TESTING STOCK MARKETS' INTEGRATION FROM CENTRAL AND EASTERN EUROPEAN COUNTRIES WITHIN EURO ZONE[1]

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Abstract

Stock market integration gives the opportunity of risk diversification on international level. The main effects of this integration are the development of stock markets and economic growth. This paper analyses the integration of stock markets from Central and Eastern Europe using convergence. Beta-convergence gives us information about integration's speed and sigma-convergence presents information about the degree of integration of stock markets from Central and Eastern Europe on the stock market of Euro Zone.

Keywords: return, beta convergence, sigma convergence

JEL Classification: C51, G15

Introduction

The financial and economic crisis broken out in 2008 in the USA and caused by the roaring bankruptcy of the Lehman Brothers bank has also impacted the European countries. The Central and East European countries which are the last ones that adhered to the Economic European Union are characterized by the prevailing development of the banking system. As a consequence, the economy financing is performed mainly through the banks while the stock markets hold a secondary place even though these help to obtain the

capital at a smaller price than the one obtained through the bank loans.

In an economy affected by a financial and economic crisis, the issue of identifying all the elements that determine the economic growth is highly debated. Devereux and Smith (1994) as well as Obstfeld (1994) reach the conclusion that the integrated capital markets through the possibility of risk diversification at international level determine economic growth.

Equity markets from Romania and the countries of Central and Eastern Europe have been the subject of many research studies. Research focuses on: the statistical properties of returns and their behavior (Harrison, B., Lupu R., Lupu I. (2010), V. Chirila, Chirlă C. (2012), Lupu R. (2006)), the presence of heteroskedasticity (Lupu R., Lupu R . (2012)), the analysis of market efficiency (S. Dumitrescu, Stroe A. et al. (2011)), Pele D. T, Voineagu V. (2008), contagion (Lupu I. (2012) Lupu I. (2013)) but also on the analysis of integration in European market (Horobeţ A., Lupu R. (2009)).

This study focuses on the analysis of the integration of Central and East Europe stock markets within the Euro Zone of the European Union. The integration of stock markets is tested by means of the beta-convergence and sigma-convergence indicators as well as by the integration level. The analysis has been undertaken for the entire period under consideration as well as for two periods separated by the start of the year 2008 which is considered the beginning of the occurrence of the financial and economic crisis.

This study is structured as follows: the second chapter presents the main studies regarding the convergence of the stock markets, the third chapter minutely describes the methodology considered and the data source and then it continues with the empirical study and the conclusions.

Description of the problem

Babecký, J. et al. (2013) taking into account the results obtained by Agenor (Agenor P. R. (2003), Agenor P. and al. (2011)) underline that the financial crisis has more benefits than costs both during the economic growth periods and during the economic downturn times if the mechanisms of financial stability function.

The studies concerning the financial integration vary both from the point of view of countries considered and from that of the methodology used. In order to determine the financial integration, the

most frequently used methods are: cointegration analysis, vector autoregression, beta and sigma-convergence and conditional correlations. The cointegration analysis offers the possibility to determine the stability of the return or of the prices of the capital markets on a long term. The vector autoregression method highlights the dynamics of the short-term returns of the capital markets but it also provides the possibility to determine the causality between the returns considered. The conditional correlations through the GARCH-type heteroscedastic models highlight the lack of linearity of volatility of the capital markets. The beta-convergence and sigma-convergence have been taken from the literature of economic growth and offer the possibility to determine both the integration speed and the integration level. It is the methodology that was chosen to be used in the present paper.

Hardouvelis and al. (2006) analyze the integration of 11 Euro zone countries within the European Union for the period 1992-1998. The results obtained confirm for the first part of the period the existence of integration with ups and downs while for the second part of the period the stock markets tend towards full integration.

Bekaert and al. (2013) take into consideration 33 countries, most of them members of the European Union, and analyze the integration of the stock markets and the economic integration by means of the segmentation method of the markets. The results confirm that the countries which become European Union members register an increase in the integration. The adoption of the Euro currency does not determine an increase in the integration of financial markets. The inclusion in the analysis of the last period of the financial and economic crisis does not significantly change the results.

The global integration of the capital markets is analyzed by Schackman J. D. (2006). The results obtained confirm that there is a direct, positive correlation between the capital markets and the excess return even if previous studies presented a reversed correlation.

Babecký, J. et al. (2013) analyze the integration of stock markets from Russia and China within the USA, Euro Area and Japan. The results obtained both at national and regional level confirm the existence of the beta-convergence which is not influenced by the financial and economic crisis from 2008-2009 while the sigma-convergence shows that there are significant differences at regional

level determined by the crisis and China is more integrated than Russia in the countries considered.

Methodology and data sources

Of the methodologies previously presented for the determination of the integration of stock markets we chose the one that was proposed in the economic growth literature by Barro and Sala-i-Martin (1991, 1992) and taken over by Adam et al. (2002): sigma-convergence and beta-convergence. When determining the beta-convergence one may identify the speed with which are decreased or even eliminated the differences between the return of the stock market under analysis in comparison with the benchmark market.

To measure the beta-convergence the following regression model is estimated:

$$\Delta R_t = \alpha + \beta_t R_{t-1} + \sum_{l=1}^{L} \gamma_1 \Delta R_{t-1} + \varepsilon_t$$

where: $R_t = r_t - r_t^B$

r_t - the rate of the continuous compound return (or log-return) of the market index portfolio. It is computed according to the relation:

$$r_t = \left(\ln\left(V_t\right) - \ln\left(V_{t-1}\right) \right) \cdot 100$$

V_t - the value of the market index portfolio under analysis;

r_t^B - the rate of the continuous compound return of the benchmark market index portfolio;

$$r_t^B = \left(\ln\left(V_t^B\right) - \ln\left(V_t^B\right) \right) \cdot 100$$

V_t^B - the value of the benchmark market index portfolio;

Δ - the difference operator

l - the lag length. The maximum value for the lag is chosen according to the values of the Schwarz criterion.

The beta-convergence is determined by the estimation of the β parameter and it measures, as we previously mentioned, the convergence speed. This indicator may take values between -2 and 0 and it is interpreted in the following manner:

if β takes the value 0 or -2 it shows that the convergence phenomenon of the capital markets is not present;

if β takes values between -2 and -1 it shows that the convergence phenomenon of the capital markets is present;

the more β approaches the value -1, the higher the convergence speed of the analyzed capital markets.

Sigma-convergence is determined as the standard deviation of the difference between the return of the analyzed market and the return of the benchmark market at a given moment of time. It is computed according to the formula:

$$\sigma_{j,t} = \sqrt{\frac{1}{N} \sum_{i=1}^{N} \left(r_{i,j,t} - \overline{r}_{j,t} \right)^2}$$

where: $\overline{r}_{j,t}$ - represents the mean of the returns for the market j at the moment t.

The convergence is reached if the standard deviation of returns decreases in time. When the standard deviation tends towards zero, full integration is reached.

Results obtained

The analysis of the stock markets integration was conducted for several countries in the Central and East Europe: Romania, Hungary, Latvia, Lithuania, Estonia and Czech Republic. The indices taken into account are the blue chip indices from the stock markets in Bucharest – BET, Budapest – BUX, Riga – OMXR, Vilnius – OMXV, Tallinn – OMXT and Prague – PPX. In order to determine the convergence in the European Union we took into consideration the Euro STOXX 50 index which expresses the general trend of the stock markets in the European Union.

Figure 1 - The evolution of the indices BET, BUX, OMXR, OMXT, OMXV and PPX during the period 5/31/2004 - 01/01/2008
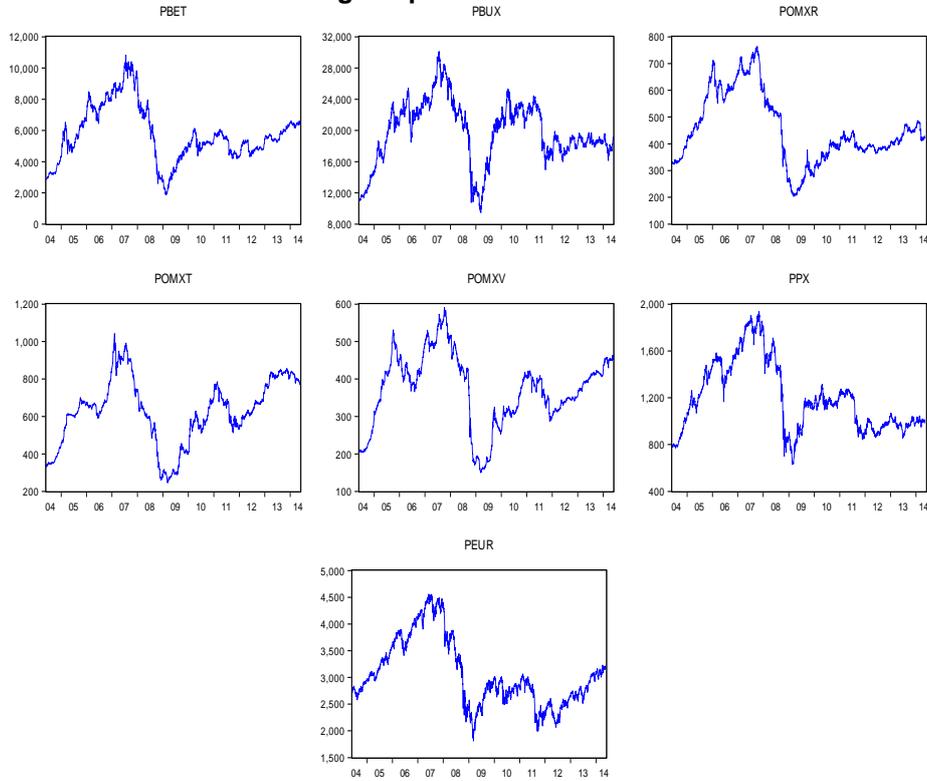
The evolution of these indices is presented in figure 1. The stock exchanges considered present a similar evolution during the analyzed period. At the end of the year 2007 and beginning of the year 2008 the stock exchanges had a general descending trend determined by the financial and economic crisis.
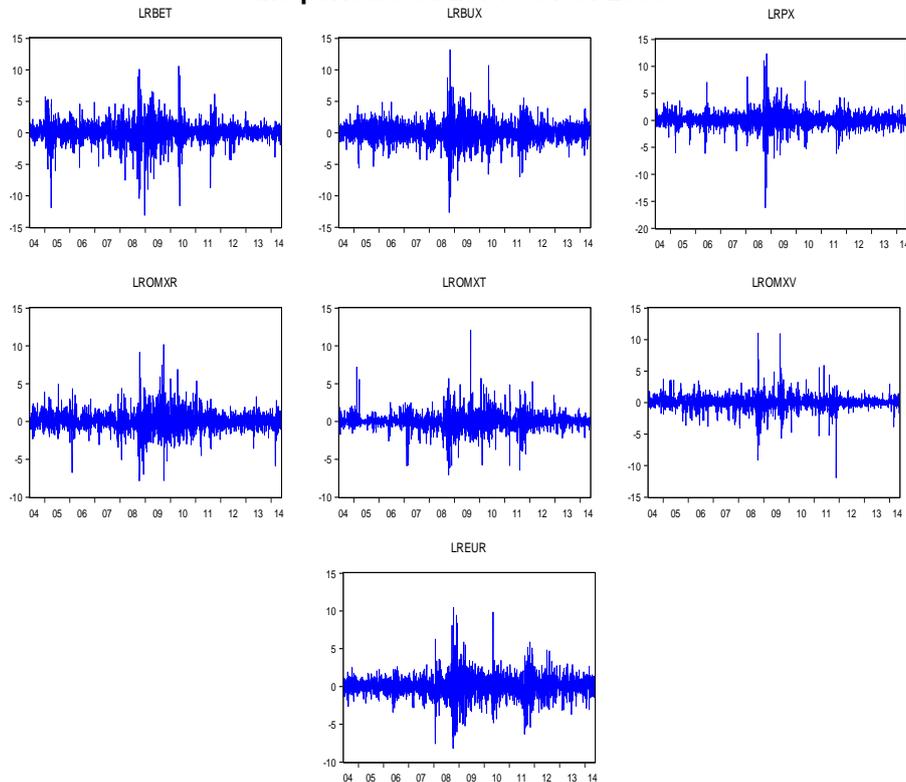
Table 1 - The indicators of the descriptive statistics for the returns of the stock exchanges from Bucharest (LRBET), Budapest (LRBUX), Riga (LROMXR), Vilnius (LROMXV), Tallinn (LROMXT), Prague (LRPPX) and Europe (LREUR) for the period 5/31/2004 - 01/01/2008

	LRBET	LRBUX	LROMXR	LROMXT	LROMXV	LRPX	LREUR
Mean	**0.032791**	0.020468	0.009775	**0.032975**	0.029733	0.009829	0.006348
Median	0.020832	0.000000	0.000000	0.017349	0.000000	0.008284	0.000178
Maximum	10.56451	13.17775	10.17979	12.09448	11.00145	12.36405	10.43765
Minimum	-13.11676	-12.64895	-7.858646	-7.045882	-11.93777	-16.18547	-8.207879
Std. Dev.	1.695880	1.647948	1.276774	1.159188	1.154563	1.509375	1.415121
Skewness	-0.649942	-0.093297	0.164402	0.213045	-0.360136	-0.554533	0.015972
Kurtosis	11.13255	9.864812	10.10871	13.27151	21.54407	18.06786	9.800462
Jarque-Bera	7370.653	5124.771	5503.082	11484.49	37424.96	24805.38	5025.540
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	2608	2608	2608	2608	2608	2608	2608

The stock exchanges reached a minimum at the beginning of the year 2009 after which an ascending tendency was noticed. At the middle of the year 2011 the stock markets recorded a decrease but not as strong as the one registered at the start of the year 2009.

The graphical representation of the returns of the stock markets considered highlight the presentation of their volatility by clusters: during the downturn periods the volatility is higher than during the growth periods.

Figure 2 - The evolution of the returns of the stock exchanges from Bucharest– LRBET, Budapest – LRBUX, Riga – LROMXR, Vilnius – LROMXV, Tallinn - LROMXT, Prague - LRPPX and Europe LREUR for the period 5/31/2004 - 01/01/2008

Source: Own results obtained by means of the Eviews software programme

Table 1 presents several descriptive statistical indicators of the returns of the stock markets under consideration. Since the returns are stationary we could consider the average returns as being the returns expected by the investors. The Bucharest and Tallinn stock exchanges offer the highest expected return followed closely by the Vilnius and Prague stock exchanges. The European market offers the lowest expected return.

Table 2 - The estimation of beta-convergence

| Country/Stock exchange	Index	Beta coefficient 5/31/2004-01/01/2008	Beta coefficient 1/01/2008-5/29/2014	Beta coefficient Entire period
Romania/Bucharest	BET 10	-0.905284	-1.660812	-1.370315
Hungary/Budapest	BUX	-0.953304	**-1.083487**	**-1.048413**
Latvia/Riga	OMXR	-1.051251	-1.112442	-1.101317
Estonia/Tallinn	OMXT	-0.975032	-1.097970	-1.076057
Lithuania/Vilnius	OMXV	-0.956169	**-1.078281**	**-1.052776**
Czech Republic/Prague	PX	-0.984722	-1.303302	-1.321039

Source: Own results obtained by means of the Eviews software programme

In order to determine the beta-convergence we took into consideration the entire period analyzed then two periods determined by the start of the year 2008 which was the moment when the financial and economic crisis made its presence in a significant manner.

The results obtained for the beta-convergence indicator are presented in table 2.

The beta-convergence coefficients for the entire period take values between -2 and -1, which proves the existence of the convergence phenomenon. If the period under study is analysed according to two sub-periods, for the first part of the period 5/31/2004-01/01/2008 only one market, the one from Latvia (Riga), has a beta-convergence coefficient very close to -1 suggesting the existence of the convergence phenomenon while the other countries have beta coefficients with values not comprised between -2 and -1 and therefore they do not present the convergence phenomenon. The second part of the period, after the beginning of the financial and economic crisis, highlights the occurrence of the convergence phenomenon in all stock exchanges, the highest convergence being recorded by the stock exchanges from Lithuania (Vilnius) and Hungary (Budapest). Thus, we ascertain a change in the convergence of the stock markets determined by the financial and economic crisis.

Figure 3 - The evolution of sigma-convergence of the stock exchanges in Bucharest - LRBET, Budapest - LRBUX, Riga - LROMXR, Vilnius - LROMXV, Tallinn - LROMXT, Prague - LRPPX for the period 5/31/2004 - 01/01/2008
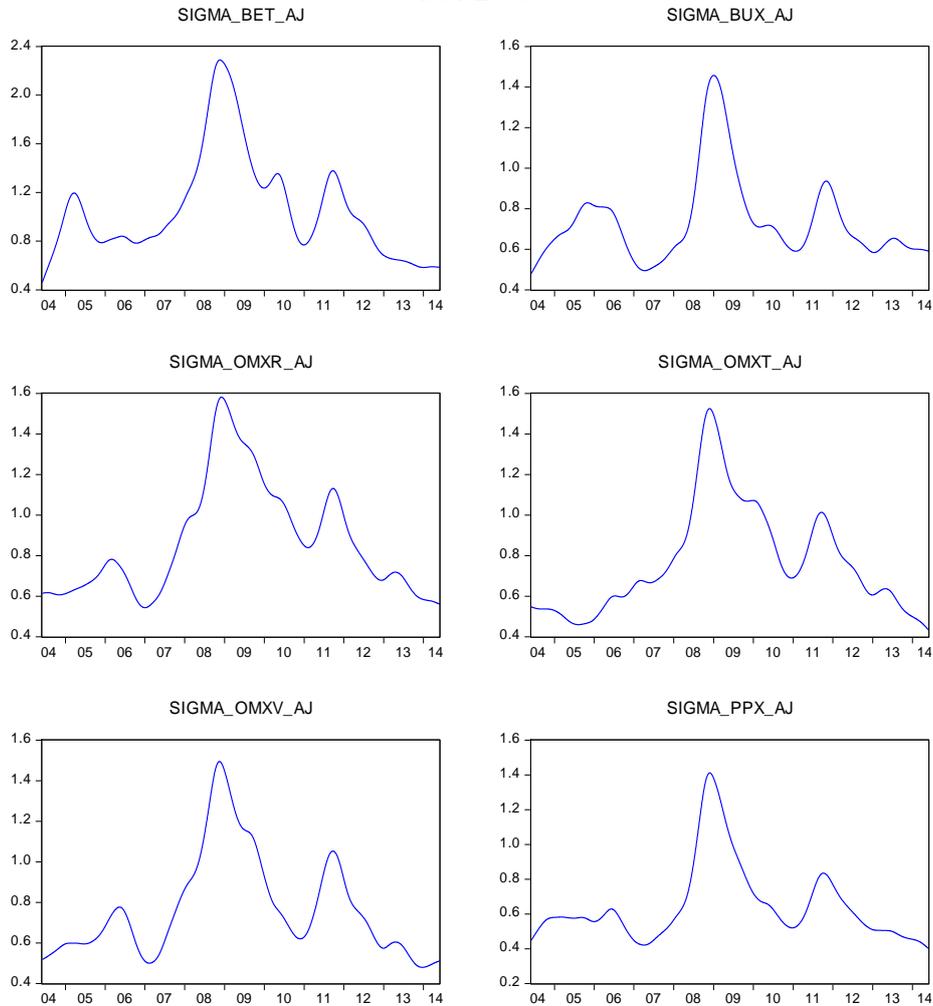
Source: Own results obtained by means of the Eviews software programme

The trend of standard deviations determined for the sigma-convergence has been highlighted by means of the Hodrick-Prescot filter and are presented in figure 3.

The figure above emphasized similar patterns of the sigma-convergence of the stock markets in Romania, Hungary, Slovenia,

Slovakia, Estonia and Czech Republic. The economic and financial crisis affects the sigma-convergence. Only after 2011 a significant reduction of the indicator has been noticed, suggesting the trend towards a total sigma-convergence.

Conclusions

The deepening of the economic and financial relationships determined by the integration of the Central and East European countries into the European Union questions the financial integration and more specifically the integration of stock markets. This study focused on the determination of the integration of stock markets from several Central and East European countries by means of the beta-convergence and sigma-convergence. The beta-convergence obtained underlines the fact that after the financial and economic crisis from 2008 the highest integration speed is registered by Lithuania and Bulgaria, being followed by Estonia, Latvia, Czech Republic and Romania on the last place. The sigma-convergence highlights that during the last period analyzed all the countries tend towards full integration.

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