PANOECONOMICUS, 2015, Vol. 62, Issue 4, pp. 469-491
Received: 03 June 2013; Accepted: 19 April 2015.

UDC 347.7:336.763 (4-12)
DOI: 10.2298/PAN1504469D
Original scientific paper

Đorđe Đukić

Faculty of Economics,
University of Belgrade,
Serbia
d.djukic@eunet.rs

Mališa Đukić

Belgrade Banking Academy,
Serbia
djukicmalisa@hotmail.com

Interdependencies of Markets in Southeastern Europe and Buyback of Shares on Shallow Capital Markets: The Application of Cointegration and Causality Tests

Summary: Due to the global financial crisis the stock exchange indices of Southeastern European (SEE) countries are stagnating or are slowly recovering. The issuers of securities, namely banks that achieve good business results, may be in a dilemma whether to buy back their shares so as to slow down the share price decrease and manage capital. In this paper, the cointegration tests, Granger causality test and equilibrium error correction model were applied to examine: 1) interdependencies of stock exchange indexes in SEE countries (Slovenia, Croatia, Serbia, Montenegro, Republic of Srpska, Macedonia - FYROM and Bulgaria); 2) interdependencies of most actively traded shares in Serbia and the representative index. The main conclusion is that it is not possible to successfully use the share buyback to stop or reduce the share price fall on a shallow capital market of SEE countries. This is opposite to what successful banks can do on deep capital markets. In interpreting quantitative results it is necessary to be cautious because of a small number of banks from SEE which were able to use share repurchase.

Key words: Capital markets, Share buyback, Southeastern Europe, Cointegration, Causality tests.

JEL: C19, G12, G14, G21.

Acknowledgement: This paper is a part of research project No. 179065, 47009 and 179015 supported by the Ministry of Education and Science of the Republic of Serbia. The authors gratefully acknowledge two anonymous referees whose comments improved this article.

In the environment of drawn out effects of global financial crises (GFC), stock exchange indices in the countries of Southeast Europe (SEE) are either stagnating or slowly recovering. Moreover, in the case of issuers with good business results and with actively traded shares, share prices may fall faster than the representative stock exchange index during a certain period of time.

By applying the cointegration tests and Granger causality test to monthly data series, in the period from 2007 to 2011 and by assessing the equilibrium/error correction model, this paper examines: firstly, interdependence of stock exchange indices' movements in the SEE countries (Slovenia, Croatia, Serbia, Montenegro, Republic of Srpska, Macedonia - FYRM, Bulgaria), with a focus on the interdependence of movements of indices in Serbia - Belex15 index and stock exchange indices in the neighbouring countries; secondly, interdependence of the movements of the most traded shares on the capital market in Serbia - AIK Banka (AIK) shares and the movements of Belex15 index. AIK is among the ten largest banks in Serbia. In the

period from 2007 to 2010, it ranked either first or second based on several key performance indicators - return on capital, return on equity, share of operating expenses in operating revenue, and the capital adequacy ratio. An important characteristic of AIK shares is that they were most heavily traded on the Belgrade Stock Exchange. Despite good business results of AIK, the price of its shares recorded a sharp drop after the onset of GFC which spilled over to the capital market in Serbia in 2008.

Considering the above, the question arises whether the management of AIK can use its good business results that were effectively achieved to influence the behaviour of the AIK share prices on the shallow domestic capital market while taking into account the negative effects of external factors relating to the protracted effect of the GFC. A question arising from the above is whether it is possible to effectively use the share buyback as a tool to stop or mitigate negative trends of the AIK share price.

1. Literature Review

Markets in SEE before and after the emergence of the GFC have not been elaborated in the recent literature by applying the quantitative methods of interdependences. The use of buyback of shares on shallow capital markets to defend the share price of banks with good business performance when the management believed that share price did not accurately reflect the bank's prospects has not been analysed. The recent literature mostly considers the movement of share prices of corporations and banks on developed markets and buyback of shares before and after the emergence of the GFC for the purpose of not only defending the share price, but also of optimising the bank's capital structure (Paul Brockman, John S. Howe, and Sandra Mortal 2008; Chun I. Lee, Demissew Diro Ejara, and Kimberly C. Gleason 2010; Amedeo De Cesari, Susanne Espenlaub, and Arif Khurshed 2011; Dev Mishra, Marie D. Racine, and Luke Schmidt 2011; Jonas Råsbrant 2011; Steven Mintz 2012; The Economist 2012; In-Mu Haw et al. 2013).

Authors who examined the share price effects and determinants of share repurchase programs of companies in developed market economies (France, Germany, Italy, and UK) before the GFC, indicated that share prices reaction to share repurchase could be both positive and negative. German and Italian share repurchases were followed by a positive and significant share price response (similar to US firms). In the case of UK they were followed by small positive abnormal returns, and in the case of France, there were abnormal returns which were insignificantly different from zero (Lee, Ejara, and Gleason 2010, p. 125). Konan Chan, David L. Ikenberry, and Inmoo Lee (2007), also reported evidence of abnormal stock performance following buyback announcements. Based on an extensive examination of 5508 programs announced by US firms in the period from 1980 to 1996, their findings indicated abnormal stock performance following buyback announcements. However, when examining the factors which led to the observed share price reactions following the buyback announcement, Chan, Ikenberry, and Lee (2007) concluded that the movement of prices was more consistent with the view that "managers possess market timing abilities when announcing and executing buyback decisions" and that pseudo-market timing would not be the viable explanation (p. 2692). Using a sample

that corrects problems of samplings in previous literature and the calendar portfolio regression method, Ken C. Yook (2010) finds that "firms that announce repurchase programs infrequently and repurchase shares actually experience significant long-term abnormal returns" (p. 323). On the other hand, Sheng-Syan Chen and Yanzhi Wang (2012) find that financial constraints of repurchasing firms especially those with high actual repurchase ratios, "experience a significantly greater increase in post-buyback distress risk than unconstrained firms. Managerial hubris could explain why constrained firms buy back shares even if the buybacks do not improve shareholder wealth" (p. 311). Cristiana Tudor (2011) investigated interdependencies among six selected stock exchanges in the CEE region (Czech Republic, Hungary, Bulgaria, Poland, Russia and Romania) from 2007 to 2009 and concluded that the interdependencies among CEE stock markets were generally larger during the crises than before as well as that the overall dominant role and the impact of the USA market on the CEE exchanges seemed to have decreased during the crises.

During the GFC many companies in developed market economies used share buyback (Leonce Bargeron, Manoj Kulchania, and Shawn Thomas 2011; Damien Farrugia, Michael Graham, and Alfred Yawson 2011; Ian Crawford and Zhiqi Wang 2012; Dimitris Andriosopoulos, Kostas Andriosopoulos, and Hafiz Hoque 2013; Andriosopoulos and Hoque 2013; Chen et al. 2013; Devra L. Golbe and Ingmar Nyman 2013; Ji-Chai Lin, Clifford P. Stephens, and YiLin Wu 2014).

Fortuna Advisors, a New York City-based consultancy, prepared the Institutional Investor's 2012 Corporate Buyback Scorecard that ranked the biggest spenders on buybacks among the S&P 500 based on the two-year returns generated by their repurchases. Institutional Investor's 2012 Corporate Buyback Scorecard which referred to 253 companies that bought back at least 4 per cent of their market capitalization in a two-year period (Q2 2010 - Q2 2012), indicated that more than a half of the 253 companies recorded negative buyback effectiveness (return on investment) "indicating that managers generally time buybacks poorly" (Mintz 2012, p. 2). During the same period Goldman Sachs surprisingly realised a USD 9.8 billion shares buyback program with 20% negative return on investment. Kathleen Farrell, Emre Unlu, and Jin Yu (2014) find that the use of share repurchases as an earnings management mechanism is discouraged in the presence of debt-financing constraints.

Certain banks from developing markets in Europe announced their buyback of shares programmes during the GFC period. In SEE, there were two cases - in Hungary (the case of OTP Bank, Hungary's largest retail bank with the largest asset sum) and in the Czech Republic (Komercni Banka AS). In the case of OTP Bank, in May 2010, shareholders adopted a plan based on which the Board was allowed to buy back shares provided the number of shares that OTP Bank kept in its own treasury did not exceed 56 million shares or 20 per cent of the bank's registered equity as of October 31, 2011. According to the Global Banking News (2010), the Board was allowed to buy the shares at a price not higher than 120 per cent of the closing price of OTP shares on the Budapest Stock Exchange by October 31, 2011. At the end of June 2010 the average price of shares was HUF 4.626, while in the first ten days of January 2011, when the share buyback program was implemented, the average price was HUF 5.205. At the end of May 2011, the price was HUF 6.303. From June to

October 2011, OTP share prices decreased and rebounded, and the portfolio of bank's own shares jumped from 1.49% to 1.66% at the end of October 2011. Due to the increase in price in 2012, selling of shares that were bought back would have increased the profit. Based on the share price movement and total amount of shares held by the bank, one is to conclude that OTP Bank's share buyback programme was successfully implemented. As for Komercni Banka AS, due to the lack of available data, it is not possible to draw the reliable conclusions with regard to the success of the buyback programme implementation.

2. Methodology and Data

2.1 Empirical Method

The analysis of interdependences requires the examination of their stationarity by applying the unit root test. If the time series are stationary, the regression analysis can be used. If the time series are not stationary it is necessary to verify if the cointegration exists. If the cointegration exists, the next steps would be to implement the analysis of causality and error correction model.

We examine the presence of causality in the Clive W. J. Granger (1969) sense at the following two planes: first, there is an examination of the correlation between stock exchange indices' movements in the SEE countries; second, there is an examination of the extent to which the behaviour of the prices of the most traded shares on the Belgrade Stock Exchange (AIK shares), affects the behaviour of the prices of all shares on the Belgrade Stock Exchange, measured by the representative index - Belex 15. This is the index in which AIK shares have the largest weight of 20%.

2.2 Data

The analysis covers a 5-year period, from January 2007 to December 2011. The monthly data series are long enough to allow identifying the patterns in the examined events and drawing reliable conclusions. Key time sequences in the analysed period are as follows: the GFC broke out after the subprime mortgage market in the U.S. collapsed in August 2007. The GFC affected SEE countries in 2008, most intensely in Q4 of 2008.

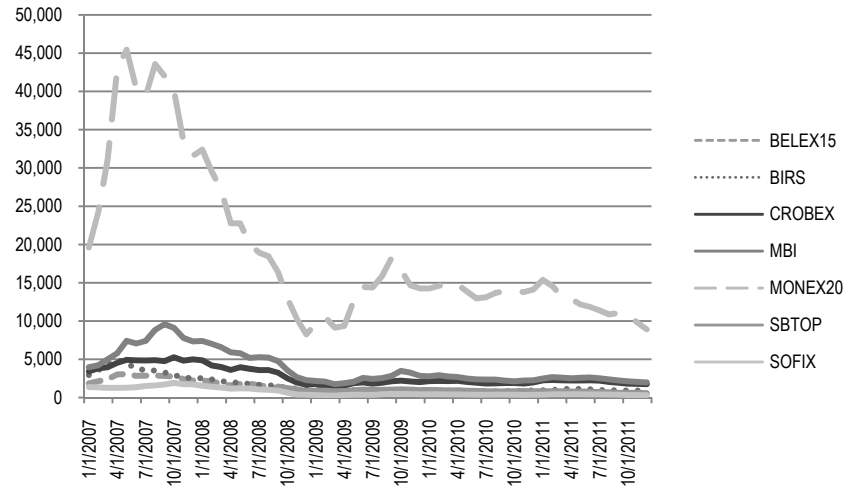
3. Results

3.1 Synchronized Movements of Stock Exchange Indices in SEE Countries

The graph of stock exchange indices in the analysed period from January 2007 to the end of 2011 shows that similar trends are present in all stock exchange indices, with the exception of Montenegro stock exchange index - Monex20 where movements are characterised by an exceptionally high degree of variability.

The analysis of correlation matrix shows that there is a high positive correlation between all stock exchange indices (see their full names in Appendix A), with Belex15 and Crobex standing out with the highest correlation coefficient of 0.9658. Setting apart of Monex20 (index) from other indices is confirmed, in addition to the

graphical presentation, by the correlation analysis, with the lowest correlation matrix coefficients being present between the Monex20 and other indices (Table 1). Due to the weakness of correlation analysis, such as a possible presence of false correlation in the case of non-stationary time series, it is followed by the stationarity analysis.



Source: Banja Luka Stock Exchange (2013)[1], Belgrade Stock Exchange (2013)[2], Bulgarian Stock Exchange (2013)[3], Ljubljana Stock Exchange (2013)[4], Macedonian Stock Exchange (2013)[5], Montenegro Stock Exchange (2013)[6], The Zagreb Stock Exchange (2013)[7].

Figure 1 Graphical Presentation of Stock Exchange Indices in the Region

Table 1 Correlation Matrix

	BELEX15	BIRS	CROBEX	DJSUBB30	MBI	MONEX20	SBTOP	SOFIX
BELEX15	1							
BIRS	0.6807	1						
CROBEX	0.9658	0.7217	1					
DJSUBB30	0.7433	0.7052	0.7354	1				
MBI	0.8953	0.7429	0.8847	0.8889	1			
MONEX20	0.6515	0.1530	0.5825	0.5896	0.5965	1		
SBTOP	0.5463	0.5939	0.52743	0.95644	0.7674	0.5636	1	
SOFIX	0.9046	0.7927	0.9138	0.8628	0.9333	0.5208	0.7037	1

Source: Authors.

[1] https://www.blberza.com/ (accessed May 20, 2013).
[2] http://www.belex.rs/ (accessed May 25, 2013).
[3] http://www.bse-sofia.bg/ (accessed May 20, 2013).
[4] http://www.ljse.si/ (accessed May 20, 2013).
[5] http://www.mse.mk/ (accessed May 25, 2013).
[6] http://www.montenegroberza.com/ (accessed May 25, 2013).
[7] http://zse.hr/ (accessed May 25, 2013).

3.1.1 Cointegration Analysis

An exceptionally high level of positive linear correlation between the observed series suggests that a movement synchronisation between relevant stock exchange indices may be present. The first step of the analysis requires checking the observed time series stationarity.

Table 2 *P*-Values in the Phases of D-F Unit Root Test

	Stationarity of time series	Presence of one unit root
BELEX15	0.7880	0.0014
BIRS	0.1696	0.0016
CROBEX	0.8911	0.0000
DJSUBB30	0.5178	0.0012
MBI	0.6209	0.0005
MONEX20	0.4822	0.0004
SBITOP	0.1544	0.0000
SOFIX	0.6460	0.0000

Source: Authors.

Testing is performed at the significance level (error in conclusion) of 0.05, with the null hypothesis rejected if the resulting significance level (*p*-value) is less than 0.05. In the example of all observed stock exchange indices (Table 2), the null hypothesis is not rejected and in the first phase of the test we conclude that every time series has at least one unit root. In the second phase of testing, we reject the null hypothesis at about at least two unit roots for every time series and conclude that every time series is non-stationary.

Based on Table 2, all time series have precisely one unit root, which allows for the analysis of the presence of cointegration. An equal degree of non-stationarity (equal number of unit roots) is a necessary precondition for testing the presence of time series cointegration. For more details, see: Russell Davidson and James G. MacKinnon (1993), James D. Hamilton (1994), Fumio Hayashi (2000), Helmut Lütkepohl (2005), Katarina Juselius (2006), Milena Jovičić and Radmila Dragutinović Mitrović (2011).

Since in the cointegration relation any time series may appear in the role of either a dependent or independent variable, we will have two cointegration tests for each time series pair (Table 3).

Table 3 *P*-Values D-F Residual-Based Cointegration Relations Test

	Cointegration of the given series combinations	
BELEX15 and BIRS	0.0029	0.0000
BELEX15 and CROBEX	0.1547	0.1678
BELEX15 and DJSUBB30	0.7532	0.8150
BELEX15 and MBI	0.5404	0.5566
BELEX15 and MONEX	0.4587	0.5203
BELEX15 and SOFIX	0.6258	0.6872
BELEX15 and SBTOP	0.8351	0.8422
BIRS and CROBEX	0.3887	0.3557
BIRS and DJSUBB30	0.6571	0.6891
BIRS and MBI	0.8755	0.8944
BIRS and MONEX	0.3551	0.3688

BIRS and SOFIX	0.3793	0.4122
BIRS and SBTOP	0.1994	0.2232
CROBEX and DJSUBB30	0.8953	0.9211
CROBEX and SOFIX	0.7908	0.8256
CROBEX and MBI	0.2909	0.3201
CROBEX and MONEX	0.4322	0.5377
CROBEX and SBTOP	0.1317	0.1299
DJSUBB30 and MBI	0.3312	0.3442
DJSUBB30 and MONEX	0.3224	0.3446
DJSUBB30 and SOFIX	0.1588	0.1447
DJSUBB30 and SBTOP	0.6341	0.8188
MBI and MONEX	0.3376	0.3197
MBI and SOFIX	0.7881	0.8774
MBI and SBTOP	0.1784	0.1677
MONEX and SOFIX	0.2217	0.2378
MONEX and SBTOP	0.1671	0.1877
SOFIX and SBTOP	0.6698	0.7661

Source: Authors.

Since the rejection of the null hypothesis implies the stationarity of the residual of observed cointegration time series combination, we conclude that only the stock exchange indices of the Republic of Srpska and the Republic of Serbia are cointegrated. Other cointegration relationships do not exhibit the stationarity of accidental error. The non-stationarity of the cointegration relation stochastic variable is, in most of the analysed time series, a consequence of the presence of structural breaks. The above conclusion is apparent based on the kurtosis coefficient analysis of each time series, but also on the auxiliary regression residual series in testing the non-stationarity. Each time series characterised by a non-standard movement trend will affect the kurtosis of the given series which, in most cases, will be greater than in the normal distribution. Kurtosis coefficients are manifestly different in every analysed time series because of different sharpness, depth, and durability of structural breaks, but also because of the point of time in which they occur.

Consequently, it can be concluded that the flows of analysed time series are not equally affected by the global financial downturn. Stock exchange indices Belex15 and BIRS are interesting examples of the presence of cointegration. These indices are also characterised by the presence of structural breaks, which is reflected in the residuals of cointegration relation auxiliary regression in which the dependent variable is the time series differential. Structural breaks are manifested in the form of two non-standard observations in May 2008 and October of the same year, simply modelled by artificial variables, after which valid conclusions about the cointegration of observed time series around the given structural breaks can be made. In other time series, it is not possible to model the structural breaks with artificial variables, due to the differences in structural breaks in those time series.

3.1.2 Causality Analysis

The existence of cointegration between the observed time series allows for the application of the analysis of the direction of causality between the observed time series. The first phase of the analysis involves the evaluation of the regression equation in

which the dependent variable is presented depending on its own earlier values from one, two, or more periods, but also the earlier values of other time series that may be statistically significant and may confirm the direction of causality. However, if an equivalent conclusion is made in the case of other analysed time series, we conclude that the time series movements are synchronised, but that unidirectional causality is not present.

Based on Table 4, we conclude that there is an influence of the BELEX15 stock exchange index movements on the BIRS stock exchange index movements. The above mentioned structural breaks are modelled with the artificial variables V1 and V2. No residual autocorrelation or disturbance of the assumption about the normality of distribution is present in the evaluated regression model. The null hypothesis about the normality of distribution is not rejected at the level of significance of 5% regardless of the low achieved level of significance resulting from the higher kurtosis coefficient. According to Juselius (2006), a kurtosis coefficient that is higher than normal is often ignored.

Table 4 Causality between the Movement of the BELEX15 Stock Exchange Index and the Movement of the BIRS Stock Exchange Index

Dependent variable: BIRS
Method: least squares
Sample (adjusted): 2007M04 2011M12

Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	-24.02768	20.37296	-1.179391	0.2438
BELEX15(-1)	-0.229127	0.057828	-3.962223	**0.0002**
BIRS(-1)	2.026603	0.085771	23.62817	0.0000
BIRS(-2)	-1.127901	0.117455	-9.602810	0.0000
BIRS(-3)	0.276424	0.066847	4.135160	0.0001
V1	1415.910	142.0403	9.968368	0.0000
V2	-1045.474	108.4603	-9.639235	0.0000
R-squared	0.994750	Mean dependent var		1525.492
Adjusted *R*-squared	0.994120	S.D. dependent var		1000.261
S.E. of regression	76.70148	Akaike info criterion		11.63230
Sum squared resid	294155.9	Schwarz criterion		11.88321
Log likelihood	-324.5207	Hannan-Quinn criter.		11.72981
F-statistic	1578.956	Durbin-Watson stat		2.274606
Prob(*F*-statistic)	0.000000			

Source: Authors.

Table 5 suggests that there is a lower degree of inertia in the movements of BELEX15 series since, among the independent variables in the model, its own trend from only one earlier period is present. On the other hand, considering the dependence on their own earlier values from three previous periods, BIRS time series reflect a considerably higher degree of inertia in their movements. In the BELEX15 model, among the dependent variables there are 4 artificial variables, two of which are related to the structural break discovered in the unit root test, and the other two relate to April and May 2007. The model does not have any residual autocorrelation

up to the 12th lag (the 12th lag is the one taken into account because of data frequency - monthly). Normality test also shows that the assumption about the normality of distribution is satisfied (p-value=0.44).

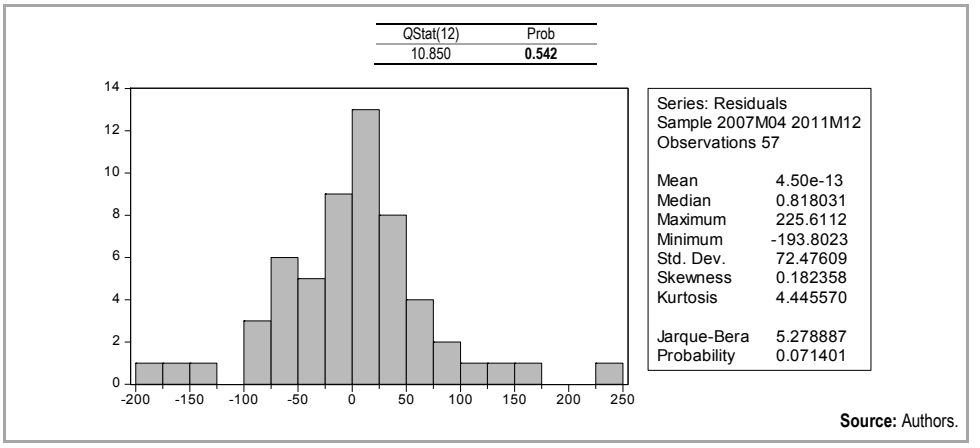


Figure 2 Autocorrelation Test and Test of the Normality of Distribution

Table 5 Causality between the Movements of the BIRS Stock Exchange Index and the Movements of the BELEX15 Stock Exchange Index

Dependent variable: BELEX15
Method: least squares
Sample (adjusted): 2007M03 2011M12

Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	-28.83581	22.74674	-1.267690	0.2108
BELEX15(-1)	0.790655	0.059170	13.36234	0.0000
BIRS(-1)	0.418450	0.084884	4.929680	0.0000
BIRS(-2)	-0.256733	0.080311	-3.196752	0.0024
V1	231.0445	85.75304	2.694301	0.0096
V2	-331.9163	86.03235	-3.858040	0.0003
V3	320.9429	120.7774	2.657308	0.0105
V4	-284.1868	126.6093	-2.244596	0.0292
R-squared	0.990998	Mean dependent var		1171.230
Adjusted *R*-squared	0.989738	S.D. dependent var		836.3285
S.E. of regression	84.72217	Akaike info criterion		11.84407
Sum squared resid	358892.3	Schwarz criterion		12.12827
Log likelihood	-335.4781	Hannan-Quinn criter.		11.95478
F-statistic	786.3380	Durbin-Watson stat		1.837583
Prob(*F*-statistic)	0.000000			

Source: Authors.

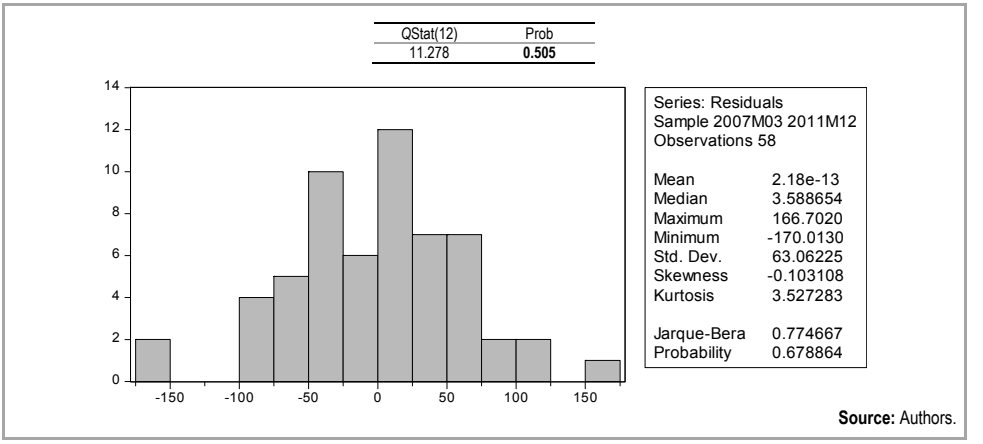


Figure 3 Autocorrelation Test and Test of the Normality of Distribution

3.1.3 Error Correction Model

Table 6 BELEX15 Time Series

Dependent variable: DBELEX15
Method: least squares
Sample (adjusted): 2007M04 2011M12

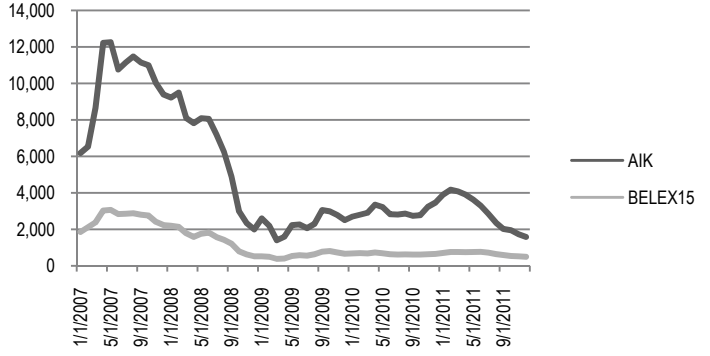
Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	-34.55157	11.31335	-3.054052	0.0036
RESBELBIR(-1)	-0.201912	0.051919	-3.888987	0.0003
DBELEX15(-1)	0.260770	0.086601	3.011165	0.0041
DBELEX15(-2)	-0.230342	0.082029	-2.808043	0.0071
V15	-340.2233	83.52772	-4.073179	0.0002
V19	526.5603	91.38446	5.762033	0.0000
V14	197.3607	86.00299	2.294812	0.0260
R-squared	0.729080	Mean dependent var		-33.20638
Adjusted *R*-squared	0.696570	S.D. dependent var		147.9579
S.E. of regression	81.50189	Akaike info criterion		11.75372
Sum squared resid	332127.9	Schwarz criterion		12.00462
Log likelihood	-327.9809	Hannan-Quinn criter.		11.85122
F-statistic	22.42606	Durbin-Watson stat		1.636353
Prob(*F*-statistic)	0.000000			

Source: Authors.

In the error correction model (ECM) for BELEX15, the dependent variable is presented in the form of a differential (its stationary presentation) in the function of an equilibrium error (the stochastic variable of cointegration relation). Based on the evaluated coefficient, we conclude that 20% of the change in BELEX15 index is, at any point in time, adjusted to the common movements it forms with the BIRS index. Evaluation of the BIRS index in the model is not statistically significant and therefore, will not be interpreted. According to Zorica Mladenović and Aleksandra

Nojković (2008), in the case of cointegrated time series, at least one must be presented in the form of the ECM.

3.2 Synchronized Movements of the Belex15 Stock Exchange Index and Price of the Most Traded Share (AIK Share Price)



Source: Belgrade Stock Exchange (2013).

Figure 4 BELEX15 Index and AIK Share Movements

A visual analysis of the BELEX15 index and AIK share price movement trends reveals that the analysed time period from January 2007 to December 2011 has three different sub-periods. During the same period one should note that according to the 12 business performance indicators, AIK was among the top 10 banks (see Appendix B).

The first sub-period, in which the given time series exhibited growth, ended in the middle of QII 2007, namely in May, when their maximum values were reached. The second sub-period lasted until the beginning of QII 2009, in which the BELEX15 index and AIK share prices were falling, with the sharpest drop recorded in QIV 2008. QI 2009 is non-standard due to the greatest difference in the series movements achieved in January. At that time, the price of AIK shares grew by 30% compared with the price in December 2008, while the BELEX15 index remained the same.

During the third sub-period, the series movements stabilised, but with two specific characteristics: the first relates to a more pronounced rise of AIK share prices than that of the BELEX15 index from the beginning of QIV 2010 to January 2011, based on the difference in the monthly price rise rates (in the given sub-period it peaked out in February 2011), after which the price of AIK shares declined faster. After January 2011, the greatest difference in series monthly growth rates in favour of the BELEX15 index was recorded in June 2011, when the monthly growth rate of AIK share prices was by 17 percentage points below the monthly growth rate of the BELEX15 index, most likely owing to the rumours about AIK's exposure to NIBENS Grupa. By releasing information that it set aside provisions for loans extended to NIBENS Grupa (EUR 40 million), AIK put to rest the rumours about its excessive

exposure to losses against the loans granted to this Group through Bloomberg Company in direct communication with largest investors and through domestic media.

3.2.1 Cointegration Analysis

The unit root test (time series stationarity) examines the alternative hypothesis about the stationarity of time series, as opposed to the null hypothesis about having at least one unit root. The testing ends with the rejection of the null hypothesis and the determination of the number of the time series unit root (Table 7).

Table 7 ADF Unit Root Test (*p*-values)

	H_0: time series stationarity	H_1: presence of one unit root
AIK	0.6210	0.0003
BELEX15	0.6965	0.0001

Source: Authors.

The ADF test is performed at the significance level of 5% (conclusion error) and the null hypothesis is rejected in the second testing phase (the realised level of significance, namely *p*-value, is less than 5%) and it is concluded that both time series have precisely one unit root, namely that they have the same order of integration. The existence of the same order of integration in the analysed time series enables us to test the presence of cointegration (long-term synchronization of movements) for the given period.

The cointegration test is a unit root test on the residuals of cointegration relation (in the regression of the BELEX15 index on the prices of AIK shares, and the other way round). In the first step, the regressions of one time series to the other are evaluated, and then the unit root test is performed on the model residuals, as indicated in Table 8.

Table 8 Cointegration Test

Dependent variable	H1: time series cointegration
AIK	**0.7732**
BELEX15	**0.0005**

Source: Authors.

In the cointegration relation (regression model), where dependent variable is the BELEX15 index, we conclude, using the time series cointegration test, that relevant time series are cointegrated. In the case where dependent variable is AIK share price, we conclude, using the cointegration test, that the observed time series are not cointegrated. The obtained result suggests that there exists a unidirectional causality between AIK share prices and the BELEX15 index, which is further confirmed by the Granger causality test.

3.2.2 Causality Analysis

■ Causality Analysis between the BELEX15 Stock Exchange Index Movements and AIK Share Price Movements

The Granger causality test is based on the regression of a dependent variable to its own values from the previous periods and to the values from earlier periods of other independent variable. It is necessary to evaluate the model in which the assumptions about stochasticity are satisfied.

Table 9 Regression Model of the AIK Share Price Movements

Dependent variable: AIK
Method: least squares
Sample (adjusted): 2007M05 2011M12

Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	63.03154	153.4631	0.410728	0.6830
AIK(-1)	1.308080	0.139630	9.368172	**0.0000**
AIK(-2)	-0.726440	0.177017	-4.103784	**0.0001**
AIK(-3)	0.558896	0.170571	3.276619	**0.0019**
AIK(-4)	-0.233727	0.095082	-2..458169	**0.0175**
BELEX15(-1)	0.185839	0.401250	0.463151	**0.6453**
R-squared	0.981817	Mean dependent var		4695.343
Adjusted *R*-squared	0.979998	S.D. dependent var		3243.873
S.E. of regression	458.7738	Akaike info criterion		15.19595
Sum squared resid	10523672	Schwarz criterion		15.41295
Log likelihood	-419.4866	Hannan-Quinn criter.		15.28008
F-statistic	539.9498	Durbin-Watson stat		1.930555
Prob(*F*-statistic)	0.000000			

Source: Authors.

The Granger causality test determined that there was no unidirectional influence of the BELEX15 index on the movements of the prices of AIK shares, which was to be expected. No autocorrelation or an impaired assumption about the normality of residual distribution is present in the evaluated model.

■ Causality Analysis between AIK Share Price Movements and the BELEX15 Stock Exchange Index Movements

Table 10 Regression Model of the BELEX15 Index Movements

Dependent variable: BELEX15
Method: least squares
Sample (adjusted): 2007M03 2011M12

Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	35.98328	16.49403	2.181594	0.0338
BELEX15(-1)	1.167196	0.065605	17.79122	**0.0000**
AIK(-1)	0.055879	0.020426	2.735652	**0.0085**
AIK(-2)	-0.106827	0.012874	-8.297917	**0.0000**
V1	-273.9686	38.64330	-7.089678	**0.0000**
V2	255.4979	51.46503	4.964495	**0.0000**
V3	425.0125	76.73004	5.539063	**0.0000**
R-squared	0.994314	Mean dependent var		1171.230
Adjusted *R*-squared	0.993645	S.D. dependent var		836.3285
S.E. of regression	66.66868	Akaike info criterion		11.35011
Sum squared resid	226680.3	Schwarz criterion		11.59878
Log likelihood	-322.1532	Hannan-Quinn criter.		11.44697
F-statistic	1486.474	Durbin-Watson stat		1.778780
Prob(*F*-statistic)	0.000000			

Source: Authors.

The movements of BELEX15 index depend on the movements of its own value from the previous month and the movements of AIK share prices from the previous two months. The artificial variables comprising the structural breaks (sub-periods) in the movements of relevant time series explained in the descriptive analysis, are present in the model. No artificial variables are present in the model of the AIK share price movements as the distribution of stochastic error does not deviate from normal. Granger causality test confirmed a high influence of the movements of AIK share prices on the BELEX15 index (significance of the influence of the movements of AIK share prices with a two-month lag). The residuals of this model satisfy the specification tests (the absence of autocorrelation and impairment of the assumption about normality).

Considering that they are cointegrated, time series can be presented in the form of an error correction model.

3.2.3 Error Correction Model

In the case of time series cointegration, it is possible to evaluate the ECM. The ECM is based on the regression of stationary transformation of the dependent variable to the cointegration relation stochastic error (equilibrium error) from the previous period. The coefficient with the equilibrium error from the previous period shows which part of the change of dependent variable is, in each period, adjusted to the evaluated equilibrium relation. The main advantage of the ECM is that it includes in the analysis the information about time series at the level, rather than their transformations. Time series at the level are included in the ECM since they are elements of the equilibrium error.

Table 11 ECM for AIK

Dependent variable: DAIK
Method: least squares
Sample (adjusted): 2007M05 2011M11
Included observations: 55 after adjustments

Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	-117.0011	69.59694	-1.681125	0.0990
RES(-1)	0.238071	0.419064	0.568101	**0.5725**
DAIK(-1)	0.509192	0.133904	3.802653	0.0004
DAIK(-2)	-0.348008	0.107510	-3.236986	0.0021
DAIK(-3)	0.209999	0.098264	2.137101	0.0375
R-squared	0.278867	Mean dependent var		-194.1439
Adjusted *R*-squared	0.221177	S.D. dependent var		544.5934
S.E. of regression	480.6089	Akaike info criterion		15.27449
Sum squared resid	11549248	Schwarz criterion		15.45698
Log likelihood	-415.0486	Hannan-Quinn criter.		15.34506
F-statistic	4.833841	Durbin-Watson stat		2.103209
Prob(*F*-statistic)	0.002249			

Source: Authors.

In the ECM for AIK residuals, cointegration relations with a time-lag of one period are not statistically significant, which is confirmed by the direction of causality between the given time series (Table 11).

Table 12 ECM for BELEX15 Index

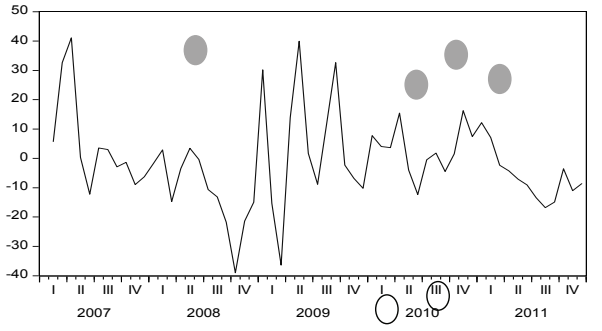
Dependent variable: DBELEX15
Method: least squares
Sample (adjusted): 2007M03 2011M12
Included observations: 58 after adjustments

Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	-3.004231	9.426481	-0.318701	0.7512
RESBELAIK(-1)	**0.281460**	0.062463	4.506019	**0.0000**
DAIK(-1)	0.098717	0.011829	8.345450	**0.0000**
V1	328.2138	49.16144	6.676246	**0.0000**
V2	-307.7301	31.71894	-9.701777	**0.0000**
R-squared	0.825439	Mean dependent var		-28.10125
Adjusted *R*-squared	0.812265	S.D. dependent var		151.7205
S.E. of regression	65.73809	Akaike info criterion		11.29150
Sum squared resid	229039.3	Schwarz criterion		11.46912
Log likelihood	-322.4534	Hannan-Quinn criter.		11.36068
F-statistic	62.65476	Durbin-Watson stat		1.660552
Prob(*F*-statistic)	0.000000			

Source: Authors.

In the ECM for BELEX15, residuals of cointegration analysis are statistically significant, which confirms the direction of causality between the given series (Table 12). The model satisfies the specification tests, namely the assumptions about the accidental element. The coefficient with the equilibrium error shows the adjustment of BELEX15 index, at any point in time, to a long-term equilibrium relation it creates with AIK share prices. It can be concluded that 28.15% of the BELEX15 index change, at any point in time, is adjusted to the path of the long-term equilibrium relation between the relevant index and the AIK share price movements. To put it differently: almost 30% of the absolute change of the value of BELEX15 index in every month compared with the previous one is adjusted to the common long-term path created by BELEX15 and AIK share prices (since the evaluated coefficient with the equilibrium error from the previous period, representing a deviation from the equilibrium path, equals 0.2815). Artificial variables covering the presence of reviewed structural breaks and the first differential of the prices of AIK shares, modelling the short-term dynamics that is not relevant for interpretation in the ECM, are present in the model.

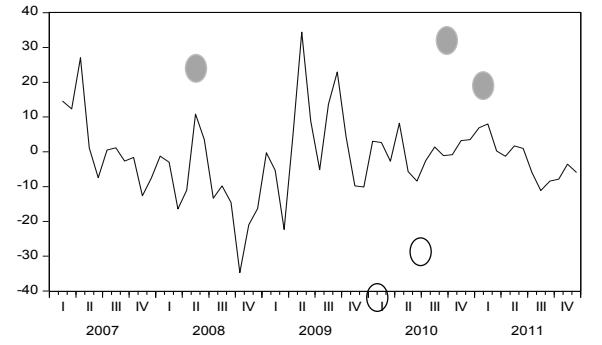
3.3 Analysis of the Monthly Growth Rates of AIK Share Price and BELEX15 Index



Source: Authors.

Figure 5 Monthly Growth Rate of AIK Share Price, in %

The analysis of the graphical presentation of monthly growth rates of AIK share prices (Figure 5) shows that they surged in March and April 2007, January 2009, May 2009, and September 2009, as marked with grey circles below. A sharp drop in AIK share price was recorded in October 2008 and March 2009, as marked with blank circles. The average annual drop in AIK share price in the observed period is -9.55%.



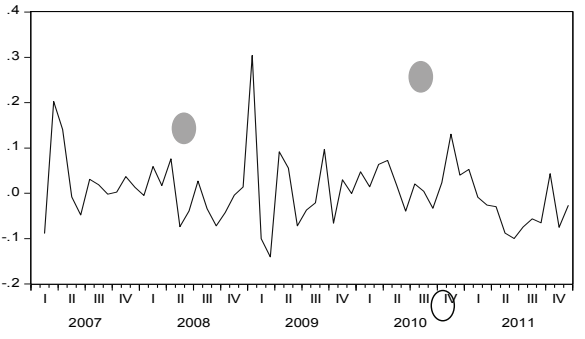
Source: Authors.

Figure 6 Monthly Growth Rate BELEX15 Index, in %

The BELEX15 index monthly growth rate peaked in April 2007, May 2009, and September 2009. A considerable drop of the given series was seen in October 2008 and March 2009 (Figure 6). The average annual drop of BELEX15 in the observed period was -9.46%.

A comparative analysis of marked drops and surges in AIK share prices and BELEX15 index shows that there is a greater drop in AIK share prices in the periods of marked decline of both series, and a greater rise in AIK share prices in the periods

of marked growth of both series. In March 2007 and January 2009, the months of significant growth in AIK share price, a marked rise in the BELEX15 index monthly rate cannot be observed. However, statistical significance of the differences between the monthly growth rates for the observed series may be analysed by the time series stationarity of the difference between monthly growth rates of AIK share prices and BELEX15 index.



Source: Authors.

Figure 7 Difference between the Monthly Growth Rates of AIK Share Prices and BELEX15 Index

Figure 7 suggests that two "positive" structural breaks for AIK took place in March 2007 and January 2009, while one negative structural break occurred in March 2009. Relevant "positive" breaks for AIK are two out of five "positive" breaks, that is, a surge in AIK share prices (when the monthly growth rate exceeds 30%) as shown in Figure 7. The negative break of the difference between the monthly growth rates is one out of two negative breaks of the monthly growth rates AIK share prices. A statistical significance of these breaks from Figure 7 is confirmed in the regression model in Table 13 where the breaks are covered by artificial variables VV1, VV2, and VV3. It can be concluded that in the case a monthly growth rate of AIK share prices is above 30%, the BELEX15 index may have a considerably higher monthly growth rates, and *vice versa*, while in the case of lower growth rates of AIK share prices, the differences in monthly growth rates are of stochastic nature, which is confirmed by the stationarity test of the given time series as indicated in Table 14.

Table 13 Statistical Significance of the Time Series Breaks for the Difference in Monthly Growth Rates of AIK Share Prices and BELEX15 Index

Dependent variable: S
Method: least squares
Sample (adjusted): 2007M02 2011M12
Included observations: 59 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	-0.001740	0.007618	-0.228475	0.8201
VV1	0.204097	0.057513	3.548693	0.0008
VV2	0.444767	0.080620	5.516865	0.0000
VV3	-0.138721	0.057513	-2.411971	0.0192

R-squared	0.459948	Mean dependent var	0.004555
Adjusted *R*-squared	0.430491	S.D. dependent var	0.075540
S.E. of regression	0.057007	Akaike info criterion	-2.825908
Sum squared resid	0.178737	Schwarz criterion	-2.685058
Log likelihood	87.36428	Hannan-Quinn criter.	-2.770926
F-statistic	15.61403	Durbin-Watson stat	1.567921
Prob(*F*-statistic)	0.000000		

Source: Authors.

Table 14 ADF Stationarity Test of the Time Series for the Difference in Monthly Growth Rates of AIK Share Prices and the BELEX15 Index (*p*-Value)

Time series	H1: Stationarity
Difference between monthly growth rates of AIK share prices and BELEX15 index	**0.0000**

Source: Authors.

4. Conclusions

The performed cointegration analysis of the observed time series suggests that, in the set of analysed stock exchange indices in the SEE countries region (Slovenia, Croatia, Republic of Srpska, Montenegro, Macedonia, Bulgaria and Serbia) equilibrium in the movements (cointegration) exists only between the BIRS (Republic of Srpska) and BELEX15 (Serbia) stock exchange indices. Moreover, BIRS time series is characterised by a higher degree of movement inertia compared to BELEX15 time series.

Besides, the Granger test does not indicate that there exists a unidirectional causality of one index to the other. Considering the nature of the analysed issue, it cannot be said that there is a bidirectional, i.e. simultaneous interdependence between the BELEX15 and BIRS indices in the relevant period, but a conclusion can be drawn about the presence of a common external factor which has caused synchronized movements of the observed indices. This factor is, primarily, the GFC.

With regard to the movements of the BELEX15 stock exchange index and the price of the most traded share - AIK share prices, it is noted that the movements of the BELEX15 stock exchange index and AIK Banka share prices are cointegrated. Also, it is observed that there is no causality between the BELEX15 index and the prices of AIK shares. The unidirectional influence of AIK share prices on the movements of BELEX15 index of 28.15% is a consequence of a high share of the relevant bank's share prices in the calculation of the BELEX15 stock exchange index.

Based on the ten indicators, AIK was one the best performing banks in the financial sector of Serbia. The downward inertia in the movements of its share price could not be caused by Bank's business performance. The results of this paper indicate that share buyback mechanism will not stop the price fall of a good performing issuer on a shallow capital market of SEE countries that was affected by GFC. If it was to try this, the Board of Directors would only have assumed a huge risk of spending considerable funds on buying back the bank's shares. This would have ultimately resulted in the decrease of bank's capital which is completely opposite to what successful banks can do on deeper capital markets - to manage capital and make profit. In interpreting quantitative results it is necessary to be cautious because of a

small number of banks from SEE which were able to use share repurchase before and during the GFK. Prerequisites for that are a multiyear active trading in bank shares on stock exchanges and above average bank (business) performance.

References

Andriosopoulos, Dimitris, Kostas Andriosopoulos, and Hafiz Hoque. 2013. "Information Disclosure, CEO Overconfidence, and Share Buyback Completion Rates." *Journal of Banking & Finance*, 37(12): 5486-5499.

Andriosopoulos, Dimitris, and Hafiz Hoque. 2013. "The Determinants of Share Repurchases in Europe." *International Review of Financial Analysis*, 27(C): 65-76.

Bargeron, Leonce, Manoj Kulchania, and Shawn Thomas. 2011. "Accelerated Share Repurchases." *Journal of Financial Economics*, 101(1): 69-89.

Brockman, Paul, John S. Howe, and Sandra Mortal. 2008. "Stock Market Liquidity and the Decision to Repurchase." *Journal of Corporate Finance*, 14(4): 446-459.

Chan, Konan, David L. Ikenberry, and Inmoo Lee. 2007. "Do Managers Time the Market? Evidence from Open-Market Share Repurchases." *Journal of Banking & Finance*, 31(9): 2673-2694.

Chen, Sheng-Syan, and Yanzhi Wang. 2012. "Financial Constraints and Share Repurchase." *Journal of Financial Economics*, 105(2): 311-331.

Chen, Sheng-Syan, Kim Wai Ho, Chia-Wei Huang, and Yanzhi Wang. 2013. "Buyback Behavior of Initial Public Offering Firms." *Journal of Banking & Finance*, 37(1): 32-42.

Crawford, Ian, and Zhiqi Wang. 2012. "Is the Market Underreacting or Overreacting to Open Market Share Repurchases? A UK Perspective." *Research in International Business and Finance*, 26(1): 26-46.

Davidson, Russell, and James G. MacKinnon. 1993. *Estimation and Inference in Econometrics*. Oxford: Oxford University Press.

De Cesari, Amedeo, Susanne Espenlaub, and Arif Khurshed. 2011. "Stock Repurchases and Treasury Share Sales: Do They Stabilize Price and Enhance Liquidity?" *Journal of Corporate Finance*, 17(5): 1558-1579.

Farrell, Kathleen, Emre Unlu, and Jin Yu. 2014. "Stock Repurchases as an Earnings Management Mechanism: The Impact of Financing Constraints." *Journal of Corporate Finance*, 25(C): 1-15.

Farrugia, Damien, Michael Graham, and Alfred Yawson. 2011. "Economic Conditions and the Motives for Multiple Open-Market Share Buybacks." *Research in International Business and Finance*, 25(2): 156-168.

Global Banking News. 2010. "OTP Holders Approve Board Authority for Share Buyback," May 3.

Golbe, Devra L., and Ingmar Nyman. 2013. "How Do Share Repurchases Affect Ownership Concentration?" *Journal of Corporate Finance*, 20(C): 22-40.

Granger, Clive W. J. 1969. "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods." *Econometrica*, 37(3): 424-438.

Hamilton, James D. 1994. *Time Series Analysis*. Princeton, New Jersey: Princeton University Press.

Haw, In-Mu, Simon S. M. Ho, Bingbing Hu, and Xu Zhang. 2013. "Legal Institutions, Ownership Concentration, and Stock Repurchases around the World: Signal Mimicking?" *The International Journal of Accounting*, 48(4): 427-458.

Hayashi, Fumio. 2000. *Econometrics*. Princeton, New Jersey: Princeton University Press.

Jovičić, Milena, and Radmila Dragutinović Mitrović. 2011. *Econometric Methods and Models*. Belgrade: Faculty of Economics, University of Belgrade.

Juselius, Katarina. 2006. *The Cointegrated VAR Model: Methodology and Applications*. Oxford: Oxford University Press.

Lee, Chun I., Demissew Diro Ejara, and Kimberly C. Gleason. 2010. "An Empirical Analysis of European Stock Repurchases." *Journal of Multinational Financial Management*, 20(2-3): 114-125.

Lin, Ji-Chai, Clifford P. Stephens, and YiLin Wu. 2014. "Limited Attention, Share Repurchases, and Takeover Risk." *Journal of Banking & Finance*, 42(C): 283-301.

Lütkepohl, Helmut. 2005. *New Introduction to Multiple Time Series Analysis*. Berlin: Springer.

Mintz, Steven. 2012. "The Most and Least Effective Stock Buyback Programs." *Institutional Investor*. November 14.

Mishra, Dev, Marie D. Racine, and Luke Schmidt. 2011. "Credibility of Corporate Announcements and Market Reaction: Evidence from Canadian Share Repurchase Programs." *Canadian Journal of Administrative Sciences*, 28(1): 83-100.

Mladenović, Zorica, and Aleksandra Nojković. 2008. *Time Series Analysis: Examples from the Serbian Economy*. 3rd ed. Belgrade: Faculty of Economics, University of Belgrade.

Råsbrant, Jonas. 2011. "The Price Impact of Open Market Share Repurchases." http://www.researchgate.net/publication/228315600_The_Price_Impact_of_Open_Market_Share_Repurchases.

The Economist. 2012. "Equity Markets: Faith in Buy-Back," March 23.

Tudor, Cristiana. 2011. "Changes in Stock Markets Interdependencies as a Result of the Global Financial Crisis: Empirical Investigation on the CEE Region." *Panoeconomicus*, 58(4): 525-543.

Yook, Ken C. 2010. "Long-Run Stock Performance Following Stock Repurchases." *The Quarterly Review of Economics and Finance*, 50(3): 323-331.

Appendix A

Table 15 Index Abbreviations in SEE Countries

Index	Stock exchange
MONEX 20	Montenegro stock exchange
SBITOP	Ljubljana stock exchange
Crobex	Zagreb stock exchange
MBI 10	Macedonian stock exchange
BIRS	Banja Luka stock exchange
BELEX 15	Belgrade stock exchange
STOXX sub Balkan 30	Index is designed to serve as underlying for financial products. Provides a Blue-chip representation of the super-sector leaders in the former Yugoslavia region, covering Croatia, Macedonia (FYROM), Serbia and Slovenia.

Note: MONEX 20 is the index of 20 companies with best liquidity in the market of Montenegroberza. BELEX 15 describes the movements of Serbian shares with best liquidity and is calculated in real time.

Source: Authors.

Appendix B

AIK Ranking among the Top 10 Banks in Serbia between 2007 and 2011

The following 9 indicators are used:

Level of net assets: AIK Banka was ranked 7th as at the end of 2009. In 2008 and in 2011 - it was ranked 8th, and in 2007 6th, which is the best rank thus far.

Loans: AIK Banka was, generally, better ranked than in net assets. In the three years of the observed period (2008-2010) it was ranked 6th, in 2007 it was 5th and in 2011, it was 8th.

Deposits and loans to banks: AIK Banka was ranked 7th as at end of 2009, 2010, and as at end of 2011. In 2008 it ranked 9th and in 2007 it was ranked 8th.

Gross profit: AIK Banka was ranked 1st as at end of 2007 and 2008, and 2nd as at end of 2009 and 2010. In the end of 2011, however, it was no. 5, which was a consequence less generated revenue (from revaluation) caused by the RSD appreciation in 2011 and large contingency reserves made due to the increased risk of its corporate clients.

Level of equity: AIK is traditionally the bank with highest degree of capitalisation in the Serbian banking sector, measured by the capital adequacy ratio (CAR). AIK CAR was:

31 Dec. 2008	31 Dec. 2009	31 Dec. 2010	31 March 2011	30 June 2011	31 Dec. 2011
38%	32%	32%	32%	36%	35%

Operating expenses/total revenue: AIK has continuously been ranked 1st. This indicator fluctuated from extremely low 7.7% in 2007, through to maximum 27.79% as at end of 2011.

Profitability measured by ROE (gross profit/share capital): AIK Banka was no. 1 in 2007 and 2008, while it was no. 2 in 2009 and 2010. The value of this indicator ranged from maximum 26.11% in 2008 to minimum 24.28% in 2009. In 2009 it was ranked second, but it slightly lagged behind the bank which was ranked first - Banca Intesa, while in 2010 it considerably lagged behind the bank which was no. 1. At the end of 2011, however, Return on (Share) Capital plummeted to 12.63%, AIK Banka was ranked the 5th.

Profitability measured by ROE (gross profit/total equity): AIK was no. 1 in 2007, 2008, and 2009. The value of this indicator ranged between maximum 17.77% in 2008 to minimum 15.77% in 2009. In 2010 it was ranked 2nd with 14.03%, and it slightly lagged behind the bank which was ranked 1st (Banca Intesa). At the end of 2011, however, ROE plummeted - to 7.98%, so that AIK Banka was ranked 8th.

Profitability measured by ROA (gross profit/net assets): AIK was ranked 1st in 2007, 2008, 2009, and 2010. The value of this indicator ranged from maximum 7.24% in 2008 to minimum 4.38% in 2010. At the end of 2011, ROA plummeted - to 2.31%, so that AIK Banka is ranked 4th.

THIS PAGE INTENTIONALLY LEFT BLANK