Financial Market Co-Movement between Transition Economies: A Case Study of Serbia, Hungary, Croatia and Slovenia

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Abstract: This paper tests and analyses the interdependence of financial markets in the transition economies of Serbia, Hungary, Croatia and Slovenia, as well as the similarity of these markets with the US financial market. The source of information is the data obtained from the financial markets of these countries in the form of stock-market indices for the period 05.10.2005-30.09.2011. The main hypothesis to be tested in the work is the assumption that there is a significant level of similarity between these financial markets. The methodology used in the study includes statistical methods of sampling and factor analysis. The research results confirm the hypothesis, which was tested in the work, that there are significant levels of similarity between the financial markets of transition economies, both among each other and with the US market.

Keywords: financial markets; transition economies; stock exchange; stock-market indices

1 Introduction

Transition economies are characterized by an array of specific features and characteristics, given that in these economies the degree of changes – both on micro and macro spheres – are manifested more intensively, market fluctuations are more significant and their effects are more obvious. Also, it is evident that the global business environment is changing very rapidly. [7] The financial markets of transition economies represent the typical conditions and circumstances of these economies in terms of their relative "shallowness", insufficient liquidity and extreme volatility. A significant issue in the modern business reality is the level of

similarities and differences between individual financial markets, especially in the terms of transition economies vs. developed markets. The turbulence of changes, both on the micro and macro levels, raises the question of a linkage between individual financial markets, in terms of an "overflow" of the state and conditions from one financial market to another. These issues have gained in importance particularly in recent years given the present financial crisis and its effects, and also the effects of the crisis transfer from one to other financial markets. Pericoli and Sbracia [9] have very analytically dealt with issues concerning financial contagion in their research. They have pointed to some key questions with which all financial analysts should start their analysis, before trying to get answers on the issues of connection between financial markets. The first question they addressed in their study refers to which channels international shocks should be transferred? The second question relates to the analysis of certain discontinuities in international transmission mechanisms and the third question poses a dilemma in terms of whether international investors and financial policy makers should be concerned about the rising levels of similarity in the forming of stock market prices on various financial markets during periods of market instability. Accordingly, the subject of the study is to test the level of similarities between the financial markets of some transition economies, with special emphasis on the study of similarity of these markets to the US market. The research especially focuses on the crisis period (especially to 2008), as well as on the effects produced by the crisis on these markets and reaching certain conclusions about the similarities and differences of the reactions made by these markets to these effects.

When researching the specific features of financial markets of transition economies, a range of factors that influence the state of affairs on these markets must be taken into account. By this, it is primarily referred to the availability and transparency of information on these markets, the level of efficiency of these markets, the institutional regulation of these markets and the like. Beine and Candelon [8] in their research confirmed the existence of a significant correlation between the volume of trading and the extent of the reforms carried out on these markets in the form of their financial liberalization. Namely, there is a significant similarity between the markets of transition economies in the domain of their institutional framework, approaches in defining trading technologies and the diversity of financial instruments. Consequently, it is interesting to test the level of similarities between these markets, expressed through the stock-market indices, which reflect the actually gained stock market prices on financial markets of transition economies.

Daly [5] in his work, which is engaged in researching and testing the connection between the markets of South-East Asia in the period before and after October 1997, came to the conclusion that no matter that there is evidence of a link between financial markets of South-East Asia, the overall results suggest that there is no significant increase in the level of correlation between the financial markets during the post-crisis period. These results are very interesting, since they

suggest the need to further analyse the factors that significantly affect the level of correlation between the financial markets. It is particularly important to test the level of correlation between the financial markets of transition economies, given the fact that these are relatively "young" markets which are extremely vulnerable to the impacts of the environment, are little or not efficient at all, and are highly volatile.

It is especially important to try to provide a precise answer to the question of the relationship between stock returns potentially generated on these markets, based on quantitative grounds. One of the main objectives of this research is to provide high quality, reliable information tested in practice for potential investors on investment opportunities on these markets and thus to reduce the risks of investing activities. Accordingly, it is essential to explore and test the existence of similarities between the financial markets and to try to test the changes in returns that may be made on these markets as well as the links between the markets in question, all in order to offer potential investors quality information on the possibilities of investment diversification.

Ciarlone, Piselli and Trebeschi [1] analysed in their article how much of the reduction in emerging markets spreads can be ascribed to specific factors - linked to the improvement in a given country's fundamentals; rather than to common factors, which are linked to global liquidity conditions and agents risk aversion. They found that a single common factor is able to explain a large part of the co-variation in emerging market economies spreads observed in the last 4 years, and they concluded that emerging market economies do remain vulnerable to sudden shifts in financial market conditions.

Berger, Pukthuanthong and Yang [3] in their research analysed international diversification in the sense of frontier markets. That is extremely interesting for our research having in mind that we are still at the beginning of international diversification in the sense of emerging markets and the possibilities of gaining larger stock returns with smaller investment risk. They proved that frontier markets have low integration with the world market and thereby offer significant diversification benefits.

Albuquerque and Vega [11] analysed the effects that real-time domestic and foreign news about fundamentals have on the co-movement between stock returns of a small, open economy, Portugal, and a large economy, the United States. They concluded that US macroeconomic news and Portuguese earnings news do not affect stock-market co-movement. For our research, this could be interesting, keeping in mind that we analysed co-movements between transition economies and the US market.

Kodres and Pritsker [6] developed a multiple asset rational expectations model of asset prices in order to explain financial contagion with a focus on contagion through cross-market rebalancing. Inci, Li and McCarthy [2] used local correlation to examine financial contagion. They found out that there is reverse

contagion from any of the German, British, Japanese and Hong Kong spot or index futures markets to those of the U.S. Corsetti, Pericoli and Sbracia [4] showed that the results of no contagion is due to arbitrary and unrealistic restrictions on the variance of country-specific shocks.

Considering all the above mentioned facts and analysing the research made in the field, it can be concluded that the issue of correlative links between financial markets in developed economies, the links between market returns, the stock returns and the volatility of the developed markets are relatively well explored, but the same cannot be said for the financial markets of transition economies. This is one of the main reasons for the implementation of the present research work, aimed at potential investors and the interested public, offering high quality, tested-in-practice information on the relationship levels between transition market economies, all with the aim of finding specific information on the possibilities of investment diversification.

In that sense, the following hypotheses were tested in the work:

H0: There is a high level of similarity between the financial markets of transition economies, both among themselves and in relation to the US financial market. This is the basic hypothesis of the research, in terms of an ambition to study and test the level of integration between financial markets of transition economies, and the level of similarity of these markets with the US financial market. The starting point of the research is the existence of a significant level of similarity between these markets, which can best be tested on the example of stock-market indices that represent the actual transactions carried out on them.

H1: The returns on these financial markets show a statistically significant correlation. This hypothesis is rooted in the previous research hypotheses, since by analysing stock-market indices, among other things, we analyse the potential returns generated. In other words, by testing this hypothesis the aim is to prove or to deny the thesis that if financial markets are substantially similar, then it is reasonable to expect that the returns on these markets are significantly correlated as well, and vice versa.

H2: Changes in stock-market indices on these financial markets are inter-linked. The aim is to test the variability level of stock-market indices, in the sense whether certain market laws are possible to be set on the movements of the stock-market indices of these markets.

The obtained research results will be significant not only to the field experts and professionals but also to a wider academic audience because it will confirm or deny the existence of links between the financial markets of transition economies and a correlation of these markets with the US financial market, which will provide important information both to potential investors and portfolio analysts. Also, through research, the direction of these relationships will be tested, as well as the links between the returns which can be achieved on these markets, in terms

of testing correlative relationships between the stock-market indices of these economies. Bearing in mind that relatively few studies have been published on this topic so far, it is assumed that this research will represent a significant contribution to the research's subject area, especially keeping in mind the recessionary conditions on the financial markets in general.

The study is organized as follows: in the first part, the introductory remarks are presented with a comparative overview of the representative research made in the field. In the second part, the used methodology is presented. In the third section, the data and the results are shown, while in the fourth section the conclusions are presented.

2 Methodology Review

The methodology used in the research is aimed towards gaining concrete, practically tested knowledge about the level of similarities between the observed financial markets. In order to obtain reliable analysis results, the analysed sample covers the period between 05.10.2005-30.09.2011, i.e. a total number of 1508 days were observed. During the observed period, the values of stock-market indices and their changes over time were analysed, as the stock-market indices represent the closed – realized market prices on the observed financial markets. Given that the stock exchanges are considered to be the typical institutions of the financial markets generally, it made sense to take stock-market indices into the analysis. The sample was taken from the following stock-market indices: Belex15, BelexLine, Crobex, SBItop, Bux, DJIA, S&P500. The stock-market indices of Belex15 and BelexLine were deliberately taken into account as a way and aspect of internal control of the given results, because it was expected that the two stock-market indices would have behaved very similarly as time passed. Bearing in mind all mentioned, it can be concluded that the sample chosen for the research is representative, and that the given results will be the result of original scientific research based on representative samples and the application of appropriate scientific methodology.

In the first part of the research, the analysis of the sample was carried out, both in terms of a single year, and the overall sample. The data is first calculated by the arithmetic mean and standard deviation. The obtained values of the mean and standard deviation values indicate movement of the sample over time and the amplitude-change values.

Standard deviation shows how the sample elements deviate in average from their arithmetic mean, and are calculated by using the formula [12]:

$$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2} \tag{1}$$

where:

n - the number of elements in the sample

$\bar{x}$ (x-bar) - the arithmetic mean of the sample

x_i - (i =1,2,...,n) the `i`-th member of the sample

In the further studies we used factor analysis [10]. With factor analysis the variables are grouped into factors, which provide variables that are related, i.e. which behave similarly. In this way, the initial set is reduced to a number of extracted factors which contain the information about the mutual relationship of all variables. The formula used for this purpose is [10]:

$$y_i = \mu_i + \sum_{j=1}^{k}\lambda_{ij} f_j + \varepsilon_i \tag{2}$$

where $\varepsilon_i \sim N(0,\psi_i)$ and $\varepsilon_1,...,\varepsilon_p$ are independent. Note that (2) appears to be a multiple linear regression problem except that the values of $f_1,...,f_k$ are unknown. The parameter λ_{ij}, relating the ith variable with the jth factor, is called a factor loading.

In order to present the results more concise, the model presented in the formula (2) can be written in a matrix form. Let $y' = (y_1,...,y_p)$, $f' = (f_1,...,f_k)$, $\varepsilon' = (\varepsilon_1,...,\varepsilon_p)$, $\psi' = (\psi_1,...,\psi_p)$ and $\Lambda = (\lambda_{ij})$. In this way we get the following formula [10]:

$$y = \mu + \Lambda f + \varepsilon \tag{3}$$

where $\mu = (\mu_1,...,\mu_p)'$ and $\varepsilon \sim N_p(0,\psi)$, with $\psi = diag(\psi_1,...,\psi_p)$. By taking the mean of variance y, we obtain:

$$E(y) = \mu, \tag{4}$$

$$\mathrm{cov}(y) = \Lambda\Lambda' + \psi \equiv \sum. \tag{5}$$

In the research we derived the estimators as solutions of the equations:

$$diagS = diag(\Lambda\Lambda' + \psi) \text{ and } \Lambda = S(\Lambda\Lambda' + \psi)^{-1}\Lambda. \tag{6}$$

When the initial choice of the factor loadings Λ was made in the research, the next step is to "rotate" the factors to obtain ones that are easily interpreted. The model

that is considered in (3) assumed the factors $f_1,...,f_k$ to be independently distributed as N(0,1). [10] That is,

$$f \sim N_p(0, I). \tag{7}$$

If we premultiply out factors by a p x p orthogonal matrix Γ, we have:

$$f^* = \Gamma f \sim N_p(0, I). \tag{8}$$

This model can be also written:

$$y = \Lambda f + \varepsilon = \Lambda \Gamma' \Gamma f + \varepsilon = \Lambda \Gamma' f^* + \varepsilon. \tag{9}$$

If we wish to relax our condition of independent factors, we can premultiply our factors f by an arbitrary matrix A, obtaining

$$f^{**} = Af \tag{10}$$

Hence (8) becomes

$$y = \Lambda f + \varepsilon = \Lambda A^{-1} A f + \varepsilon = \Lambda A^{-1} f^{**} + \varepsilon. \tag{11}$$

where $f^{**} \sim N_p(0, AA')$.

3 Data and Results

For the purpose of the study a representative sample was formed, which includes the daily values of stock-market indices of Serbia, Hungary, Croatia and Slovenia, as transition economies from the region of South-East Europe; and also the daily values of the S&P500 and DJIA stock-market indices were analysed, as representatives of the typical conditions and circumstances on the US financial market. The time period covered by the survey is the period from 05.10.2005 to 30.09.2011. The data are collected from the official stock exchange web sites. Statistically, this is a representative sample which covers a large amount of information that could be characterised as reliable, because they represent official information about the movements of stock-market indices on the observed stock exchanges. In 2005, the sample has 63 days; in 2006 a total of 248 days; in 2007 it has 251 days; in 2008 the sample consists of 254 days; in 2009 it covers 254 days; in 2010 the sample is represented with 251 days, and in 2011 the sample has 187 days. Totally, the observed period covers 1508 days. In the first part of the research, the statistical analysis of the observed sample was carried out in order to gain qualitative knowledge on the behaviour and characteristics of the observed sample year by year, as well as through the passing of time, i.e. years. This was

carried out on the basis of observing the movements and the dynamics of the changes that occurred on the stock-markets. The arithmetic mean, the standard deviation, the maximum and minimum values were calculated. These indicators describe the form of the sample, and also the movements of the stock-market indices values are shown during the observation period. When observing the values of the stock-market indices annually, a similar behaviour can be seen, in terms of the standard deviation of the sample, as well as in terms of minimum and maximum values. To get a complete insight into the characteristics of the entire sample, statistical analysis was conducted for the entire sample and the data obtained are presented in Table 1 below.

Table 1

The descriptive statistical analysis of the sample

Stock index	Mean	N	Std. Deviation	Minimum	Maximum	Range
Belex15	1225.318	1508	752.32	354.39	3304.64	2950.25
BelexLine	2144.457	1508	1105.24	841.99	5007.34	4165.35
Bux	21400.68	1508	4039.46	9461.29	30118.12	20656.83
Crobex	2771.613	1508	1072.25	1262.58	5392.94	4130.36
SBItop	1276.882	1508	547.53	592.07	2674.69	2082.62
DJIA	11174.75	1508	1557.06	6547.05	14164.53	7617.48
S&P500	1227.228	1508	190.86	676.53	1565.15	888.62

Source: Author's calculations

On the basis of the value of the standard deviation, it is seen that the slightest deviation from the mean is in the case of the stock-market indices of S&P500 and SBItop, while the maximum deviation was that of Bux. Based on minimal and maximum values, the ranges of stock-market indices values are represented. Moderate deviations are observed at Crobex and BelexLine, while the DJIA stock-market index shows a slightly larger deviation. This all suggests that the least volatile financial markets were Croatia and Serbia, and the most volatile was the Hungarian financial market. It is interesting to note that in the case of the DJIA stock-market index, a significant level of volatility is also present, as compared to both the transitional financial markets and in relation to the financial markets represented in the values of S&P500.

The application of the descriptive analysis methods on the value changes of stock indices over time (returns), leads to interesting results about the behaviour of the sample, or returns. When the entire sample is analysed, the following results are obtained (Table 2).

Based on the standard deviation, it is noted that the slightest deviation from the mean values were in the case of BelexLine and SBItop, while the maximum deviation was for Bux. Based on minimum and maximum values, the ranges of stock-market indices value changes (returns) are seen. Moderate deviations are observed for the DJIA, S&P500 and Crobex, while Belex15 has a slightly larger deviation. The highest range is noted for Bux and CROBEX, as seen according to the values.

Table 2
The descriptive analysis of the value changes of the stock-market indices

Stock index	Mean	N	Std. Deviation	Minimum	Maximum	Range
Belex15	-0.0174	1507	0.71694	-4.72	5.28	10
BelexLine	-0.0169	1507	0.48493	-3.03	4.29	7.31
Bux	-0.011	1507	0.83574	-5.49	5.72	11.22
Crobex	-0.0014	1507	0.67343	-4.68	6.42	11.09
SBItop	-0.0101	1507	0.555	-3.66	3.63	7.29
DJIA	0.0017	1507	0.60354	-3.56	4.56	8.13
S&P500	-0.0015	1507	0.66255	-4.11	4.76	8.87

Source: Author's calculations

The mean value of the stock-market indices by years are presented in the following table (Table 3).

Table 3
Mean values of stock-market indices by years

Stock index	2005	2006	2007	2008	2009	2010	2011
Belex15	1028.304	1241.705	2617.193	1439.761	599.1034	659.4091	720.6143
BelexLine	1942.79	2198.118	4121.986	2568.696	1202.729	1280.005	1350.109
Bux	21197.63	22446.97	26087.15	19690.18	16279.62	22487.13	21612.07
Crobex	2040.55	2640.626	4482.458	3508.53	1857.744	1992.694	2181.096
SBItop	904.8417	1167.838	2135.025	1692.112	977.8764	886.7618	760.7701
DJIA	10636.67	11416.31	13178.26	11235.41	8905.041	10677.76	12014.07
S&P500	1233.297	1310.928	1477.184	1218.907	950.325	1141.063	1281.748

Source: Author's calculations

The value of the stock-market indices per year increased in 2005, 2006 and 2007, while a decrease was noted in 2008 and 2009, a slight stabilization in 2010, and decline again in 2011. Bux shows this trend the most obviously, and other stock-market indices show a similar trend, but since they show a more moderate growth, the fall is consequently also more moderate.

By data analysis, we can see changes in the value of stock-market indices (returns) per year, which is presented in Table 4.

Table 4
The mean change in value of stock-market indices (returns) per year

Stock index	2005	2006	2007	2008	2009	2010	2011
Belex15	0.0346	0.0801	0.0562	-0.2413	0.0275	-0.0032	-0.0383
BelexLine	0.0002	0.0562	0.0604	-0.1995	0.0198	-0.0068	-0.0387
Bux	-0.0722	0.0268	0.0109	-0.1177	0.0949	-0.0016	-0.0819
Crobex	0.0145	0.0837	0.0766	-0.178	0.0238	0.0106	-0.0345
SBItop	0.0545	0.0761	0.0957	-0.1869	0.0297	-0.033	-0.071
DJIA	0.0394	0.0238	0.0108	-0.0657	0.0269	0.0174	-0.016
S&P500	0.0466	0.0189	0.006	-0.0778	0.0341	0.0192	-0.0269

Source: Author's calculations

The results show that the value of the stock-market indices changes (returns) is positive in 2006 and 2007, while in 2008 an expressed negative value of the stock-market indices changes (returns) is seen. In 2009, as well as in the following year, the returns are mostly positive and then again fall to negative values in 2011. In the previous phase, the observed sample was analysed for changes in the value of the stock-market indices, and also according to changes of returns values, which result from the changes in the values of stock-market indices in the given period. In the following, the research emphasis is placed on the analysis of the sample structures, all in order to test the level of similarities or differences between the observed financial markets and as such to gain specific, empirically tested knowledge about the relationships between the observed markets. This analysis included the following stock-market indices: Belex15, BelexLine, Bux, Crobex SBItop, DJIA, S&P500. For easier representation, the results shown in Tables 5, 7, 8, 10, 12, 13 were multiplied by 1000.

The study will first test whether there is a difference in the correlation of stock-market indices related to years, i.e. which values of stock-market indices show higher and which show lower correlation with the years. A structure analysis is carried out of two separate factors with the observed stock-market indices and years (the way stock-market indices behave over time is tested). Through the method of main components, the structure of the two separate factors are analysed on the basis of eight factors: year, Belex15, BelexLine, Bux, Crobex, SBItop, DJIA, S&P500, with a sample of 1445 days. The analysis covers the years 2006, 2007, 2008, 2009, 2010 and 2011.

Table 5

Correlation matrix of the values of stock-market indices and years

	Year	Belex15	BelexLine	Bux	Crobex	SBItop	DJIA	S&P500
Year	1000							
Belex15	-593	1000						
BelexLine	-610	997	1000					
Bux	-237	651	644	1000				
Crobex	-516	941	953	624	1000			
SBItop	-553	902	918	529	960	1000		
DJIA	-261	759	755	878	761	632	1000	
S&P500	-402	794	791	878	770	644	983	1000

Source: Author's calculations

Table 5 shows that the highest correlation (997) is seen between the values for BelexLine and Belex15, which has been expected, since they represent the same financial market, and the two stock-market indices were taken into consideration as parts of the analysed sample functioning as corrective factors, i.e. to test the correctness of the selected methods of analysis. The highest correlation with a negative sign (-610) is seen between BelexLine and year (years).

Table 6
The characteristic root and the participation percentage of stock-market indices and years

n	Root	%	Sum
1	6.094	76.176	76.176
2	1.128	14.103	90.279
3	0.507	6.336	96.615
4	0.148	1.852	98.467
5	0.098	1.219	99.686
6	0.019	0.243	99.930
7	0.003	0.044	99.973
8	0.002	0.027	100.000

Source: Author's calculations

According to the results of Table 6, it is visible that the two selected factors cover ca. 90% of sample information.

Table 7
The structure of the two extracted factors of the stock-market indices and the years

					1 -factor			2 -factor		
	J1	qlt	wrig	inr	krd	cor	ctr	krd	cor	ctr
1	Year	712	1	125	574	329	54	618	383	339
2	Belex15	953	1	125	-962	925	152	-167	28	25
3	BelexLine	967	1	125	-965	932	153	-188	35	31
4	Bux	879	1	125	-788	621	102	508	258	229
5	Crobex	923	1	125	-949	901	148	-150	22	20
6	SBItop	881	1	125	-891	793	130	-296	88	78
7	DJIA	966	1	125	-879	772	127	440	194	172
8	S&P500	942	1	125	-906	821	135	347	120	107
			8.0	1000			1000			

Source: Author's calculations

In Table 7, the columns mean the following: qlt - communality, wrig - weight coefficient, inr - inertia; krd – coordinate points; cor – the contribution of the factors to the variable, ctr - the contribution of the variable to the factors.

The results show that the values of stock-market indices are mutually compatible, while the values of the stock-market indices do not agree with the time lapsing (years). The first factor includes all the stock-market indices, and they reversely agree with the time passing. The reason for this is the decline in the values of the stock-market indices, which was detected in the analysed period. The whole of the eight characteristics is reduced to two separate factors. A significant contribution of the extracted factors (qlt) individually was observed in all eight features (year and the seven observed values of the stock-market indices). The results show that all values of the stock-market indices belong to one factor.

All analysed stock-market indices, including changes according to the years, were divided into two factors, and since all the stock-market indices belong to the first factor, they tend to show a similarity in the changes by years.

The structure of the first extracted factor consists of seven stock-market indices, namely: BelexLine with factor contribution (cor) 932, Belex15 with factor

contribution (cor) 925, Crobex with factor contribution (cor) 901, S&P500 with factor contribution (cor) 822, SBItop with factor contribution (cor) 794, the DJIA with factor contribution (cor) 773, Bux with factor contribution (cor) 621. The latent contribution to the structure consist of years with contribution factor (cor) 329. The structure of the second extracted factor consists of the year with factor contribution (cor) 383.

By the analysis of the correlation at the two extracted factors for the value of the stock-market indices (the time factor is not taken into analysis, analysis were carried out within the stock-market indices values), the structure of the two extracted factors were analysed (with principal component method) based on the seven values of stock-market indices, namely: Belex15, BelexLine, Bux, Crobex, SBItop, DJIA, S&P500, with a sample of 1445 days.

Table 8

Correlation matrix of the values of the stock-market indices

	Belex15	BelexLine	Bux	Crobex	SBItop	DJIA	S&P500
Belex15	1000						
BelexLine	997	1000					
Bux	651	644	1000				
Crobex	941	953	624	1000			
SBItop	902	918	529	960	1000		
DJIA	759	755	878	761	632	1000	
S&P500	794	791	878	770	644	983	1000

Source: Author's calculations

According to Table 8 the highest correlation (997) is seen between BelexLine and Belex15, while the lowest was between SBItop and Bux (529).

Table 9

The characteristic root and the percentage of contribution of the stock-market indices values

n	Root	%	Sum
1	5.804	82.921	82.921
2	0.899	12.843	95.764
3	0.149	2.126	97.890
4	0.112	1.604	99.494
5	0.021	0.299	99.793
6	0.012	0.174	99.968
7	0.002	0.032	100.000

Source: Author's calculations

The percentage of characteristic roots ranges from 0.032% to 82.921% (Table 9). The newly acquired structure consists of the two extracted factors, which contain 95.764% of the entire information of the tested section.

In Table 10, the columns mean the following: qlt - communality, inr - inertia; krd - coordinate points; cor – the contribution of the factors to the variable, ctr - the contribution of the variable to the factor.

Table 10
The structure of the two extracted factors of the stock-market indices

				1 -factor			2 -factor		
	J1	qlt	inr	krd	cor	ctr	krd	cor	ctr
1	Belex15	962	143	953	908	156	232	54	60
2	BelexLine	975	143	955	912	157	249	62	69
3	Bux	913	143	810	655	113	-508	258	287
4	Crobex	971	143	947	897	155	272	74	82
5	SBItop	952	143	881	777	134	419	175	195
6	DJIA	962	143	902	814	140	-385	148	165
7	S&P500	969	143	917	841	145	-357	128	142
			1000			1000			

Source: Author's calculations

Based on the results in Table 10, it can be seen that there is a high correlation and agreement between the values of the stock-market indices, which means that when a stock-market index rises, others rise as well; or when one of the stock-market indices fall, other values fall, too. Higher values for communality are seen at: BelexLine 975, Crobex 971, S&P500 969, Belex15 962, DJIA 962, SBItop 952, Bux 913.

The structure of the first extracted factor consists of seven separate stock-market indices, namely: BelexLine with contributing factor (cor) 913, Belex15 with contribution factor (cor) 909, Crobex with the contribution factor (cor) 898, S&P500 with contribution factor (cor) 841, DJIA with contribution factor (cor) 814, SBItop with contribution factor (cor) 777, and Bux with contribution factor (cor) 656. The structure of the second extracted factor cannot be defined.

According to the analysis of the stock-market indices values by years, the research provides the following information (Tables 11 and 12, Figure 1).

Table 11
The grouping of the stock-market indices values

Level	Proximity
Belex15, BelexLine	0.00
Belex15, Crobex	0.01
S&P500, Bux	0.02
DJIA, S&P500	0.04
Bux, DJIA	0.14
Belex15, Bux	0.25

Source: Author's calculations

Based on the displayed dendrogram (Figure 1), a grouping by similarity of the stock-market indices are observed, and it clearly can be concluded that one group consists of Belex15, BelexLine and Crobex, while the second group includes SBItop, DJIA and S&P500. It can be concluded that Bux tends to lean towards the second group, which is confirmed by other research results, as well.

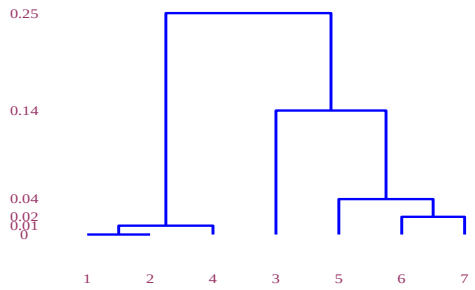

Figure 1
The grouping of the stock-market indices according to similarities

Legend: Belex15 (1); BelexLine (2); Bux (3); Crobex (4); SBItop (5); DJIA (6); S&P500 (7)
Source: Author's calculations

The mutual contribution of the factor structure of the years in relation to the values of the stock-market indices also provides interesting results (Table 12).

Table 12
The mutual contributions between groups (6) division and extracted structure factor analysis

				1-factor			2-factor		
	Mass	inr	kvl	krd	cor	ctr	krd	cor	ctr
2006	172	7	1000	178	120	1	-483	880	45
2007	174	383	1000	3909	989	457	417	11	34
2008	176	30	1000	625	326	12	897	674	157
2009	176	204	1000	-2713	908	223	863	92	146
2010	174	61	1000	-1369	761	56	-766	239	113
2011	129	42	1000	-808	285	15	-1282	715	236

Source: Author's calculations

In Table 12, the columns mean the following: inr - inertia, kvl – the quality of the elements in the structure; krd – coordinate points, cor – the contribution of the factor to the variable, ctr - the contribution of the variable to the factor.

The results presented in Table 12 show that in 2007, 2009, 2010, and to a lesser extent, 2008 and 2011 belong to the first factor, while the years 2006, 2008 and 2011 belong to the second group. The relations between the years can be seen based on the results, i.e. which years are inter-related.

Table 12 shows that the highest weighting coefficient 176 is seen in 2008, which means that most part of the sample belongs to one class – and exactly to the class corresponding to the above specified weighting, and the next is with the classes: 2009 (176), 2007 (174), 2010 (174), 2006 (172), 2011 (129). The inertia (inr) for the class of 2007 is 383, which means that it is distinguished the most from other classes, and the results follow as listed: 2009 (204), 2010 (61), 2011 (42), 2008 (30), 2006 (7). On the basis of mutual distance per year, the following results were calculated (Tables 13, 14 and 15, Figure 2):

Table 13

Mutual contributions of the extracted factor structures and the differences in the two centres of the groups (dipoles)

				1-factor			2-factor		
group		inr	kvl	krd	cor	ctr	krd	cor	ctr
2007	2006	1272	1000	3731	945	207	901	55	78
2008	2006	183	1000	446	95	3	1381	905	184
2008	2007	962	1000	-3284	979	162	480	21	22
2009	2006	883	1000	-2891	822	125	1346	178	175
2009	2007	3849	1000	-6622	995	660	446	5	19
2009	2008	979	1000	-3338	1000	169	-34	0	0
2010	2006	213	1000	-1547	968	36	-283	32	8
2010	2007	2541	1000	-5278	952	417	-1184	48	135
2010	2008	589	1000	-1993	589	60	-1664	411	269
2010	2009	390	1000	1345	405	27	-1629	595	258
2011	2006	119	1000	-986	604	12	-798	396	52
2011	2007	1864	1000	-4717	885	284	-1699	115	238
2011	2008	507	1000	-1433	302	26	-2179	698	394
2011	2009	613	1000	1905	441	47	-2145	559	381
2011	2010	43	1000	560	542	4	-515	458	22

Source: Author's calculations

In table 13, the columns mean the following: inr - inertia, kvl – the quality of the elements in the structure; krd - coordinate points; cor – the contribution of the factors to the variable, ctr - the contribution of the variable to the factor.

Table 14

Distance (Mahalanobis) between the years in relation to the movement of stock-market indices values

	2006	2007	2008	2009	2010	2011
2006	0.00	3.40	2.83	6.82	5.03	3.34
2007	4.93	0.00	5.98	3.26	6.82	3.34
2008	3.40	2.83	6.82	5.03	3.34	0.00
2009	0.00	5.98	3.26	6.82	3.34	1.05
2010	2.83	6.82	5.03	3.34	0.00	1.05
2011	5.98	3.26	6.82	3.34	1.05	0.00

Source: Author's calculations

By the Mahalanobis distance calculation, yet another indicator of the similarities or differences between the stock-market indices or the financial markets that they represent is obtained (Table 14). This way the distances between different spaces can be compared. Table 14 results indicate that the distance is the least between the years 2009 and 2006 (0.00), and the maximum distance is observed between the years 2010 and 2007 (6.82).

Based on the displayed dendrogram (Figure 2), it can be seen that the closest to each other are 2008 and 2011 with a 0.00 distance, and the distance is the biggest between 2006 and 2007, with a result of 6.35. The results show which years are the most similar to each other, and when the difference is the least.

Table 15

Year groupings according to the stock-market indices values

Level	Proximity
2008, 2011	0.00
2008, 2010	3.03
2007, 2009	3.26
2006, 2008	4.44
2006, 2007	6.35

Source: Author's calculations

The years 2008 and 2011 are the closest to each other; the distance between them is 0.00. The closest to them is 2010 with a result of 3.03 in distance, while 2006 is at a distance of 4.44. The second group consists of 2007 and 2009, with a distance of 3.26; and this represents a group for itself, while the proximity of this group compared to the first group is 6.35.

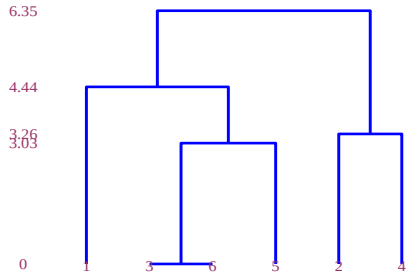

Figure 2

Analysis of the mutual distance between the values of stock-market indices per year

Legend: 2006 (1); 2007 (2); 2008 (3); 2009 (4); 2010 (5); 2011 (6)
Source: Author's calculations

Conclusions

In this paper, the level of similarities have been analysed between the financial markets of transition economies of some South-East European countries (i.e. Serbia, Hungary, Croatia and Slovenia) and the similarities of these markets to the US financial market. By the analysis of the behaviour of the sample – i.e. the stock-market indices by years, and with the aim to reach certain conclusions about the similarities between the markets analysed by years; it can be concluded that the stock-market indices have behaved similarly according to the years, both in terms of standard deviation changes and according to the maximum and minimum values. In 2005, a significant value dispersion is present in the case of the Bux stock-market index, that is for Hungary, which is also evident by the results for the standard deviation and the value ranges of the stock-market indices (minimum-maximum). Other markets were stable and behaved similarly in this year; only the DJIA stock-market index differed in behaviour according to the

standard deviation values. So, it can be concluded that in 2005, the markets were relatively stable, with significant fluctuations on the Hungarian market and on the market share in the US, which is represented by the DJIA stock-market index. In 2006, significant fluctuations-dispersions were present for the value of the Bux stock-market index, while other markets represented through the values of the realized stock-market indices behaved relatively stable. In 2007, significant fluctuations-dispersions are again seen in the value of the Bux stock-market index, which now becomes symptomatic for the Hungarian financial market, since for three years in a row the behaviour of this market has been extremely volatile and fluctuating, when compared to other markets which are the subject of the analysis. In 2008, the trend continues, confirming empirically the thesis that the Hungarian financial market is highly volatile. The situation is similar in 2009, 2010 and in 2011, also. These facts indicate that we can talk about a similar behaviour of the markets in terms of volatility level, noting that Hungary's financial market behaves somewhat differently than the other markets analysed; in the sense, that the level of volatility of this market is very high as compared to other monitored markets.

The thesis about the level of the Hungarian financial market's volatility in the observed period (as compared to the other observed markets), was confirmed by statistical analysis on the level of the whole sample (Table 1); because the standard deviation value in the case of the Hungarian financial market, as well as the fluctuations on it, are significantly higher when compared to the other markets.

By the analysis of the stock-market indices values, it can be seen that these values have formed similarly through the years (there is a similar trend of changes), with the conclusion that the deviations in the values of certain stock-market indices in some cases were higher, and in other cases lower. The largest differences in behaviour are present in the case of the Bux stock-market index, that is the Hungarian market, followed by the DJIA stock-market index, while the other markets have behaved very similarly according to this criteria. Based on these empirical results, it can be stated that the hypothesis H0 set in the research is confirmed, or that the assumption that there is a high level of similarity between the transition economies and their financial markets is true, both among themselves and in relation to the US financial market. As such, it is interesting to note that the stock-market indices values have behaved very similarly.

By analysing the behaviour of the sample – stock-market indices values changes (returns) annually – and with the aim of reaching certain conclusions about the similarities between the markets analysed through the observed years, it can be concluded that the returns have behaved similarly according to the years, both in terms of standard deviation level, and in terms of minimum and maximum values. In 2005, the highest level of volatility is present in the case of the Bux stock-market index, while the lowest level of volatility is present in the cases of Belex15 and BelexLine stock-market indices. This trend of the returns` behaviour changes and varies from year to year, in the sense that in 2006, the biggest change was

observed in the case of the Bux stock-market index; in 2007, for Belex15, and again for the Bux in 2008, 2009, 2010 and 2011. The conclusion is that the Hungarian financial market behaved the most volatile-fluctuating, in terms of changes in returns. Looking at the overall sample during the observed period of time, it can be concluded that the level of returns have behaved similarly over time on these markets, thus confirming hypothesis H1 set in the survey.

The analysis of the sample structure resulted in significant findings. By testing whether there is a difference in the correlation of stock-market indices according to the years (i.e. which stock-market indices show a higher, and which of them show a lower level of correlation), it was obtained that all stock-market indices correlated negatively according to the years, and the most negatively correlated stock-market index was the stock-market index of BelexLine. Describing the structure of the sample, it was obtained that the analysed sample can successfully be reduced to two factors which contain approximately 90% of the information from the entire tested data. On the basis of further research on the structure of the sample, it can be concluded that all stock-market indices reversely agree with the lapsing of time, which can be explained by the fact that in the analysed period there was an overall fall in the stock-market indices. The values of the stock-market indices are mutually compatible.

By applying factor analysis of the extracted two factors based on the seven values of the stock-market indices, a result was obtained that there is a significant level of correlation between the Serbian, Croatian and Slovenian financial markets, while the US and Hungarian financial markets have clearly separated according to their own correlation.

Observing the structure of the analysed sample and connections between the individual markets, the obtained information show that values of the stock-market indices could be conditionally grouped into two groups. The first group consists of the Serbian and Croatian stock-market indices, and the other consisting of stock-market indices of Hungary, Slovenia and the US market. Based on the results, it can be concluded that there is a significant level of similarity between the stock-market indices that consist the first group, and also between the stock-market indices that make up the second group, which creates real prerequisites assuming that there is a significant market correlation within groups, and between the groups with each another.

By analysing the contribution of the factor structure of the years in relation to the value of the stock-market indices, it has been obtained that in terms of belonging to the first or second factor, the years have differentiated. As such, the years 2007, 2009, 2010 and – to a lesser extent – the years 2008 and 2011 belong to the first factor, while the years 2006, 2008 and 2011 belong to the second factor. By this, the level of integration between years, and the similarities between the behaviour of the markets according to the years becomes clearly evident. It is interesting to note that the years 2006, 2008 and 2011 behave similarly, though 2008 was

characterized by a significant decline of activities in general, and of heavy destabilization. 2008 and 2011 are closest to one another, while the largest distance can be seen between the years 2006 and 2007. Maybe it is exactly the fact of this similarity between 2008 and 2011 that indicates a new wave of the crisis and disturbances in the economic trends, because the research has clearly come to the conclusion of a very similar behaviour of these two years.

The results are very interesting, because they clearly show the present trends over the years and give a clear signal to future trends. 2008 and 2011 form a group for itself, the closest to them being 2010 (which was expected, keeping in mind the above described facts), while they were most distanced from 2006 (again as expected, bearing in mind these results). 2007 and 2009 form a group for themselves, and they can be understood as transitional years, in terms of transition from prosperity to recession conditions and vice versa. Based on the research results, the hypothesis H2 set in the research also can be adopted, namely that there is a high correlation and agreement between the values of stock-market indices.

The results of the study clearly indicate the existence of significant correlations and similarities between the analysed markets, which has a definite significance in assessing the state of affairs to be expected on these markets. It is interesting to realise that there is not only a significant level of similarities between the markets and economies of the observed transition economies of South-East Europe, but also between these markets and the US market, both in terms of the values of the stock-market indices, and in terms of the returns. Another significant result indicates the high level of similarity between the Hungarian and the US financial markets, because it was found, that of all financial markets in the region, the Hungarian market correlates the most and is the most similar to the US market. Observing the structure of these markets it has been realised that these markets are structurally similar also, which in turn provides important information to all potential investors and analysts in the process of anticipation of the state of affairs on these markets. The directions of further research will be aimed at testing the characteristics of financial contagion on these markets, in the terms of defining the effects of "overflow" of crisis from one to the other market, given that this study has confirmed the hypothesis of similarity between these markets.

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