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International stock market integration: Central and South Eastern Europe compared

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ABSTRACT

We examine the international stock market comovements between Western Europe vis-à-vis Central (Czech Republic, Hungary and Poland) and South Eastern Europe (Croatia, Macedonia and Serbia) using multivariate GARCH models in the period 2006–2011. Comparing these two groups, we find that the degree of comovements is much higher for Central Europe. The correlation of South Eastern European stock markets with developed markets is essentially zero. An exemption to this regularity is Croatia, with its stock market displaying a greater degree of integration toward Western Europe recently, but still below the levels typical for Central Europe. All stock markets fall strongly at the beginning of the global financial crisis and we do not find that the crisis altered the degree of stock market integration between these groups of countries.

1. Introduction

The economies in Central and Eastern Europe witnessed major structural changes during the last two decades. Many countries, especially in Central Europe, carried out ambitious reforms soon after the fall of communism, successfully integrated in European structures and after the initial period of transition experienced solid growth. On the other hand, some countries, especially in South Eastern

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Europe, progressed more slowly in creating a market-oriented economy and some important reforms have been undertaken only recently (Campos and Horvath, 2012).

In this article, we want to compare the stock market integration of these two groups – Central Europe and South Eastern Europe – with the developed markets and examine whether the degree of integration differs. While we know relatively much about stock market behavior in Central Europe (Égert and Kočenda, 2007; Hanousek and Kočenda, 2011; Kočenda and Égert, 2011), a systematic examination of stock market comovements in South Eastern European countries is, to our knowledge, missing. We want to bridge this gap and examine whether the degree of stock market comovements with developed markets differs from that in Central Europe. For this reason, we collect daily data on stock market indices from the Central European countries (Czech Republic, Hungary and Poland) and several South Eastern European countries (Croatia, Macedonia and Serbia) from 2006 to 2011. As regards the South Eastern European countries, we specifically focus on countries that used to be a part of Yugoslavia and are not integrated in the European Union.[1]

Although the financial systems in Central European and South Eastern European countries are largely bank-based, an analysis of stock market developments can still provide useful insights. First, it may help policymakers understand the nature of cross-country shock transmission in a timely fashion since unlike many other economic series, stock market data are available at a high frequency. Similarly, it may be useful to investment managers for international portfolio diversification. Second, although the stock markets in these countries are relatively small in size, they still possess predictive power for future economic activity and prices. Using the Czech data, Havranek et al. (2012) compare the forecasting accuracy of various financial variables such as credit growth, loan loss provisions, banking sector liquidity, share of non-performing loans and stock market index and find that the stock market index tends to provide more accurate forecasts for the macroconomic environment than the remaining financial variables. Third, Baele (2004) puts forward that looking at stock market comovements is one way to assess financial integration. Clearly, financial integration has direct consequences for financial stability (see De Nicolo and Tieman, 2006; Fecht et al., 2008).

Our results suggest that Central European stock markets are highly integrated with the developed markets. The conditional correlations between Central European and Western European stock markets reach a value around 0.6, which is close to the correlation reported in the literature for the US and Canadian stock markets (see, for example, Longin and Solnik, 1995; Forbes and Rigobon, 2002). On the other hand, the degree of comovements between Serbian as well as Macedonian stock markets with developed markets is practically zero. The Croatian stock market evolves from nearly zero comovements at the beginning of our sample to values as high as those for Central Europe before the outset of the global financial crisis and subsequently falls to lower but still positive values during the crisis. The results for Croatia vis-à-vis other South Eastern European countries should not come as a surprise, as the stock market capitalization is greater in Croatia than in the remaining South Eastern European stock markets, financial reforms progressed faster and EU entry negotiations are in progress.[2]

The article is organized as follows. Section 2 discusses the related literature, while Section 3 describes the data. In Section 4 we briefly introduce the multivariate GARCH model. Section 5 presents the results. Concluding remarks are offered in Section 6. An Appendix A with additional results follows.

2. Related literature

This section briefly reviews the literature on stock market comovements that focuses on Central and South Eastern European countries. The literature typically employs either vector autoregression or vector error correction modeling to examine the short-term and long-term transmission,

[1] As concerns other former Yugoslavian countries with stock markets, Bosnia and Herzegovina is excluded, since the European Bank for Reconstruction and Development shows that the degree of financial reforms is still rather low. Slovenia is excluded since it is fully integrated into European structures (EU member since 2004 and euro area member since 2007).

[2] Even though it has to be acknowledged that stock market capitalization decreased in Croatia during the crisis and therefore the estimated stock market integration may be partly driven by the lower liquidity in this market.

respectively. It also uses various GARCH models to assess the degree of stock market volatility transmissions. Most research relies on stock market data on the Czech Republic, Hungary and Poland, i.e. on Central Europe. As we will see, stock markets in South Eastern Europe have been analyzed rather rarely.[3]

Cappiello et al. (2006) examine the degree of integration between the stock markets in several new EU members and the euro area. Investigating the comovements of the equity markets returns suggests an increasing degree of integration between the new EU members and the euro area in the process toward EU accession, especially in the Czech Republic, Hungary and Poland.

Based on various cointegration tests, Gilmore et al. (2008) find increasing degrees of integration of the Czech, Hungarian and Polish equity markets with respect to the German and UK markets for the period from 1995 to 2005. Similarly to Cappiello et al. (2006), the stronger linkages of these stock markets are found to reflect the integration of Central European countries into the EU.

There are several contributions examining stock market interdependence between Central and Western European countries based on intraday data. In general, these studies – in contrast to studies based on cointegration – find that the interdependence is rather weak when relying on ultra-high frequency data.

Using intraday data from June 2003 to February 2004, Cerny and Koblas (2008) examine the degree of stock market integration and the speed of information transmission between Western and Central Europe. The results suggest fast transmission of shocks from Western to Central Europe, with the stock market in the Czech Republic displaying the fastest reaction.

Égert and Kočenda (2007) analyze the interconnections between the Western European stock markets and the stock markets in the Czech Republic, Hungary and Poland. Using Granger causality tests based on 5-minute tick intraday data from mid-2003 to early 2005, they do not find any robust cointegration relationship between Central European and Western European stock markets. Kočenda and Égert (2011) also employ ultra-high frequency data for three developed (France, Germany, and the United Kingdom) and three emerging (Czech Republic, Hungary and Poland) European stock markets. They find that the correlation between these developed and emerging markets is rather weak during the trading day. This suggests that the shock transmission among these markets, if there is any, materializes more at daily or even weekly frequency rather than at tick-by-tick data frequency. The question of the speed of shock transmission is tackled by Babetskii et al. (2007).

Babetskii et al. (2007) take a different perspective to assess stock market integration. They calculate the rolling β-convergence (to assess the convergence of stock market returns) and σ-convergence (to assess the convergence of stock market volatility) for evaluating the interdependence of Central European and Western European stock markets. Doing so, their findings support the existence of β-convergence and, to a certain extent, σ-convergence as well. In terms of the speed of shock transmission, they find that shocks are typically fully absorbed in less than half a week. This also explains why studies employing intraday data find little stock market interdependence, while studies based on cointegration techniques with daily or weekly data – i.e. focusing more on establishing the long-term relationship – typically reach the opposite conclusions.

Kasch-Haroutounian and Price (2001) examine the volatility transmission among stock markets in Central Europe (Czech Republic, Hungary and Slovakia) using the bivariate BEKK model. The results indicate that the returns in all these stock markets are positively correlated. Interestingly, the results suggest that the volatility in the Polish stock market is affected by the volatility originating in the Hungarian stock market, but not vice versa.

Samitas and Kenourgios (2011) investigate the stock market integration in a number of Balkan countries and compare it to the integration among several developed markets (US, UK, Germany) in 2000–2006. Using several cointegration tests, the results support the existence of long-term relationships among Balkan stock markets and developed markets. On the other hand, Vizek and Dadic (2006) examine the integration between German equity markets, selected CEE equity markets and the Croatian equity market. Interestingly, no evidence of a long-term relationship between the Croatian

[3] Obviously, there is a large literature examining stock market comovements among developed countries. See, for example, Bekaert and Harvey (1995), Longin and Solnik (1995), Forbes and Rigobon (2002), Johnson and Soenen (2003), Benelli and Ganguly (2007), among many others.

and German stock markets is found. A similar conclusion is drawn for the Central European stock markets with respect to the German stock market.

All in all, previous research gives somewhat mixed results. Some papers fail to find even a long-term relationship between Central European and Western European stock markets. Nevertheless, it seems that the majority of papers suggest that there are some interconnections among these stock markets in the short term, but the speed of volatility transmission is not very fast.

3. Data

The daily closing levels of the PX (Prague Stock Exchange), WIG (Warsaw Stock Exchange), BUX (Budapest Stock Exchange), MBI10 (Macedonian Stock Exchange), CROBEX (Zagreb Stock Exchange) and BELEX15 (Belgrade Stock Exchange) indices are used. Therefore, three Central European and three South Eastern European stock markets are chosen. The STOXX Europe 600 index is chosen as some sort of benchmark for European stock market movements in Europe. The STOXX Europe 600 represents large, medium and small capitalization companies across 18 countries of the European region: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.[4] Our daily data starts in January 2006 and ends in mid-May 2011 (see Fig. 1 in Section 5 for the plot of all time series). The number of observations is between 1325 and 1370 depending on the stock market; it differs somewhat due to different national holidays, see Table A1 in Appendix A for descriptive statistics. The liquidity, turnover as well as market capitalization in many emerging stock markets, especially in South Eastern Europe, is not high. To reduce these considerations, we focus on data from 2006 onwards and do not use previous data. The source of data is Reuters Wealth Manager.

Some basic information about the Central European and South Eastern European stock markets is given in Table 1. The stock markets were set up after the fall of communism in these countries, although it is interesting to mention that stock markets in most of these countries already existed decades before. For example, the Belgrade Stock Exchange was already founded in 1894 and functioned until the beginning of World War II. Market capitalization is higher in Central Europe, although the market capitalization of the Croatian stock market is not too far below the Hungarian stock market. Interestingly, the number of companies traded on the stock markets in these countries differs sharply and is only weakly correlated with the market capitalization. As regards the composition of national stock indices, large companies with liquid shares from various sectors such as banking, telecommunications, utilities, mining, oil and gas or the pharmaceutical sector are typically included. The number of companies included in the calculation of the national stock index is not high in most countries (about 10–25) with the exemption of Poland, where WIG lists more than 300 companies.

For our econometric analysis we study the daily returns, which are represented by a continuously compounded rate specified for country i at time t as follows:

$$r_{i,t} = (\ln(p_{i,t}) - \ln(p_{i,t-1})) \times 100 \quad (1)$$

It is noteworthy that unit root (augmented Dickey-Fuller) and stationarity (KPSS) tests were used to assess the degree of integration of all series (the results from these tests are available upon request). We find that the original series in levels are not stationary. To the contrary, the daily returns, $r_{i,t}$, are found to be stationary.

4. Multivariate GARCH model

We use a multivariate GARCH model to assess the comovements among stock markets. For ease of exposition, we present the model for N=2, i.e. two stock markets. A survey of multivariate GARCH models is available in Bauwens et al. (2006).

[4] Since Icelandic and Norwegian companies enter into the calculation of this index, we label this group as Western Europe (and not, for example, old EU members).

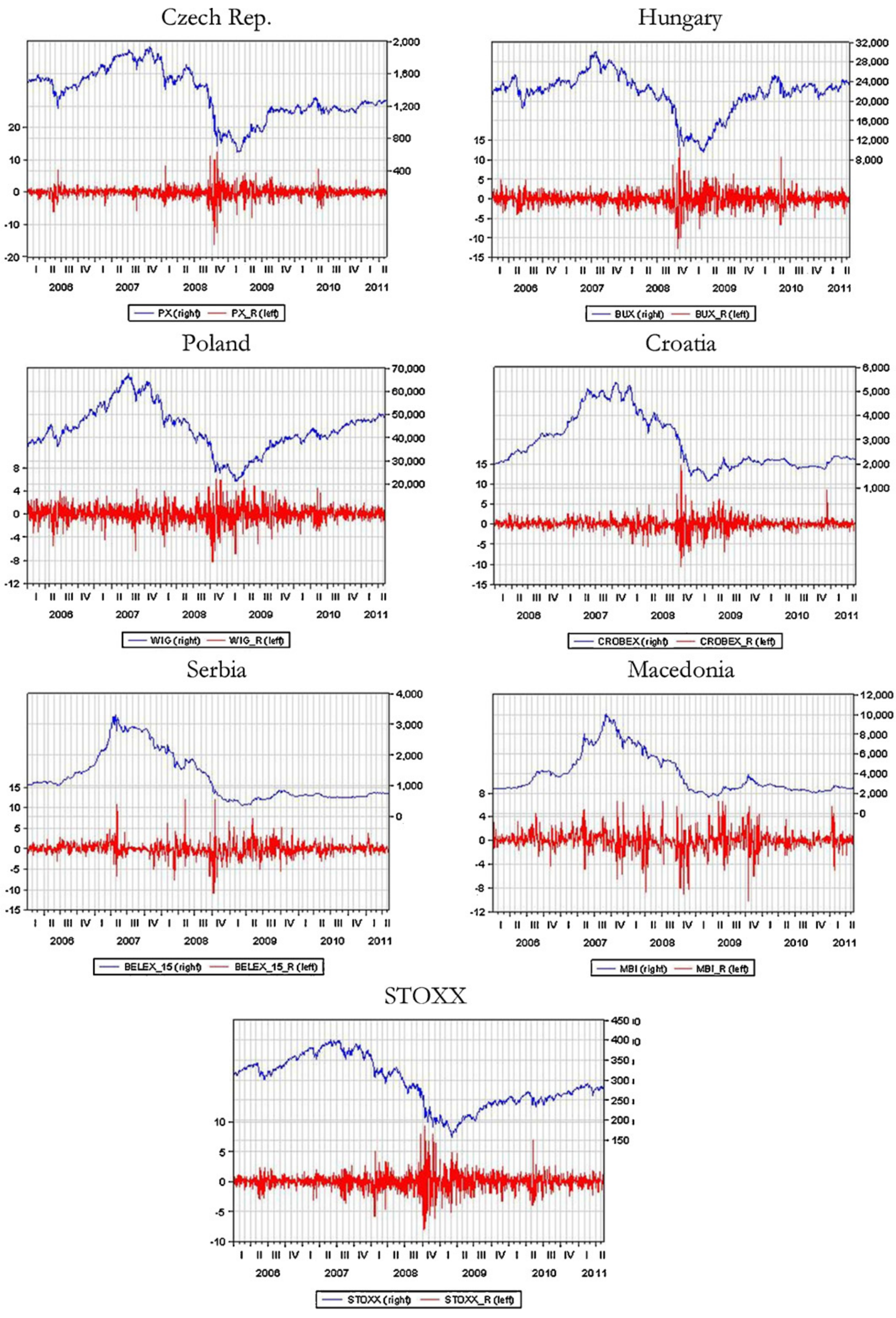


Fig. 1. Stock market developments in 2006–2011 – levels and returns.

Table 1
Stock markets in Central and South Eastern Europe – key indicators.

	Czech Rep.	Hungary	Poland
Year established	1993	1990	1991
Market capitalization	31,922	20,624	142,272
Number of companies	25	46	486
Index	PX	BUX	WIG
	Serbia	**Macedonia**	**Croatia**
Year established	1992	1995	1991
Market capitalization	7268	1985	18,971
Number of companies	1779	86	271
Index	BELEX	MBI	CROBEX

Source: Federation of European Securities Exchanges Statistics December 2010, market capitalization in EUR mil.

Consider 2×1 dimensional vector of daily returns $\mathbf{r}_t$. We assume that the mean equation is specified as:

$$\boldsymbol{r_t} = \boldsymbol{\mu} + \boldsymbol{u_t} \tag{2}$$

where μ is conditional mean vector, i.e. $\mathbb{E}(r_t|\Omega_{t-1}) = \mu$ and

$$\boldsymbol{u_t} = H_t^{1/2}\boldsymbol{\nu_t} \tag{3}$$

where $H_t^{1/2}$ is a 2×2 conditional variance matrix, i.e. $var(\boldsymbol{r_t}|\Omega_{t-1}) = H_t$, and ν_t is a 2×1 random vector with the following properties:

$$\mathbb{E}(\boldsymbol{\nu_t}) = 0 \tag{4}$$

$$\text{var}(\boldsymbol{\nu_t}) = I_N \tag{5}$$

where I_N is a 2×2 identity matrix.

The direct generalizations of the variance formula in a univariate GARCH model for the multivariate variance-covariance matrix H_t primarily include VECH and BEKK models. The VECH model was introduced by Bollerslev et al. (1988). The specification of the VECH model is as follows:

$$VECH(H_t) = W + A.VECH(u_{t-1}u'_{t-1}) + B.VECH(H_{t-1}), \quad u_t|\Omega_{t-1} \sim N(0, H_t) \tag{6}$$

where $\mathbf{u}_t$ is a 2×1 disturbance vector, W is a 3×1 parameter vector, A and B are 3×3 parameter matrices and VECH(·) stands for the operator that stacks the upper triangular porti· symmetrical matrix.

The VECH operator transforms a 2×2 matrix into a 3×1 vector in the following way:

$$VECH(H_t) = VECH\begin{pmatrix} h_{11,t} & h_{12,t} \\ h_{21,t} & h_{22,t} \end{pmatrix} = \begin{pmatrix} h_{11,t} \\ h_{22,t} \\ h_{12,t} \end{pmatrix} \tag{7}$$

and analogously for other elements. We can now rewrite it as follows:

$$\begin{pmatrix} h_{11,t} \\ h_{22,t} \\ h_{12,t} \end{pmatrix} = \begin{pmatrix} w_1 \\ w_2 \\ w_3 \end{pmatrix} + \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} u_{1,t}^2 \\ u_{2,t}^2 \\ u_{1,t}u_{2,t} \end{pmatrix} + \begin{pmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{pmatrix} \begin{pmatrix} h_{11,t-1} \\ h_{22,t-1} \\ h_{12,t-1} \end{pmatrix} \tag{8}$$

Thus, we have the conditional variance equations for both returns series ($h_{11,t}$ and $h_{22,t}$) and the conditional covariance equation between the series ($h_{12,t}$). The drawback of this model is that we have to estimate 21 parameters (3 in matrix W and 9 in each of matrices A and B), which is computationally demanding and risky in the sense that the local instead of the global maximum of likelihood function is more likely to be encountered. To account for this problem, several extensions of the VECH models were proposed, such as constant correlation or diagonal multivariate GARCH.

In addition, the VECH model cannot ensure that the covariance matrix H_t is positive definite, which is necessary because the variance cannot be less than zero. The BEKK model, as introduced by Engle and Kroner (1995), resolves this drawback. In this model the matrix H_t is defined as:

$$H_t = W'W + A'\boldsymbol{u_{t-1}}\boldsymbol{u'_{t-1}}A + B'H_{t-1}B \tag{9}$$

where A and B are 2×2 parameter matrices and W is a 2×2 upper triangular parameter matrix. It is easy to show that after multiplication we can express the conditional variances and covariance of H_t as:

$$\begin{aligned} h_{11,t} &= w_{11}^2 + (a_{11}u_{1,t-1})^2 + b_{11}^2 h_{11,t-1} + 2b_{11}b_{21}h_{12,t-1} + b_{21}^2 h_{22,t-1}, \\ h_{12,t} &= w_{11}w_{12} + a_{11}a_{12}u_{1,t-1}^2 + u_{1,t-1}u_{2,t-1}(a_{12}a_{21} + a_{11}a_{22}) + a_{21}a_{22}u_{2,t-1}^2 + b_{11}b_{12}h_{11,t-1} \\ &\quad +(b_{11}b_{22} + b_{12}b_{21})h_{12,t-1} + b_{21}b_{22}h_{22,t-1}, \\ h_{22,t} &= (w_{12}^2 + w_{22}^2) + (a_{12}u_{1,t-1} + a_{22}u_{2,t-1})^2 + b_{12}^2 h_{11,t-1} + 2b_{12}b_{22}h_{12,t-1} + b_{22}^2 h_{22,t-1} \end{aligned} \tag{10}$$

The right-hand sides of the three equations above contain mainly quadratic terms and the matrix H_t is indeed positive definite even "under very weak conditions" (Engle and Kroner, 1995). Moreover, the number of parameters to be estimated is reduced to eleven, as compared to twenty-one in the VECH model.

Note also that the conditional variances ($h_{11,t}$ and $h_{22,t}$) and the conditional covariance ($h_{12,t}$) depend on lagged values of conditional variances ($h_{11,t-1}$ and $h_{22,t-1}$) and the conditional covariance between the two series ($h_{12,t-1}$) as well as on lagged values of squared disturbances of both series and the cross-products of the disturbances. This feature distinguishes the BEKK–GARCH model from the univariate GARCH model.

The maximum likelihood method is used to estimate the parameters. Assuming conditional normality, the log-likelihood function has the following form:

$$L(\theta) = -\frac{TN}{2}\log(2\pi) - \frac{1}{2}\sum_{t=1}^{T}\log(|H_t| + u'_{\mathbf{t}}H_t^{-1}\boldsymbol{u_t}) \tag{11}$$

where θ represents the set of all parameters to be estimated, N is the number of dependent variables (in our case $N=2$) and T is the number of observations.

Using multivariate GARCH we can model time-varying variances and covariances between stock market returns. We estimate the magnitude of comovements by computing dynamic conditional correlations, which are defined in time t as:

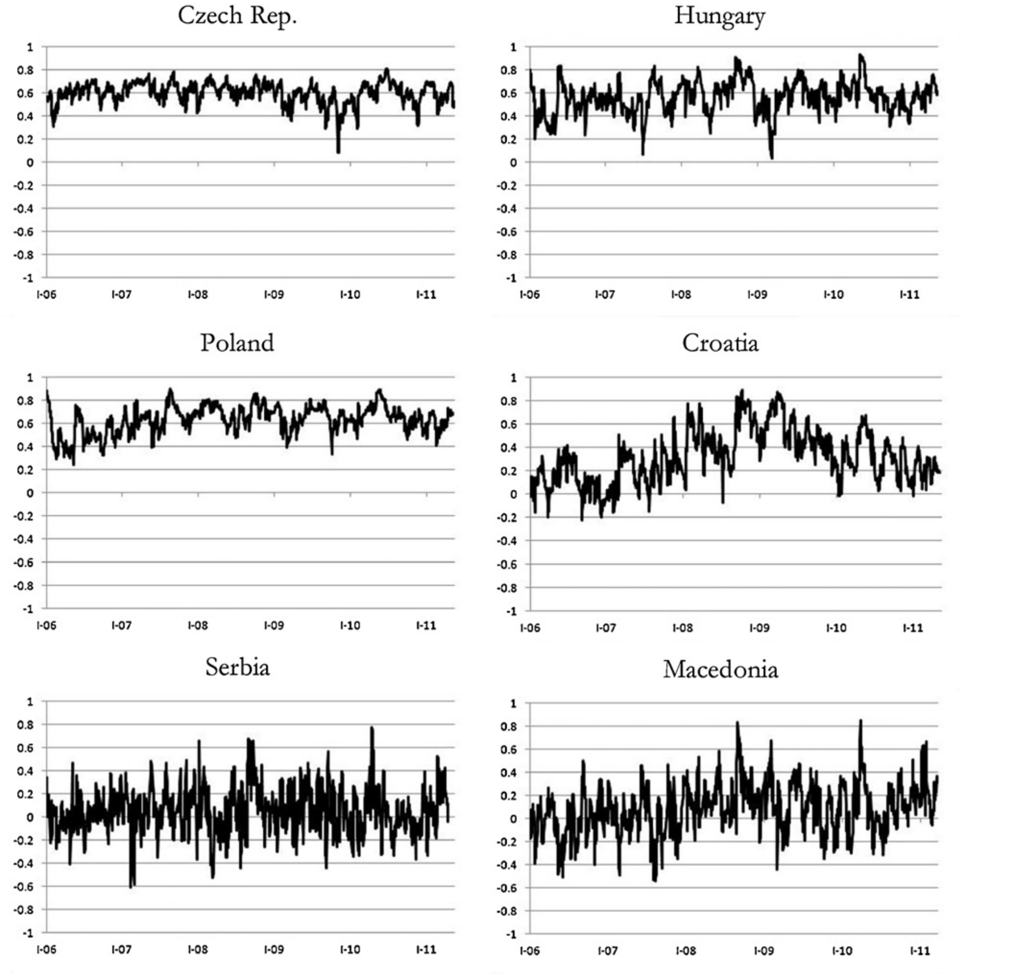
$$\rho_{12,t} = \frac{h_{12,t}}{\sqrt{h_{11,t}h_{22,t}}} \tag{12}$$

5. Results

This section presents our results on measuring the comovements among stock markets. More specifically, we use the BEKK–GARCH model to receive the time-varying conditional correlations among the stock markets, e.g. $\rho_{12,\mathrm{t}}$.

The plot of all stock markets – both levels as well as returns – is available in Fig. 1. All stock markets were hit substantially by the global financial crisis and the values of stock market indices often fall below the level at the beginning of our sample. There is a clear volatility clustering, with the stock markets being the most volatile in the second half of 2008 after the fall of Lehman Brothers.

Fig. 2 reports the conditional correlations for all Central and South Eastern European stock markets vis-à-vis STOXX 600. The results indicate that Central European stock markets comove strongly with Western European stock markets. The value of conditional correlation fluctuates somewhat, but typically it is around 0.6. This complies with the previous findings of Hanousek and Kočenda (2011), who document strong linkages between Central European and old EU members' stock markets.



Notes: The figures present the conditional correlations from the estimation of a multivariate GARCH model between the returns of the STOXX index (to represent Western Europe) and the respective Central or South Eastern European stock market returns.

Fig. 2. Assessing the degree of stock market integration. *Notes*: The figures present the conditional correlations from the estimation of a multivariate GARCH model between the returns of the STOXX index (to represent Western Europe) and the respective Central or South Eastern European stock market returns.

Interestingly, the conditional correlation decreases somewhat in the Czech Republic and Hungary in about mid-2009. However, in general, the global financial crisis does not change the degree of stock market integration between Central and Western Europe. This is also apparent when looking at the stock market series in Fig. 1. All stock markets tend to grow before the onset of the global financial crisis, then fall sharply in 2008 and recover, to a certain extent, afterwards.

On the other hand, the volatility between Serbian and Macedonian stock markets and Western European stock markets is not correlated. In other words, these stock markets are unlikely to be integrated. Interestingly, the Croatian stock market evolves from nearly zero comovements at the beginning of our sample to values as high as the ones for Central Europe before the onset of the global financial crisis and subsequently falls to lower, but still positive values during the crisis. The results for

Croatia are likely to reflect four main factors: (1) greater stock market capitalization in Croatia than in the remaining South Eastern European stock markets; (2) financial reforms progressing faster in Croatia than in other countries in the region with financial services legislation largely aligned with the EU's *acquis communautaire* by 2009; (3) the EU entry negotiations in progress with the expected entry to the EU in July 2013. Nevertheless, it has to be mentioned that the decrease in market capitalization during the crisis may influence the degree of stock market integration, too. The results for Croatia are broadly in line with Cappiello et al. (2006) and Gilmore et al. (2008), who report the increasing integration of the Central European stock markets before EU entry, but not afterwards (see also Babetskii et al., 2007).

All in all, the results suggest that the stock market integration between Central Europe and Western Europe is high with the values typical for most major stock markets in the developed countries. South Eastern European stock markets exhibit a much lower degree of integration, but also show more heterogeneity. While the volatility of the Croatian stock market is positively correlated with the volatility of Western European stock markets, the remaining stock markets – Serbia and Macedonia – tend to display no common pattern.

6. Conclusion

In this article, we examine the stock market comovements between Western Europe vis-à-vis Central (Czech Republic, Hungary and Poland) and South Eastern Europe (Croatia, Macedonia and Serbia) using daily data from 2006 to 2011. For this reason, we estimate the bivariate BEKK–GARCH models to receive the conditional correlation in order to shed light on stock market integration in this set of countries.

Our motivation for this exercise is to assess whether stock markets in Central Europe, i.e. in countries sufficiently integrated into European structures, are indeed more closely linked with stock markets in Western Europe. Next, as the conditional correlations are available on a daily basis, we may also assess whether stock market integration changes over time. More specifically, we assess the hypothesis whether some countries that intensified their integration process toward the EU are more likely to exhibit increased stock market integration. In addition, our motivation is also to evaluate whether the global financial crisis changed the nature of shock transmission between these countries. In doing so, we not only update previous research by including the current global financial crisis period, but also evaluate the stock market integration of Western Europe vis-à-vis several South Eastern European countries, a topic on which we have very limited empirical evidence.

The results show that the degree of stock market integration of Central Europe vis-à-vis Western Europe is much higher than integration of South Eastern Europe vis-à-vis Western Europe. As concerns Central Europe, the corresponding conditional correlation is around 0.6. This is a sizeable correlation, especially in light of previous studies examining the correlation among developed countries with a high degree of economic integration. For example, Longin and Solnik (1995) report the value of 0.7 for the conditional correlation between the US and Canadian stock markets.

On the other hand, the conditional correlation between South Eastern European vis-à-vis Western European stock markets is much lower. In the case of Serbia and Macedonia, the correlation is, on average, zero for the full sample. Croatia displays zero correlation at the beginning of our sample, the correlation increasing to values as high as the ones for Central Europe before the onset of the global financial crisis and subsequently falling to lower, but still positive values. The evolution of the conditional correlation of Croatia is in some sense unique, as the corresponding correlations do not exhibit any apparent trend and remain largely the same for all countries. The increasing correlation for Croatia is likely to be associated with the growing economic integration toward the EU coupled with the intensified negotiation process especially in 2007–2010, when Croatia aligned most of the negotiation chapters including those related to the financial sector in line with the EU's *acquis communautaire*. Nevertheless, we have to keep in mind that the results are also likely to be influenced by the decrease in market capitalization during the crisis, which may have translated into somewhat weaker stock market integration.

In terms of future research, we believe it would be worthwhile to examine other South Eastern European countries as well as to broaden the scope in the direction of covering a wider array of various financial segments in order to evaluate the financial integration of these countries with the EU in a fuller manner.

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Appendix A

See Table A1.

Table A1
Descriptive statistics – stock market returns.

	STOXX	PX	BUX	WIG
Mean	−0.007	−0.012	0.007	0.022
Median	0.074	0.046	0.036	0.052
Maximum	9.41	12.36	13.177	6.083
Minimum	−7.92	−16.18	−12.64	−8.288
Std. dev.	1.428	1.836	1.931	1.499
Skewness	−0.052	−0.497	−0.017	−0.356
Kurtosis	9.586	15.366	9.076	5.647
Jarque–Bera	2476.9	8644.8	2069.2	421.6
P-value	0	0	0	0
Observations	1370	1348	1345	1346

	CROBEX	BELEX-15	MBI
Mean	0.008	−0.025	0.009
Median	0.066	−0.028	0
Maximum	14.77	12.15	6.661
Minimum	−10.76	−10.86	−10.28
Std. dev.	1.605	1.677	1.652
Skewness	−0.008	0.168	−0.404
Kurtosis	14.17	12.54	8.614
Jarque–Bera	6953.3	5118.1	1776.3
P-value	0	0	0
Observations	1337	1346	1325

Notes: P-value for Jarque–Bera test for normality reported.

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