POSITION AND INTEGRATION OF BALKAN STOCK MARKETS

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Abstract

This paper investigates how global financial trends and shifts in neighboring stock markets concern the Belgrade Stock Exchange in short and long-run relations. To achieve such a goal, the study operates with daily values of stock market indices of three major stock markets (DJI, FTSE100 and NIKKEI225) and Balkan stock markets (BELEX15, CROBEX, SASX-10 and SOFIX). Applying a Markov Switching Vector Error Correction Model (MS-VECM), the study has ability to capture cointegrations and sudden shifts in transition probabilities of used financial data series. The level of market integration is presented by the parameters of the long-run equilibrium and the speed of adjustment estimated by a MS-VECM. Furthermore, modeling the shift of presented stock market indices has been encouraged by the fact that the change in regime should be considered as a random, not predictable event. Consequently, a MS-VECM provides a good characterization of domestic stock market opposite to a linear VECM which do not include any regime switches. Finally, findings towards integration of domestic stock market to neighboring and major world stock markets suggest that local investors can not avoid any influence from the outside of a national market even if some markets are still not fully opened to potential international investors.

Key words: Integration, Stock Markets, Error Correction Model, Markov Switching

JEL Code: G14, G15

Introduction

After the 2008 financial crisis, emerging stock markets become more integrated towards global market. After the 2008 financial crisis, emerging stock markets become more integrated towards global market. National markets are developing into open markets where market participants pursuing for better investment opportunities by following information from other stock markets. Nevertheless, according to Bae and Zhang (2015), financial market integration and stability do not always go together. In last couple of years, we have witnessed that financial risks can spread to other markets or other market segments. Indeed an increase of market integration can lead to the higher market volatility and unwanted exposure to foreign market disturbances. Therefore, the transmission of market turbulences is likely to be higher if international financial markets are more integrated (Assidenou, 2011).

Considering different aspects of a cost-benefit analysis of market integration, it is recognized as necessity to determine national market position in terms of its integration level into the global financial environment. Stock markets around the world have become increasingly integrated due to financial deregulation and technological developments that have reduced transaction and information costs. Many studies justified stock market integration through a decrease in the cost of capital (Bekaert and Harvey, 2000), an increase in real investment (Chari and Hendry, 2008) and economic growth (Baele et al., 2004).

The existence of cointegration relationships among financial markets leads to the rejection of any form of market efficiency hypothesis in general. With possession of relevant information about market movements, potential investors are able to predict future trends of stock returns. In such a case, there are no extra profits yielded by individual market participants. Otherwise, the lack of cointegration relations makes investment opportunities through better risk diversification in global financial environment.

1 Literature review

With the development of the first techniques for measuring long-run relations among financial market, Taylor and Tonks (1989) showed that stock markets of Great Britain, Germany, Japan and USA are moving together in long-term during the 80`s of the last century. However, Granger and Ding (1996) found that the parameters of the long memory model varied considerably across subsamples. Numerous conflicting studies have induced Longin and Solnik (1995) to confirm that correlation between international markets increases with time, but it is not a stable phenomenon. Some new researches prove such allegations. Caporale et al. (2015) indicates that cointegration between the US and European stock market does not hold over the whole sample.

Anyhow, with the lack of significant cointegration with major world stock markets, Scheicher (2001) observed stock markets from Hungary, Poland and Czech Republic and found that mentioned markets are more influenced by the regional movements. The same author, beginning with the assumption that mentioned markets have no significant long-run connection with major world financial markets, infers that global integration of three markets remains at the same level, while regional integration is significantly high. Comparable results are confirmed by Maneschiold (2006) and Masood et al. (2010) in case of countries from Baltic region. Also, Keneurgios and Samitas (2011) examined cointegration of five emerging Balkan markets through involvement of developed financial markets. These markets show higher integration during the period of financial market breakdown in 2008. Accordingly, main goal of this study is to examine short and long run integration of stock markets in Balkan region and major world stock markets with the interest to the position of Belgrade stock exchange.

2 Methodology

Long-run equilibrium of cointegration given by the basic cointegration methodology (Johansen, 1988) is not suitable in case of modeling dynamic processes market integration. Due to the incomplete procedure which continues to generate strong variations in results over time, it is inevitable to upgrade previous procedure emphasizing the nature of time variations. To fulfill mentioned assumption, this paper contains three supplementing methodology segments: unit root testing, cointegration testing and Markov switching vector error correction modeling.

In the first iteration, the study examines a stochastic structure of time series by applying the Augmented Dickey-Fuller test (ADF test) through the following equation:

$$\Delta Y_t = \alpha + \mu T + \omega Y_{t-1} + \sum_{i=1}^{p} \delta \Delta Y_{t-i} + \varepsilon_t \quad (1)$$

Using the equation (1) it is feasible to test the null hypothesis about random walk of variable Y, which involves the presence of unit root versus stationary process with trend.

According to cointegration theory, it is possible to determine a cointegration relationship between time series if their first differences are stationary. Such an analysis uses Johansen's procedure of maximum likelihood as a framework for estimation and testing of cointegration relations. The cointegration test is calculated using ranks of eigenvalues λ. Eigenvalues are sort ascending $\lambda_1 \geq \lambda_2 \geq ... \geq \lambda_g$. Using Johansen's approach, it is possible to form test statistics of the following form:

$$\lambda(r) = -T \sum_{i=r+1}^{g} \ln(1 - \hat{\lambda}_i) \quad (2)$$

Where r denotes the number of cointegrated vectors based on the null hypothesis, while $\hat{\lambda}_i$ is an estimated value of the i-th eigenvalue. $\lambda(r)$ is a mutual test where the null hypothesis represents the number of cointegrated vectors less than or equal to r versus an alternative hypothesis that the number is greater than r.

Although a vector error correction model is considered as an alternative to basic vector autoregressive model in cointegration relations estimation, it also has numerous limitations. In such a model, the constancy of variance and covariance over time can significantly affect a reliability of model estimation. Moreover, the presence of autocorrelation becomes sensitive matter in terms of number of lags include in the model. All of this guides to the introduction of the new version of a model with Markov chains, where variance and covariance are followed by the probability variable.

Including nonlinearities in the model, a MS-VECM represents a special form of model in different time series regimes. This model is specially recommended in cases when the price changes (price regimes) are unknown. Thus, price changes in this model have stochastic feature. In other words, the state variable is introduced and it generates by the Markov chains, where tomorrow state of market is driven only by the today’s state (Krolzig, 1997). The form of a Markov switching vector error correction model can be presented as follows:

$$\Delta Y_t = \nu(s_t) + \alpha(s_t)(\beta(s_t)'Y_{t-1}) + \sum_{i=1}^{p-1} A_i(s_t)\Delta Y_{t-i} + \varepsilon_t \qquad (3)$$

Where Y_t denotes a vector of stock market indices values, $\nu(s_t)$ is a vector of intercept term, $\alpha(s_t)$ denotes a vector of the speed of adjustment coefficients, $\beta(s_t)$ is a long-run cointegrating vector and A_i is a matrix of short-run parameters, capturing the autoregressive part of price movements. One should emphasized that the main segment of equation (3) is state variable $s_t = 1,\ldots,M$. All parts of the model specification involving this variable. Therefore, the probability of being in state s in period t is presented in expression (4).

$$P\left(s_t \middle| s_{t-i}, \Delta Y_{t-1}, \beta' Y_{t-1}\right) = P\left(s_t \middle| s_{t-i}, \Pi\right) \qquad (4)$$

Where the square matrix Π contains probabilities π_{ij} for switching from the regime in row i to the regime in column j, conditioned on the regime in the previous period.

3 Empirical analysis

The Balkan stock markets have a brief history compared to the developed markets of Europe and US. Mostly, these markets started trading in 90`s with small number of illiquid stocks. Despite the robust growth rates (70% in average during 2000-2006), these markets remain small in terms of capitalization, turnover and liquidity compared to developed markets. Nevertheless, prosperity for these markets appear to be certain due to the vast restructuring efforts in public and private sectors, the expectations to join EU, the increased value of institutial investors and improvements in investment protection.

This paper examines four Balkan stock markets using stock indices (BELEX15, CROBEX, SASX-10 and SOFIX) and three indices from developed markets (DJI, FTSE100 and NIKKEI225). The sample is made of daily stock index values and returns in period of time after the financial crisis, concerning the period from October, 2009 to January, 2016 or 1564 daily observations. Table 1 presents descriptive statistics of stock index returns in observed sample of time.

Table 1: Descriptive statistics and unit root test

Stock Index	BELEX15	CROBEX	SASX-10	SOFIX	DJI	FTSE100	NIKKEI225
Mean	0.00012	0.00000	-0.00035	0.00022	0.00046	0.00029	0.00054
St. deviation	0.01142	0.01024	0.00942	0.01602	0.01041	0.01074	0.01476
Maximum	0.08317	0.08563	0.05938	0.18171	0.06612	0.05032	0.05522
Minimum	-0.07580	-0.07020	-0.06940	-0.13741	-0.05706	-0.05482	-0.11153
Skewness	0.43885	0.26851	0.21968	-0.25598	-0.18824	-0.18549	-0.58470
Kurtosis	10.1909	13.0552	9.58702	11.6019	7.32170	5.64510	7.04620
$\rho(1)$	0.24896	0.10412	0.11682	-0.01674	-0.08345	0.00347	-0.05666
$\rho(2)$	0.11211	-0.01613	0.01205	0.06025	0.04914	-0.01451	0.04307
$\rho(3)$	0.03175	0.06805	0.01401	-0.03048	-0.03692	-0.03504	-0.00246
$\rho(4)$	0.09974	0.03001	-0.01088	0.04637	0.04446	-0.01035	-0.06413
ADF test	-1.9672*	-2.5453*	-2.9014*	-1.7901*	-0.4561*	-1.9122*	-0.5674*

Source: Authors

Only SASX-10 performs negative average return in observed period after the financial crisis, as we can see in Table 1. Standard deviations are similar comparing all included indices. First three observed indices had positive skewness, while next three had negative skewness in mentioned period. According to several authors, negative skewness is a feature of developed financial markets, although it brings higher risk of potential investment. All observed indices had leptokurtic distribution (kurtosis>3), which is one of the main characteristics of financial data. Finally, autocorrelation coefficients $\rho(i)$ did not show any sign of significant correlations between current index return in time t and lagged return in time t-i. Also, Table 1 shows the results of ADF test where * denotes the level of significance bellow 1%. Hence, all seven observed indices are nonstationary or integrated in first order I(1). Considering the results, the study takes the fallowing step by testing cointegration of nonstationary time series with λ_{trace} Johansen's test.

Table 2: Johansen's cointegration test

No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value	Prob.
None	0.0344	126.6211	95.7537	0.0000
At most 1	0.0177	63.2453	69.8189	0.0545
At most 2	0.0131	39.5366	47.8561	0.2395
At most 3	0.0048	18.2677	29.7971	0.5463
At most 4	0.0036	10.4927	15.4947	0.2447

Source: Authors

The results from Table 2 notice one cointegrated vector (equation) with significance level bellow 1%. It infers that there is some long-run integration among observed time series. This study applies two different model specificiation: linear and Markov switching vector error correction model. Both models are estimated and compared by Likelihood-ratio (LR) test and Akaike information criteria. The tests show superiority of nonlinear model, MS-VECM with two regimes. Consequently, the next sequence of the paper will contain only the results of MS-VECM in case of BELEX15.

Table 3: Regime probabilities

From Regime to Regime	Regime 1	Regime 2
Regime 1	0.966382	0.033618
Regime 2	0.540153	0.459847

Source: Authors

Table 3 represents the results of transition probabilities between regimes in case of index BELEX15 returns as a dependent variable in estimated model MS(2)-VECM(1). The regime 1 is the standard regime where the volatility of returns is not to high, while the regime 2 is an extreme one where the volatility of returns is high. At the intersection of row and column in Table 4 are the probability results of transition between regimes. Regime 1 keeps the high level of probability if it stays in the same regime. On the other hand, regime 2 has smaller probability of staying in the same regime. The following Table 5 will present the estimated model MS(2)-VECM(1).

Table 4: Estimated MS(2)-VECM(1) model in case of BELEX15

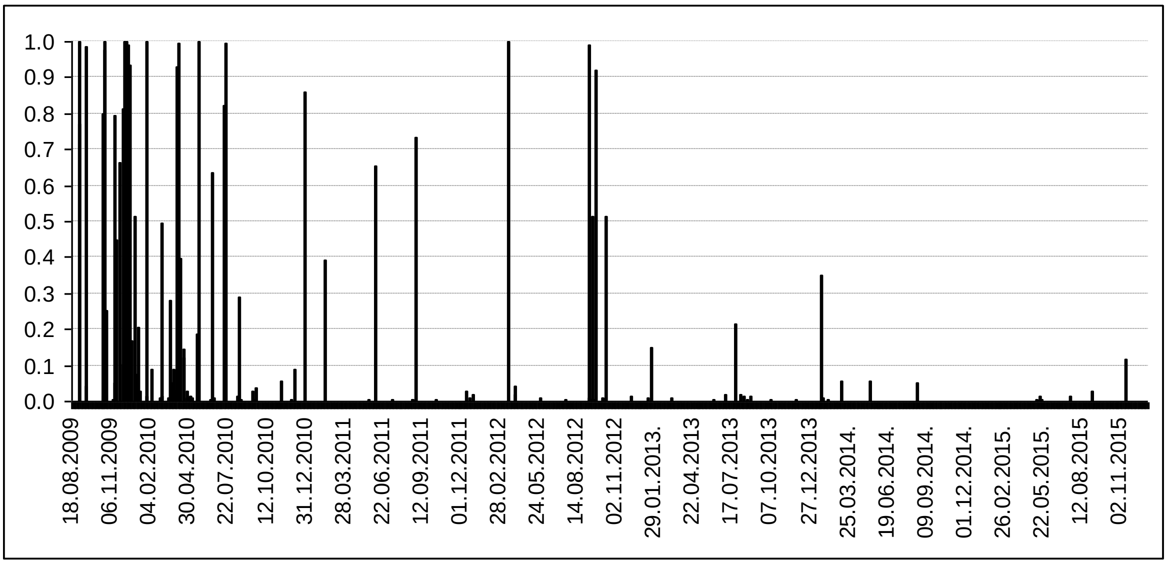
Variable		parameter	t - statistics
regime dependent intercept	v_1	0.03777	15.3417
	v_2	-0.00132	-1.71498
short run dynamics	$\Delta BELEX15_{t-1}$	0.21228	9.83281
	$\Delta CROBEX_{t-1}$	0.07556	3.14511
	$\Delta SASX\text{-}10_{t-1}$	0.08334	3.86283
	$\Delta SOFIX_{t-1}$	-0.02415	-1.82459
	ΔDJI_{t-1}	0.00162	1.75514
	$\Delta FTSE100_{t-1}$	-0.00512	-4.12588
error correction term	ecm_{t-1}	-4.12257	-234.242
long run dynamics	Regime 1	0.13155	4.82690
	Regime 2	0.17459	3.45522

Source: Authors

Estimated MS(2)-VECM(1) model is presented in Table 4. Three main components could be identified by interpreting the results of the model: short and long-run market integration, market stability and average regime duration. The market integration will be analyzed by estimated parameters in Table 4. Regime dependent intercepts v_1 and v_2 are significantly different between regimes and represent starting points of the model. The parameters with $\Delta BELEX_{t-1}$, $\Delta CROBEX_{t-1}$, $\Delta SASX\text{-}10_{t-1}$, $\Delta SOFIX_{t-1}$, ΔDJI_{t-1} and $\Delta FTSE100_{t-1}$ symbolize the short-run integration with non-switching parts. Index NIKKEI225 is excluded from the model due to the statistical significance. The results lead to the conclusion that strong short-run integration exists in the Balkan region, especially in case of former Yugoslav Republics. The error correction term is highly statistically significant, which means that BELEX15 is capable to adjust to new trends in the world and mentioned region. In other words, observed stock markets from Balkan region are highly integrated in short and long-run and they are partly integrated with major stock markets.

The stability of the national financial market is investigated using filtered probabilities of dependent variable being in one of two mentioned regimes. Applying estimated MS(2)-VECM(1), Figure 1 represents distribution of those probabilities in observed sample period.

Figure 1: Filtered probabilities of Regime 2



Source: Authors

Figure 1 demonstrates the filtered probabilities of state variable being in Regime 2. The most of the sample time sample variable was in Regime 1. The Figure reminds that BELEX15 is in period of stabile price changes, particularly in last four years where periods of extreme regime emerged in only few observations. Moreover, the Regime 2 do not retain in following daily observations. After all, to support the fact of market stability the estimated MS(2)-VECM(1) offers the average time duration of each regime. Dependent variable (BELEX15 index) stays in the period of stabile price changes for 41.5655 daily observations in average, while the period of extreme price changes last for 1.8843 daily observations in average.

Conclusion

Balkan financial market due to their size and volume of trade belong to the category of small emerging markets in global scale. Therefore, it is inevitable to consider international, as well as regional, financial effects before any investment decision making. Such an approach brings an opinion about the level of market integration and stability from the perspective of a regional market position. From the estimated results, it is obvious that the movement of BELEX15 index is highly connected with the new world financial trends, as well as, the signals from the neighboring financial markets. Hence, the results of the estimated MS(2)-VECM(1) indicate that both domestic and external factors shape the long-run equilibrium of mentioned stock markets. Overall, growing comovement between Balkan stock markets have implications regarding market efficiency hypothesis which impacts international or regional portfolio diversification and the long term economic growth prosperities. In other words, the diversification benefits for international investors with long horizon strategy in the stock markets are quite limited. Market internationalization could be attributed to the growing foreign capital flows, the liberalization of the market and regional economic chances for EU enrolment. Nevertheless, small number of significant extreme regimes in last four years creates positive environment to attract many domestic and foreign rational investors.

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