Markets”. *International Financial Markets,Institutions and Money,* 19(4): 565-585.

Ye, G. L. (2014). “The Interactions between China and US Stock Markets: New Perspectives”. Journal of International Financial Markets, Institutions and Money, Vol.31: 331-342.