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Long and Short-Term Dynamic Relationship between Macedonian and Croatian Stock Markets

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Abstract: *The aim of this study is the empirical investigation of the long-run relations and the short-term dynamics between two Balkan stock markets: Macedonian and Croatian. The presence of long run common trend between the Macedonian and Croatian stock market indices is identified by applying Johansen's cointegration maximum eigenvalue and trace tests, while potential causal relations are examined by employing Granger's causality tests. Data sample spans from January 3rd, 2005 to March 31st, 2017. The stock market indices were found to be co-integrated with significant relationships. A bi-directional pattern of causality is documented between the Macedonian and Croatian returns. This pattern is remarkably stable and suggests significant economic ties between the investors in Macedonian and Croatian stock markets. The findings are important for the investors meaning that they cannot gain diversification benefits of investing in the Croatian or Macedonian stock market.*

Keywords: integration; dynamic relationship; interdependence; Macedonian stock market; Croatian stock market.

JEL Classification: G15, F36, C32

Introduction

Croatia and Macedonia are characterized as transitional, meaning they are in the process of moving from a closed to an open market economy while building accountability within the system. Transitional countries examples include the former Soviet Union, Eastern bloc countries and Balkan countries. As a transitional market, a country is embarking on an economic reform program that will lead it to stronger and more responsible economic performance levels, as well as transparency and efficiency in the capital market. As Croatia and Macedonia used to belong to one

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common state, with almost same mentality, language, but not the same economic growth, they passed through transition, not at the same time, some of them faster while the rest of the countries lag through this process. The model of privatization was not the same but some characteristics were common like in all transitional countries meaning that the values of the stocks were underestimated through the process of privatization and people in these countries knew nothing about trading on the stock exchange. Many of the new stock holders didn't evaluate the peace of paper they got through the process of privatization and were selling on low prices. Investors that start buying securities knew the real value of these new created stocks and made huge capital gains. Macedonian stock market development was behind the Croatian stock market. Croatian investors having experience what happened in their country started to expand their trading in other transitional stock exchanges where stocks were still underestimated. Until 2005, the Macedonian Stock Exchange was almost exclusively a domestic market. Real development of the Macedonian stock market was after foreigners entered the market. Domestic investors were following the trend of raising stock prices produced mostly by foreign investors and started to buy stocks raising the bubble on the Macedonian Stock Exchange that busted 2007-2008. In the following period the foreigners were most sellers of the stocks on the Macedonian stock market. The index was down reaching the minimum in March 2009, reflecting the world recession, and political situation in Macedonia. The index level is stalled in the period after the crisis. Dominant foreign investors in Macedonia are Croatian and Slovenian investors. By the Law on foreign exchange operations in Macedonia, the residents, other than authorized banks are limited to buy securities abroad. Following the previous facts it is interesting to investigate the level of long and short run interdependence between Croatian and Macedonian stock markets.

The goal of this research is to investigate the relationship between Macedonian and Croatian stock indices and to find out existence of financial ties between the investors of these countries. The investigation is made through the Macedonian - MBI10 and Croatian - CROBEX index. Both are official share indices of the Zagreb stock exchange and Macedonian stock exchange and they are capitalization-weighted price indices of the most liquid shares, so called blue chips stocks and major stock market index for each country. Long-run relationship in the movement of the indices is explored by using cointegration analysis, while to detect short dynamic relations, Granger's causality test is employed.

The remainder of the paper is organized as follow. After reviewing some of the literature on financial integration in section 1, section 2 presents the methodology used. Section 3 provides description of data and empirical analyses with the results regarding existence, level, degree and the speed of financial integration. The last section offers concluding remarks.

Literature Review

Comovement of stock market returns represents an important issue in finance as it has important practical implications for investors and portfolio managers. There is a vast body of literature that studies the comovement of international stock market indices. Most of these studies have found that the comovement of stock market indices is not constant over time. Kizys and Pierdzioch (2009) found evidence of increasing international comovement of stock returns among the major developed countries since the mid-90s.

Even though the issue of stock market integration attracts interest for 40 years, more intensive it was investigated after 90's (King at al., 1994; Longin and Solnik, 1995; Karolyi and Stulz, 1996; Forbes and Rigobon, 2002; Brooks and Del Negro, 2004; Brooks and Del Negro, 2006). Within the context of the European markets, Syriopoulos (2007) highlights the fact that Central European markets (Poland, Czech Republic, Hungary, Slovakia) tend to display strong linkages with the U.S. and German markets. The financial linkages between the Central and Eastern European markets and the world markets increased with the beginning of the E.U. accession process (Syllignakis and Kouretas, 2010).

Li and Majerowska (2008) show limited interactions between the emerging markets (Warsaw and Budapest) and the developed markets (Frankfurt and the U.S). The long-run interactions and cointegration between the U.K., German and Central European stock markets (Hungary, Poland, and Czech Republic) was not found (Gilmore et al., 2005). These findings are in line with the study of Égert and Kočenda (2007) who do not find any interactions between the Western European stock markets (France, Germany, and the U.K.) and the stock markets of Central and Eastern Europe (Czech Republic, Hungary and Poland). Voronkova (2004) shows evidence of long-run relationships between the German and Polish stock indices as well as the German and Hungarian indices over the period from 1993 to 2002. Tudor (2011) presents evidence on time-varying interdependencies among six Central and Eastern European stock markets and the U.S. market.

The Balkan stock markets exhibit time-varying correlations among themselves, but correlations with the mature markets are modest (Syriopoulos and Roumpis, 2009). Vizek and Dadić (2006) examine the integration between German equity markets, selected CEE equity markets and the Croatian equity market. Interestingly, no evidence of long-term relationship between the Croatian and German stock markets is found. Samitas and Kenourgios (2011) investigate the stock market integration of a number of Balkan countries and compare it to the integration among several developed markets (US, UK, Germany) in 2000-2006. Using several cointegration tests, the results support the existence of long-term relationships among Balkan stock markets and developed markets.

International stock market comovements between Czech Republic, Hungary and Poland, and Croatia, Macedonia and Serbia for the 2006-2011 time period was examined by Horvath and Petrovski (2013). They study time varying comovement (correlations) of the volatilities in the time domain and show that there is a zero correlation between Western stock markets and Serbian and Macedonian stock markets. Angelovska (2016) using Cointegration analysis and Granger causality tests investigates the bilateral relationship between young and small Macedonian stock exchange and three Yugoslav Republics (Slovenia, Croatia and Serbia), and three world stock exchanges (USA, Germany and UK) for the time period covering January 3nd, 2005, through December 1th, 2009. The only evidence of comovement of Macedonian stock indices before the 2007 Crisis is found for Croatian and Slovenian indices. The Macedonian capital market responds to short-term dynamics arising from the developed countries and regional or Macedonian Stock Exchange is the only recipient of short-term dynamics with no ability for further transmission. MBI10 is Granger caused by CROBEX, BELEX, DAX, FTSE and DOW and there is no reversibility in the impact, except for CROBEX (Angelovska, 2016).

Methodology

The cointegration method is used to model the dynamic co-independence that is often found in the financial market. Cointegration analysis was firstly developed with the seminal contributions by Granger (1981), Engle, Granger (1987) and Granger, Hallman (1991). It can reveal regular stochastic trends in financial time series data and be useful for the long-term investment analysis. The analysis considers the I (1) – I (0) type of cointegration in which linear permutations of two or more I (1) variables are I (0) (Christensen, Nielsen, 2003). Such linear combinations would then point to the existence of a long-term relationship among the variables (Johansen and Juselius, 1990). The cointegration tests allow to determine whether stock prices or indices of different national markets move together over the long run while providing the possibility of short-run divergence. As far as the methodology is concerned, this study uses a two-step approach to analysis. The first step is to test each index series for the presence of unit root, which will show whether the series are nonstationary. Non stationarity is a precondition for cointegration; additionally, all the series must be integrated in the same order. To detect the unit root property of the stock market indices two tests are used. The first one is the Augmented Dickey and Fuller (ADF) test (Dickey and Fuller, 1979), and is generally employed as shown below:

$$\Delta y_t = \propto + \beta_t + (\rho - 1) y_{t-1} + \sum_{i=1}^{k-1} \theta_i \, \Delta y_{t-i} + \alpha_t \qquad (1)$$

where Δ is first difference; y_t are stock indices' prices; t is trend variable; and α_t is a white noise term. The null hypothesis is ρ=1 and y_t is said to be unit root if the null failed to reject the null. Beside ADF test nonparametric Phillip-Perron (1988) PP test is used.

The second step is the well-known methodology of cointegration analysis to test the presence of long-run equilibrium relationships between the Macedonian and Croatian stock market. The Johansen method, which takes its starting point in the vector autoregression (VAR) of order *p* is given by the Equation (2):

$$\Delta y_t = \mu + \Pi y_{t-1} + \Sigma G_i \Delta y_{t-i} + \varepsilon_t \quad (2)$$

where $\prod = \alpha\beta'$; the matrix α contains short-run adjustment parameters to the long-run relationship reflected in the matrix β, and the rank ∏ determines the *r* number of cointegrating vectors. It can reveal regular stochastic trends in financial time series data and be useful for long-term investment analysis. Consequently, the nonstationary series shift together in the sense that a linear permutation of them is stationary and therefore a regular stochastic trend is shared.

To determine the direction of short-term dynamics, ie the interdependence of the Macedonian market with Croatian market, causality test based on Granger's approach (Granger, 1969) is used. According to Brooks (2002), "causality simply implies a chronological ordering of movements of the series." It does not mean that movements in one market will be the direct result of movements in other markets. In this context it means that only past values of X can "cause" Y. Sims (1972) points out that a necessary condition for X to be exogenous of Y is that X fails to Granger-cause Y. Similarly, variables X and Y are only independent if both fail to Granger-cause the other.

To test the general hypothesis that there is Granger causality between the returns of the Macedonian and Croatian index returns the following equations are used:

$$\Delta Y_t = a_0 + \sum_{i=1}^{k} a_i \Delta Y_{t-i} + \sum_{i=1}^{k} \beta_i \Delta X_{t-i} + e_t \quad (3)$$

$$\Delta X_t = a_0 + \sum_{i=1}^{k} a_i \Delta X_{t-i} + \sum_{i=1}^{k} \beta_i \Delta Y_{t-i} + u_t \quad (4)$$

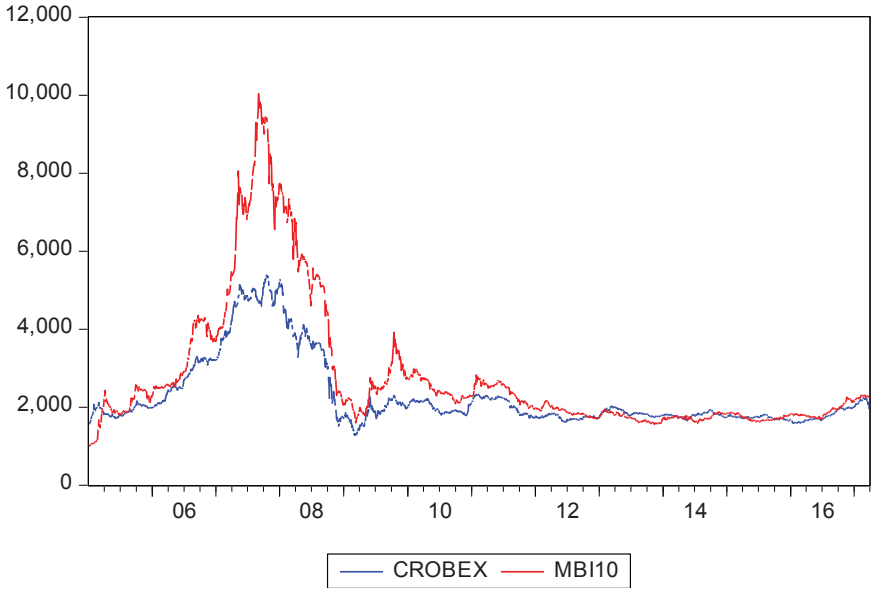
In these equations, *Xt* and *Yt* are returns on two stock market indices. In the first equation (3), *Xt* is said to Granger-cause *Yt* if Σ *βi* is significantly different from zero. The second equation (4) is essentially the same as the first equation with *Xt* and *Yt* reversing their positions. In this equation, *Yt* is said to Granger-cause *Xt* if Σ *δi* is significantly different from zero. Wald-F test is used to verify the following hypotheses:

H1: CROBEX does not Granger Cause MBI10: β i = 0, i = 1 to n,
H2: MBI10 does not Granger Cause CROBEX: γi = 0, i = 1 to n.

Empirical Results

The data used in this study comprised of the daily closing prices (in logs) in Croatian and Macedonian stock markets. The stock market indices of interest are MBI10 of Macedonia, and CROBEX of Croatia. The indices are official share indices of the Zagreb stock exchange and Macedonian stock exchange and they are capitalization-weighted price indices of the most liquid shares so called blue chips stocks and major stock market index for each country. The high frequency data incorporated here include information on short-run market interactions that may be absent in lower frequency data. The data were obtained from national stock exchanges and were adjusted or all dates were lined up for comparison. This is needed due to the fact that each country had different holidays on which the stock markets are closed. When a stock exchange is closed due to a national holiday, the previous day closing price is used. The sample covers a period from January 3rd 2005 till March 31st 2017 totalling 3190 observations each. The indices' movements are presented in Figure 1.

Figure 1: Equity market developments



Source: National Stock Exchanges

The returns are calculated by Equation 6. Table 1 reports descriptive statistics for the stock market returns that are of prime interest to international portfolios.

$$rt = \ln(Pt / Pt\text{-}1)*100 \quad (5)$$

Table 1 reports descriptive statistics for the stock market returns that are of prime interest to international portfolio investors. The non-normality of the returns can be seen from the leptokurtic distributions and the results of Jarque-Bera normality tests for both stock markets. The third moment reveals that the return series are not symmetric.

Table 1: Descriptive statistics of the Macedonian and Croatian stock returns in the period January 2005-March 2017

	MBI10	CROBEX
Mean	0.025420	0.007258
Median	0.000000	0.000000
Maximum	8.089667	14.77896
Minimum	-10.28315	-10.76363
Std. Dev.	1.262908	1.163108
Skewness	-0.134110	0.028326
Kurtosis	13.64843	22.56928
Jarque-Bera	13.64843	22.56928
Probability	15090.31	50933.66
Observations	0.000000	0.000000

Source: National Stock Exchanges

The mean of the returns is higher 0.025, but followed by higher volatility 1.26 for the Macedonian stock market index. The maximum return of 14.8 is reached for the Croatian and 8.1 on the Macedonian Stock market index.

Cointegration requires the variables to be integrated of the same order. So, as a first step the variables are tested for unit roots to verify their nonstationarity. The results from Augmented Dickey-Fuller (ADF) unit root test indicate that the null hypothesis of a unit root in the log levels cannot be rejected for any time series, while a unit root in the first differences is rejected at the 1% significance level (Table2). As a result, the stock markets follow a process integrated of order one. The Phillips Peron (PP) test results shown in Table 2 support the findings of the previous test.

Table 2: ADF and PP unit root tests

	ADF test		PP test*	
	Level	Return	Level	Return
Macedonia-	-1.96	-33.11	-2.03	-37.05
Croatia	-1.41	-29.20	-1.58	-53.34

Note: ADF - Augmented Dickey-Fuller test; MacKinnon critical values for rejection of hypothesis: 1%Critical value -3,436749, 5%Ceritical value -2,864254, 10% Critical value -2,568267

Source: Authors' calculations

As the variables showed non-stationarity in their level forms, and stationarity in first difference, the co-integration test (Trace and Maximum Eigenvalue) between the Croatian and Macedonian stock market indices is performed and the results are shown in Table 3. The null hypothesis of no co-integration vectors is rejected in 1 co-integration relation, indicating that there is co-integration between the indices.

Table 3: Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized		Trace	0.05	Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Statistic	Critical Value	Prob.**
None *	0.015055	50.86411	15.49471	48.26460	14.26460	0.0000
At most 1	0.000785	2.503872	3.841466	3.841466	3.841466	0.1136
Trace test and Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level						

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Authors' calculations

Existence of cointegration between MBI10 and CROBEX is precondition to perform Vector error correction (VEC). The model was developed and cointegration term known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments is found. The cointegrating vector based on the largest eigenvalue is: $u_t \equiv (1, 2.91, -1.4, 0.01)$ and this gives the cointegrating relation shown in Equation (6).

$$LM_t = 1.4*LC_t - 2.91 \quad (6)$$

The term u_{t-1} is the magnitude by which y was above or below its long-run equilibrium value in the previous period. In conclusion, the results lead us to believe that the Macedonian stock market tends to follow the directions taken by the Croatian stock market and that their impact on Macedonian market is highly significant.

Granger causality is an analysis to understand the nature of linkages between two markets – whether one market is influencing or causing the other market, or whether the two markets are causing each other. The number of optimal lag in Granger causality test is based on the Akaike Information Criterion (AIC). Granger casualty test can be performed and valid only if the series are stationary (Table 2). The results of the Granger's causality tests are presented in Table 4 based on F-statistic. Both hypotheses are rejected indicating a two-way causality of Macedonian and Croatian Stock Market.

Table 4: Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
CROBEX does not Granger Cause MB10	3190	55.4332	2.E-24*
MB10 does not Granger Cause CTCROBEX		8.48506	0.0002*

* denotes rejection of hypothesis at the 1% level of significance, ** denotes rejection of hypothesis at the10% level of significance.

Source: Authors' calculations

Two bidirectional or full causality between Macedonian and Croatian stock markets are detected. This means that changes in the prices at Croatian stock market predict changes in the prices at Macedonian stock market and vice versa. The Granger causality tests only indicate the most significant direct causal relationship. The fact that majority of foreign investors on the Macedonian Stock Exchange are Croatian investors means that the investors are following the movement of the stock prices producing interaction between them. Detected bi-causality in these two cases are expected.

Conclusion

Using a Johansen's cointegration tests to formulate the relationship of the daily stock levels of the Macedonian and Croatian stock markets this research has identified that two markets have common stochastic trend. This suggests that changes in the Croatian stock market has a significant effect on the Macedonian stock market. Vector error correction model was developed and the results lead us to believe that the Macedonian stock market tends to follow the directions taken by the Croatian stock market and that their impact on Macedonian market is highly significant. In particular, Macedonian stock market has a positive long-run equilibrium relation with the Croatian stock market that can be limit to the benefits of equity portfolio diversification within these two countries. Granger's causality tests found two bidirectional or full causality between Macedonian and Croatian stock markets. The Macedonian stock market responds quickly to changes in the Croatian market or the Macedonian stock market tends to follow the directions taken by the Croatian stock market and that the impact on Macedonian market is highly significant. Long and short-run relationship of Macedonian stock markets is considerably influenced by the Croatian stock market.

From a perspective of Macedonian and Croatian investors, this means that the possibilities to gain diversification benefits of investing in the Croatian or Macedonian stock market are vigorously diminished.

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