LONG-RUN AND SHORT-RUN CAUSALITY BETWEEN STOCK PRICE INDICES AND MACROECONOMIC VARIABLES: EVIDENCE OF PANEL VECM ANALYSIS FROM BOSNIA AND HERZEGOVINA, CROATIA, NORTH MACEDONIA AND SERBIA

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Abstract

The purpose of this paper is to identify the long-run and short-run relationship between the values of the Macedonian Stock Exchange Index composed of 10 most liquid listed stocks (MBI10), the Zagreb Stock Exchange Index (CROBEX) composed of the most liquid listed stocks, the Sarajevo Stock Exchange Index (SASX-10) composed of 10 most liquid listed stocks and the Belgrade Stock Exchange Index composed of 15 most liquid listed stocks (BELEX 15) and the selected macroeconomic variables. In order to identify the macroeconomic variables that affect the values of the selected stock indices, the analytical-synthetic method and the statistical method are applied. The statistical method uses econometric models for data analysis and interpretation and includes the application of the following econometric tools: Panel unit root test, Fisher -Johansen cointegration test, application of the panel vector error correction model (PVECM) and the Wald test statistics. The results of PVECM between the values of the selected stock indices and independent variables such as industrial production index 2015=100, average monthly gross wages, shows existence of conditionality or causal relationship on the long-run, when independent variable Harmonized Index of Consumer Prices (HICP) according to the COICOP classification 2015=100 is exluded from the model. By applying PVECM, it can be concluded that there is a long run causality running from independent variable to dependent variable, meaning that between the values of the selected stock indices and industrial production and average gross wages there is speed of adjustment towards long run equilibrium.

Keywords: panel VECM, stock index, macroeconomic variables

JEL: C32, G10, C58

1. Introduction

Examination of the determinants causing the Stock indices movements attracts the academic attention, especially in the securities markets of developing countries. To understand the development and the course of the dynamics of securities markets, it is crucial to know the connection between finance and economic growth and the impact of government policies over the creation of an economic and institutional environment that is in favor of the securities market development.

The first steps in establishing securities markets in post-communist European countries (Draženović & Kusanović 2016, p. 760) were defining and implementing the legal and institutional framework which enabled establishing stock exchanges and broader infrastructure.

Accordingly, one of the key factors that determined the future form of securities markets in economies in transition were the adopted privatization strategies (privatization by issuing vouchers, transferring ownership to employees, initial public offers and direct sales to strategic investors).

For example, in the first decade of transition of the economies, the framework of securities markets was largely an outcome of the privatization method, while in the next phase of development, important impulses for liquidity on the market and turnover were provided with the pension reform, i.e., the introduction of pension funds.

The development of financial intermediaries has a positive impact on the development of

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securities markets. Countries with well-developed securities markets tend to have well-developed financial intermediaries (Demirgüç-Kunt & Levine 2008, p. 14). Causality between the development of the capital market and non-bank financial intermediaries is found (Draženović & Kusanović 2016, p. 767) in certain countries of Central and Eastern Europe. On the other hand, their conclusion is that these markets are still underdeveloped due to low-level assets managed by institutional investors, inadequate institutional characteristics, a failed system for formation and execution of privatization, *etc.*

In the first decade of the establishment of stock exchanges in economies in transition, stock exchange indices were created as relative numbers that show the movement of prices of the most liquid securities at different time periods. Stock indices as indicators of the capital market are a consequence of investor efforts to buy cheap and sell more expensive. This creates the need for predicting the movement of stock prices.

The main feature of stock indices as indicators of the movement of securities value is that they do not indicate about how prices will move in the future, but show how much prices have changed in the current period compared to the previous period. The aim of stock exchange index is to better and more securely reflect changes in the price of securities on a particular market.

Today, the most famous stock price indices can be divided into two groups: (1) price-weighted stock index and (2) a capitalization-weighted index, also known as a market value-weighted index.

The world's most known stock indices are the Dow Jones Index, especially the Dow Jones Industrial Average, the Standard and Poor's 500, and the Japanese Nikei Index. Stock indices are a tool for measuring price changes of a group of securities. Taking into account the importance of value movement of stock price indices that help market participants to receive appropriate information on their investment decisions, the question that arises is which factors determine the movement of stock indices in developing countries?

In order to answer this question, the value movements of the Macedonian Stock Exchange Index of 10 most liquid shares of the Macedonian Stock Exchange - MBI 10, the Zagreb Stock Exchange Index (CROBEX) composed of the most liquid shares, the Sarajevo Stock Exchange Index (SASX-10) composed of 10 most liquid shares and the Belgrade Stock Index composed of 15 most liquid stocks of the Belgrade Stock Exchange are examined in this study. The following part of this paper elaborates the theoretical stands for the determinants of securities market and stock indices, together with an overview of the relevant empirical literature. The analysis explains the used data, applied methodology, the results from the obtained analyses, and the conclusion.

2. Literature review

The existing literature emphasizes three sets of factors that influence securities markets: macroeconomic, financial and institutional factors. These three sets of factors are interconnected. For example, institutional development directly affects macroeconomic and financial conditions and vice versa, convenient macroeconomic and financial environment facilitates development of institutions. Stock indices as an appropriate indicator of securities market movements and trends have a significant role in summarizing the overall performance of shares belonging to a particular group. They provide indications of general market performance and could lead the trading strategy for certain actions.

The literature determines that as much as the country is developed, the securities market is deep.

Several studies found out that the openness of the country for the entry of foreign capital and liberalization increase the activity of the securities market (Levine & Zervos 1998, p. 1169; Bekaert & Harvey 2000, p. 565; Edison & Warnock, 2003). Garcia and Liu (1999, p. 29) explored the impact of macroeconomic determinants in the development of securities markets in Latin American and Asian countries. Their findings showed that income, savings, development of financial intermediaries and liquidity of the securities market are important

determinants in the development of the securities market.

Also, Yartey (2008) in his research of 42 developing countries for the period 1990-2004, found out that the level of income, domestic investments, development of the banking sector, movement of private equity, and liquidity of the stock market are important determinants for the development of securities markets in developing countries. On a sample of 40 countries for the period 1980-2000, El-Wassal (2005, pp. 606-624) investigated the connection between the growth of securities market and economic growth, financial liberalization and foreign portfolio investments. The results of this research showed that these are the leading factors in the expansion of the securities market.

Regarding institutional factors, the literature shows that countries with a better institutional framework tend to have better securities markets. Pagano's study (1993, pp. 613-622) showed that regulatory and institutional factors affect efficient functioning of securities markets. This means that compulsory publication of confidential information and financial data of listed companies will encourage investor participation, while increased trust of investors in established regulations in brokerage houses can stimulate investment and trading in securities markets. Lazarov and Slaveski (2016) found that the quality of institutions has a significant positive impact on the development of securities markets in developing countries in Europe, while the same does not apply to the Western Balkan countries and the former countries of the Soviet Union.

The study "Political risk, economic risk and financial risk" (Erb *et al*., 1996, pp. 29-46) showed that the expected yields and the size of political risk are positively correlated. The lower political risk, the smaller expectations for return rate of the investment, regardless of whether it is developed or developing country. The results indicated that political risk plays a significant role in decision-making for investing and the amount to be invested and subsequently there may be significant implications on the development of the securities market. Also, the research of Yartey and Adjasi (2007) showed that political risk and quality of institutions, together, have a strong impact on the growth of market capitalization of the securities market.

There are studies that proved the existence of long-term and short-term interdependence of stock prices and dividend yields (Nasseh & Strauss, 2004, pp. 191–207; Persson, 2015). The research of Nasseh and Strauss investigatedwhether there is a stable link between the stock prices of the S&P 100 and dividends for a 20 year-period, while Persson examined FTSE All Share for a 24 year-period. By applying the error correction model on panel data, the results showed that in the analyzed period there was a direct long-term relationship between the stock prices of large companies and the dividend yield of these companies.

A vector error correction model was utilised to test the causal relationship between stock price index in the Jordanian equity market (Bekhet & Matar, 2013, pp. 285-301) and its determinants (GDP, money supply - M2, exchange rate and consumer price index (CPI)) for the 1978–2011 period. The results identified a co-integration between stock price index and Jordanian macroeconomic variables indicating a long-run equilibrium relationship among them. The error-correction term coefficient had a significant negative sign pointed to the adjustment back from short-run disequilibrium to the long-run equilibrium. The Granger causality test suggested a bidirectional causal relationship between SPI and M2 in the short and long runs.

Applied VECM of Singapore stock market (Maysami & Koh, 2000, pp. 79–96) detected that changes in Singapore's stock market levels do form a cointegrating relationship with changes in price levels, money supply, short- and long-term interest rates, and exchange rates.

While changes in interest and exchange rates contribute significantly to the cointegrating relationship, those in price levels and money supply do not. The research suggested that the Singapore stock market is interest and exchanges rate sensitive.

The study of stock price index of the Amman Stock Exchange (Al-Majali & Al-Assaf, 2014, pp. 156 – 171) indicated that there is a bi-directional long run relationship between stock price index and credit to the private sector, weighted average interest rate on time deposits, and consumer price index. The evidence implied that an increase in the weighted average interest rate on time deposits in the banking system has a greater effect on the stock price index than other macroeconomic and financial variables.

The study of the Korean stock market (Kwon & Shin, 1999, pp. 71–81) reflected that stock price indices are cointegrated with a set of macroeconomic variables: production index, exchange rate, trade balance, and money supply, which provides a direct long-run equilibrium relation with each stock price index.

The study of stock prices of Islamic banks (Aishahton & Mansur, 2014) examined the effects of interest rate and exchange rate on Islamic bank stock return by employing a panel cointegration and panel vector error correction (VECM). The result of this paper indicated a significant cointegrating relationship between the variables. The dynamic panel data, GMM results showed that interest rate has a negative impact and insignificant relationship to the Islamic bank stock prices.

On the other hand, the exchange rates have a negative impact and significant relationship to the Islamic bank stock prices.

The applied cointegration analysis of stock market index and exchange rate (Marjanovic *et al.*., 2021, pp. 59-71) which examined the long-term relationship between the leading stock market index BELEX15 and the RSD/EUR exchange rate in Serbia showed that the BELEX15 index adjusts to the long-run equilibrium relationship to RSD/EUR exchange rate in Serbia. This paper found evidence of both short-run and long-run relationship between stock prices and exchange rate in Serbia. A panel analysis (Chandrashekar *et al.*., 2018, pp. 91 -100) of macroeconomic variables and stock prices in emerging economies showed the interaction between index of industrial production, inflation, exchange rate, and interest rate to have a significant role in stock prices movement.

Long run and short run relationship between the selected macroeconomic variables (i.e., GDP, Inflation, Interest Rate, Exchange Rate and Money Supply) and aggregate stock returns in emerging markets constituting the BRICS block over the period 1995 to 2014 was examined (Tripathi and Kumar, 2015, pp. 104-123) by using quarterly panel data. In the short run there is unidirectional causality running from stock returns to GDP growth rate, inflation rate, rate of change in exchange rate, and money supply. Panel cointegration test showed that stock indices are cointegrated with GDP in total period and with GDP, inflation and money supply in post crisis period (after Q3 2007).

In the following part of this paper apanel cointegration and panel VECM was developed on the Macedonian Stock Index of the 10 most liquid shares of the Macedonian Stock Exchange - MBI 10, CROBEX – the official index of the Zagreb Stock Exchange composed of most liquid companies, the SASX-10 index of the most liquid company on the Sarajevo Stock Exchange and the Belgrade Stock Index (BELEX15) composed of 15 most liquid shares of the Belgrade Stock Exchange. The VECM model was used to examine whether there is a conditionality or a causal relationship between the examined variables.

The error correction model (VECM) is a limited VAR model that possesses cointegration restrictions within the specification and this model refers to non-stationary time series, which are cointegrated. VECM has long-term and short-term information about the changes of the dependent variable.

Some variables may not have short-term conditionality, but have long-term conditionality and vice versa. Based on the financial theory applied on the indices in Korea, Singapore, Japan, India and Brasil (Kwon & Shin, 1999, pp. 71–81; Mukherjee & Naka, 1995, pp. 223-237; Chen *et al.*., 1986, pp. 383-403; Chandrashekar *et al.*., 2018, pp. 91 - 100), the relationship was examined between the values of MBI10, CROBEX, SASX-10 and BELEX15 indices and macroeconomic

variables of Macedonia, Croatia, Bosnia and Herzegovina (BiH), and Serbia: industrial production index 2015=100, average monthly gross wages and the Harmonized Index of Consumer Prices (HICP) according to the COICOP classification 2015=100.

3. Research methodology

3.1 Data

The time series with the values of selected indices which are the subject of analysis in this paper were analyzed in the period from the first month of 2010 to the first month of 2020. In this period, the value of the MBI stock exchange index was declining from January 2010 when it was 2838 index points and decreased until November 2013 reaching 1575 index points.

In the period from December 2013 to January 2020, the MBI 10 index increased, with small price corrections in this period. In January 2020, the MBI 10 index was 4919 index points. The value of the BELEX15 Stock Index had constant ups and downs from January 2010 until the end of 2012, and from January 2013 until January 2020 the monthly value of the index had a stable growth with few price corrections in this period.

The value of SASX-10 showed a sharp decline between January 2010 until June 2012 and showed a very slow growth in the following period, but did not reach the value as in the beginning of the period.

The value of CROBEX performed significant variations in the first three years of the analyzed period and in the following years the value of this index performed modest variations. The monthly values of several macroeconomic variables of the selected countries were examined for the same period: industrial production index 2015=100, average monthly gross wages and the Harmonized Index of Consumer Prices (HICP) according to the COICOP classification 2015=100. The data of MBI 10, CROBEX, SASX-10 and BELEX15 indices were provided from Thomson Reuters database and the data for macroeconomic variables were provided from Eurostat database.

3.2 Methodology

In order to identify the long-run and short-run relationship between the values of the selected stock indices with the selected macroeconomic variables, the Eviews statistical software was used. At the beginning the variance of the time series was stabilized by logarithmization of the variables. Then, the panel unit root test was applied for each variable covered in this paper.

The aim was to determine whether their statistical properties (variance, autocorrelation, *etc.*.) are constant over time. The variables that are non-stationary over time were examined how many times they need to be differentiated in order to become stationary. With differentiation we can find out what is the degree of differentiation or integration of time series.

In the panel unit root test the risk level is considered to be 5% for acceptance or rejection of the null hypothesis (H0). The null hypothesis (H0) states that the time series has a "unit root" i.e., it is a non-stationary time series. If the „p“ value in the panel unit root test is higher than 0.05, then we accept the null hypothesis. If the „p“ value is lower than 0.05 then we accept the alternative hypothesis (H1) which states that there is no „unit root“, i.e., the time series is stationary.

Furthermore, when variables that are non-stationary at their level and integrated from the same order, we applied the panel contagion test, better known as the Johansen test to check the existence of long run equlibrium among integrated variables from the same order.

For panel cointegration the Fisher (combined Johansen) test type was used, which distinguishes two tests, the Fisher Trace test and the Fisher maximum eigenvalue test.

The Trace test is considered as a stricter test, so it is up to the researcher to choose from which test he/she will interpret the grades. In these tests, the acceptance of the null hypothesis (H0) determines whether there is cointegration between the examined variables or not, i.e., there is a balanced movement of the examined variables in the long run. To accept

the null hypothesis, the "p" value must be greater than 0.05.

If a set of variables are found to have one or more cointegrating vectors (Andrei & Andrei, 2015, pp. 568-576), then a suitable estimation model is VECM which adjusts to both short run changes in variables and deviations from equilibrium.

Lag length criteria also suggest to choose one lag for estimating VECM. General form of VECM model used is:

$$\Delta Yt = a_1 + a_2 ect1 + a_3 \Delta Yt1 + a_4 \Delta Xt1 + \epsilon t(1)$$

A crucial parameter in the estimation of the VECM model is the coefficient of the error correction term, (ect-1), which measures the speed of adjustment of dependent variable to its equilibrium level.

In order to establish the joint effect of variables, under VECM all those variables are taken as endogenous (ΔY) and exogenous (ΔX), in order to establish the long and short run association between them.

We applied a PVECM with cointegrating equations and under Eviews environment we estimated with OLS, a system of four equations, ordered by each variable.

Short run effects are captured through individual coefficients of the differentiated terms. This captures the impact while the coefficient of the VECM variable contains information about whether the past values of variables affect the current values of the variables under this study.

The size and statistical significance of the coefficient of the error correction term, measures the tendency of each variable to return to the equilibrium. A significant coefficient implies that past equilibrium errors play a role in determining the current outcomes captures the long-run impact.

PVECM in this study was used to examine whether there is conditionality or causality between the examined variables. For an error correction model to be acceptable, its error correction term (C1) needs to be negative and significant.

Additionally, the coefficient of determination R2 has a lower value than the Durbin-Watson stat. Finally, when testing the regression residuals of VECM, the residuals should be normally distributed without serial correlation and heteroskedasticity.

In this model, the coefficients (C4, C5, C6…) in the regression that denote the differences of individual independent variables can be tested so that we see if they have a short-term effect on the movement of the dependent variable, in this case the movement of the BELEX15, CROBEX, SASX-10 and MBI10 values. This analysis was performed using the Wald test.

In the next part of the paper, we focus on the results of the time series analysis. Eviews statistical software was used to conduct the analysis.

3.3 Results

Panel data techniques are employed to observe the nature of relationship between the variables separately for each panel. However, data should be first tested for the presence of a unit root. The results of applying the panel unit root test to check the stationarity of the panel data showed that all variables are non-stationary in their level.

Stationarity in the first differentiation is applied for the following time series: values of selected stock indices, industrial production index 2015=100, average monthly gross wages and HICP according to the COICOP classification 2015=100. Because all variables were differentiated from first order I(1), panel cointegration test could be applied.

In this study the Johansen Fisher panel cointegration test was applied (Table 1) between the values of the selected stock indices, the Industrial Production Index 2015=100, average monthly gross wages and HICP according to the COICOP classification 2015=100. The Fisher statistics of Trace test and Max-eigenvalue test of the panel cointegration test showed that the null

hypothesis is rejected for the category "None" and “At most 1” because the value "p" is less than 0.05, and is accepted for the category "At most 2", which means that there is a cointegration relationship and there is a long-run equilibrium movement between stock indices values and other variables in the model.

In order to be able to create PVECM, it is necessary to have at least one cointegration relationship between the given variables.

With the results from the panel cointegration test, we can continue with the creation of appropriate PVECM.

Table 1. *Johansen Fisher panel cointegration test of Belex15, SASX-10, CROBEX and MBI10 indices values and selected macroeconomic variables*

Results of Johansen Fisher panel cointegration tests				
Panel cointegration test 1 (stock indices, hcip_ind, production index, gross wages)				
Hypothesized no. of CE(s)	Fisher stat. (trace test)	Prob.	Fisher stat. (max-eigen test)	Prob.
None	47.07	0.0000	38.05	0.000
At most 1	19.22	0.0137	13.58	0.0933
At most 2	11.60	0.1702	10.37	0.2402
At most 3	11.61	0.1697	11.61	0.1697

Source: Author’s own work

Since there was a cointegration relationship and we me*et* all the previous conditions regarding the stationarity and cointegration of the selected variables, the next step was to test whether there is a long run causality between the values of stock price indices and selected variables by using PVECM.

The results showed that the appropriate panel VECM was identified between the stock price indices values of Belex15 and MBI10 and industrial production index 2015=100, average monthly gross wages and HICP according to the COICOP classification 2015=100.

This model had an error correction term (C1) with a positive sign 0.001009 (Table 2) and was not significant (its p-value is 0.1268), which means that the independent variables didnot have long run effects over the values of the selected stock indices.

Table 2. *Error correction model of selected stock indices*

Dependent Variable: D(LN_INDICES)
Method: Panel Least Squares
Date: 05/17/22 Time: 01:12
Sample (adjusted): 2010M04 2020M01
Periods included: 118
Cross-sections included: 4
Total panel (balanced) observations: 472
D(LN_INDICES) = C(1)*(LN_INDICES(-1) - 0.482711485854
*LN_GROSS_WAGES(-1) - 11.0603057021*LN_PRODUCTION(-1) +
48.4759724417*LN_HICP(-1) - 174.224210976) + C(2)
*D(LN_INDICES(-1)) + C(3)*D(LN_INDICES(-2)) + C(4)
*D(LN_GROSS_WAGES(-1)) + C(5)*D(LN_GROSS_WAGES(-2)) + C(6)
*D(LN_PRODUCTION(-1)) + C(7)*D(LN_PRODUCTION(-2)) + C(8)
*D(LN_HICP(-1)) + C(9)*D(LN_HICP(-2)) + C(10)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.001009	0.000660	1.529583	0.1268
C(2)	0.141190	0.046566	3.032039	0.0026
C(3)	0.032272	0.046943	0.687482	0.4921
C(4)	0.091098	0.058632	1.553741	0.1209
C(5)	0.017465	0.058491	0.298593	0.7654
C(6)	-0.018618	0.048917	-0.380601	0.7037
C(7)	-0.029702	0.048992	-0.606264	0.5446
C(8)	0.440535	0.384225	1.146555	0.2522
C(9)	0.150653	0.378843	0.397665	0.6911
C(10)	-0.000287	0.002040	-0.140621	0.8882

R-squared	0.039866	Mean dependent var	0.000935
Adjusted R-squared	0.021163	S.D. dependent var	0.041514
S.E. of regression	0.041072	Akaike info criterion	-3.526013
Sum squared resid	0.779358	Schwarz criterion	-3.437942
Log likelihood	842.1391	Hannan-Quinn criter.	-3.491370
F-statistic	2.131450	Durbin-Watson stat	1.990075
Prob(F-statistic)	0.025733		

Source: Author’s own work

To identify the proper PVECM, in each equations the elimination of each independent variable has been applied.

All models had at least one cointegreation, but when the variable HICP according to the COICOP classification 2015=100 was eliminated, (Table 3) PVECM had an error correction term (C1) with a negative sign -0.000373 (Table 4) and was significant (its p-value was 0.0087) which means that the independent variables had a long run effects over the values of Belex15, CROBEX, SASX-10 and MBI10 indices.

Also, it can be noticed here that the value of R2 (R-squared = 0.0.047583) was lower than the Durbin-Watson statistic (Durbin-Watson stat =

1.988600), which is one of the indicators for the suitability of the model.

The testing of the regression residuals of PVECM, showed that the residuals were normally distributed.

From the obtained results it can be concluded that there is conditionality or a causal relationship on the long-run between the values of the selected stock indices and independent variables such as industrial production index 2015=100 and average monthly gross wages.

Table 3. *Johansen Fisher panel cointegration test of Belex15, SASX-10, CROBEX and MBI10 indices values and selected macroeconomic variables*

Results of Johansen Fisher panel cointegration tests				
Panel cointegration test 1 (stock indices, production index, gross wages)				
Hypothesized no. of CE(s)	Fisher stat. (trace test)	Prob.	Fisher stat. (max-eigen test)	Prob.
None	32.23	0.0001	23.82	0.0025
At most 1	16.73	0.0331	16.06	0.0416
At most 2	9.30	0.3175	9.30	0.3175

Source: Author's own work

Table 4. *Appropriate panel error correction model of selected stock indices*

Dependent Variable: D(LN_INDICES)
Method: Panel Least Squares
Sample (adjusted): 2010M04 2020M01
Periods included: 118
Cross-sections included: 4
Total panel (balanced) observations: 472
D(LN_INDICES) = C(1)*(LN_INDICES(-1) - 1.18639709701 *LN_GROSS_WAGES(-1) - 188.301766623*LN_PRODUCTION(-1) + 872.099474871) + C(2)*D(LN_INDICES(-1)) + C(3)*D(LN_INDICES(-2)) + C(4)*D(LN_GROSS_WAGES(-1)) + C(5)*D(LN_GROSS_WAGES(-2)) + C(6)*D(LN_PRODUCTION(-1)) + C(7)*D(LN_PRODUCTION(-2)) + C(8)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.000373	0.000142	-2.633716	0.0087
C(2)	0.134876	0.046328	2.911352	0.0038
C(3)	0.030871	0.046430	0.664907	0.5064
C(4)	0.070821	0.057702	1.227346	0.2203
C(5)	-0.002582	0.057735	-0.044728	0.9643
C(6)	-0.062121	0.050777	-1.223414	0.2218
C(7)	-0.060040	0.049464	-1.213803	0.2254
C(8)	0.000816	0.001901	0.429132	0.6680

R-squared	0.047583	Mean dependent var	0.000935
Adjusted R-squared	0.033215	S.D. dependent var	0.041514
S.E. of regression	0.040819	Akaike info criterion	-3.542557
Sum squared resid	0.773095	Schwarz criterion	-3.472100
Log likelihood	844.0436	Hannan-Quinn criter.	-3.514843
F-statistic	3.311663	Durbin-Watson stat	1.988600
Prob(F-statistic)	0.001890		

Source: Author's own work

The short-run causality of the appropriate PEVCM was also tested by using the Wald test. The Wald test computes a test statistic based on the unrestricted regression. The Wald statistic measures (Banumathy & Azhagaiah, 2015, pp. 247-256) how close the unrestricted estimates come to satisfy the restrictions under the null hypothesis.

If the restrictions are in fact true, then the unrestricted estimates should come close to satisfy the restrictions.

The Wald test was employed to identify the short run relationship between the variables in this study. According to the results (Table 5) of the Wald test, the coefficients (C4, C5, C6…) in the regression that denote the differences of individual independent variables showed that there is no existence of short-term effect on the movement of the values of the selected stock indices.

Table 5. *The Wald test results*

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.172218	(4, 464)	0.3223
Chi-square	4.688873	4	0.3207

Null Hypothesis: C(4)=C(5)=C(6)=C(7)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	0.070821	0.057702
C(5)	-0.002582	0.057735
C(6)	-0.062121	0.050777
C(7)	-0.060040	0.049464

Restrictions are linear in coefficients.

Source: Author's own work

3.4 Discussion

In the analyzed period (January 2010 to January 2020), the economies of Macedonia, Croatia, Serbia and BiH were in recession in 2012 as a result of the debt crisis that occurred in the EU member states.

As the European Union is the largest foreign trade partner for all these countries, its debt crisis affected theseeconomies, especially with reference to declining industrial production which is one of the variables in PEVCM, and in this crisis period the value of the selected indices was declining and had significant variations.

On the other hand, average gross wages in the selected countries had a constant growth in the analyzed period which was more significant in the period between 2018 until 2020.

Due to mass privatization before the global financial crisis, more than 4,000 new companies in Serbia were listed on the stock exchange and they were attracting foreign investors and domestic mutual funds.

However, the stock market collapsed in 2008 during the global financial crisis, causing considerable losses to investors, who consequently lost their confidence in the equity market. Rebuilding investor confidence is challenging, especially if the stock market does not offer attractive investment alternatives.

Nowadays there are hardly any valuable companies with substantial free-floats listed on the Belgrade Stock Exchange and the daily turnover is negligible.

Although the stock exchange had several initiatives and infrastructural upgrades to attract prospective companies to use capital markets for their financing, as of 1940 until 2018 there was no initial public offerof shares in Serbia. Fintel Energija successfully completed Serbia's first initial public offer at the end of October 2018.

The movements on the Macedonian securities market were influenced by the political crisis that started in 2015 and the potential for market growth was limited, it even registered negative tendencies. With the stabilization of the political situation in 2017, the market reacted positively.

So far at the Macedonian Stock Exchange there has been no initial public offer of shares through which the companies would finance their development plans and projects. Investors still use traditional sources of capital, i.e., bank loans. Also, the legislation in the country and the market environment are still in process of harmonization with the EU regulations.

Croatia's economy remained in recession for the sixth consecutive year, with GDP down by 0.6% in the first half of 2014. Croatia became a member of the EU on July 1st 2013. After a long period of recession, Croatia was slowly recovering but, in this period, the largest Croatian firm, Agrokor, collapsed, which created revenues of over 6 billion euros in one year.

According to the 2020 European Commission country report, BiH remains at an early stage in establishing a functioning market economy, and major structural reforms are required to enable the country to cope with competitive pressure and market forces over the long term. Some improvements were made with regard to modernizing labor legislation, addressing

weaknesses in the banking system and improving the business environment.

The lack of a single economic space within BiH remains a serious impediment to business activity. According to the European Commission, network industries still need to be liberalized, and the state continues to influence the economy through state-owned monopolies and nontransparent public procurement procedures.

4. Conclusion

There are various studies for macroeconomic, financial and institutional factors that have an impact on securities markets, but the individual impact of each factor is difficult to determine because the factors are interrelated and the relationship between them and securities markets developement is a complex process to unravel.

Knowledge of this relationship, and the ability to predict the future trends for each factor can be exploited as a valuable forecasting tool by investors, on the one side, in their everlasting attempts to earn greater profits, and by authorities, on the other side, in their attempts to maintain the stability of financial markets (Aydemir & Demirhan, 2009, pp. 207-215). Economic theory posits that certain pairs of financial time series are expected to move together in the long run. In the short run they may deviate from each other, but investors' tastes and preferences, market forces and government regulations will bring them back to their equilibrium.

In this paper PVECM is developed to examine whether there is long-term causality between the values of BELEX15, CROBEX, SASX-10 and MBI 10 indices as dependent variable and selected independent macroeconomic variables such as: industrial production index 2015=100, average monthly gross wages and HICP according to the COICOP classification 2015=100.

By applying PVECM it can be concluded that there is a long run causality running from independent variable to dependent variables industrial production index 2015=100 and average monthly gross wages, meaning that between these variables there is speed of adjustment towards long run equilibrium.

The findings of this research are important for finance academics and practitioners. They may also be useful to the investors of the selected stock markets to analyze the macroeconomic factors that affect the stock market return in both short and long terms.

These results could be the product of deeper causes, macroeconomic or institutional factors such as government policy, expectations, degree of market liberalization or capital control, *etc.* Additionally, we should be aware that the significance of the results may be due to the chosen time horizon or data frequency. Also, this study is limited to only a few selected macroeconomic variables.

Thus, inclusion of more macroeconomic variables like interest rates, sector wise market return, international trade, *etc.* with a longer time period may improve the results.

Therefore, further and broader analysis is needed. I suggest further research by using other economic variables such as interest rates, money supply and international trade in exploring the relationship of stock indices in developing countries such as North Macedonia, BiH, Croatia and Serbia.

References

1. Aishahton, A., & Mansur, M. (2014). Interest Rate, Exchange Rate, and Stock Prices of Islamic Banks: A Panel Data Analysis. *MPRA Paper*, No. 58871.
2. Al-Majali, A. A., & Al-Assaf, G. I. (2014). Long-Run and Short-Run Relationship Between Stock Market Index and Main Macroeconomic Variables Performance in JordaN. *European Scientific Journal*, 10(10), 156 – 171.
3. Andrei, D. M., & Andrei, L. C. (2015). Vector error correction model in explaining the association of some macroeconomic variables in Romania. *Procedia Economics and Finance,* 22, 568 – 576.
4. Aydemir, O., & Demirhan, E. (2009). The relationship between stock prices and exchange rates: evidence from Turkey.

International Research Journal of Finance and Economics, 1(23), 207–215.
5. Bango, Z., Iacovella, S., C., & Rodriguez, E. (2019). *Republic of Serbia Capital Market Development*. World bank group.
6. Banumathy, K., & Azhagaiah, R. (2015). Long-Run and Short-Run Causality between Stock Price and Gold Price: Evidence of VECM Analysis from India. *Management Studies and Economic Systems (MSES)*, 1 (4), 247-256.
7. Bekaert, G., & Harvey, C. R. (2000). Foreign Speculators and Emerging Equity Markets. *The Journal of Finance,* 55, 565–613.
8. Bekhet, H. A., & Matar, A. (2013). The influence of global financial crisis on Jordanian equity market: VECM approach. *Int. J. Monetary Economics and Finance,* 6(4), 285-301.
9. Bertelsmann Stiftung, BTI (2022) *Country Report — Bosnia and Herzegovina*. Gütersloh: Bertelsmann Stiftung.
10. Chandrashekar, R., Sakthivel, P., Sampath, T., & Chittedi, K., R. (2018). Macroeconomic variables and stock prices in emerging economies: A panel analysis. *Theoretical and Applied Economics,* XXV(3), 91-100.
11. Chen, N., Stephen, R. R. & Ross, A. (1986). Economic Forces and the Stock Market. *The Journal of Business,* 59(3), 383-403.
12. Demirgüç-Kunt, A., & Levine, R. (2008). *Finance, Financial Sector Policies, and Long-Run Growth*. World Bank Group.
13. Draženović, B. O., & Kusanović, T. (2016). Determinants of capital market in the new member EU countries. *Economic Research-Ekonomska Istraživanja*, 29, 758-769.
14. Edison, H., & Warnock, F. E. (2003). *Cross-Border Listings, Capital Controls, and Equity Flows to Emerging Markets*. Federal Reserve Board, International Finance Discussion Papers, N. 770.
15. El-Wassal, K. A. (2013). The Development of Stock Markets: In Search of a Theory. *International Journal of Economics and Financial Issues*, 3(3), 606-624.
16. Erb, C. B., Harvey, C. R., & Viskanta, T. E. (1996). Policy risk, Economic Risk and Financial Risk. *Financial Analysts Journal*, 3, 29-46.
17. Eurostat (2022). *Database*. Available at: https://ec.europa.eu/eurostat/data/database [Accessed: 24 January 2022]
18. García, V. F., & Liu, L. (1999). Macroeconomic Determinants of Stock Market Development. *Journal of Applied Economics*, 4, 29–59.
19. Kwon, C. S., & Shin T. S. (1999). Cointegration and causality between macroeconomic variables and stock market returns. *Global Finance Journal* 10(1), 71–81.
20. Lazarov, D., & Slaveski, T. (2016). Empirical estimation of macroeconomics and institutional specific determinants of capital market development in the CEE countries. In: 14th EACES conference*: Comparative Economic Development in the Long Run*, 8-10 September, 2016, Regensburg, Germany.
21. Levine, R., & Zervos, S. (1998). Capital Control Liberalization and Stock Market Development. *World Development*, 26(7), 1169-1184.
22. Marjanović, M., Mihailović, I., & Dimitrijević, O. (2021). Cointegration analysis of stock market index and exchange rate: the case of Serbian economy. *The Annals of the Faculty of Economics in Subotica*, 57(46), 59-71.
23. Maysami, R. C., & Koh T. S. (2000). A vector error correction model of the Singapore stock market. *International Review of Economics and Finance, 9*, 79–96.
24. Mukherjee, T. K., & Naka, A. (1995). Dynamic relations between macroeconomic variables and the japanese stock market: an application of a vector error correction model. *The Journal of Financial Research,* XVIII(2), 223-237.
25. Nasseh, A., & Strauss, J. (2004). Stock prices and the dividend discount model: did their relation break down in the 1990s? *The Quarterly Review of Economics and Finance, 44*, 191–207.
26. Pagano, M. (1993). Financial Markets and Growth: An Overview. *European Economic Review*, 37, 613-622.
27. Persson, R. (2015). *The short and long-term interdependencies between stock prices and dividends: A panel vector error correction approach.* Master thesis. Uppsala University, Department of Business Studies.
28. Tripathi, V., & Kumar, A. (2015). Relationship between macroeconomic factors and aggregate stock returns in

BRICS stock markets - A panel data analysis. *New age business strategies in emerging global markets*, *Excel India Publishers*, pp. 104-123.
29. Yartey, C. A. (2008). *The determinants of Stock Market Development in Emerging Economies: Is South Africa Different?*. IMF Working Paper, 08/32.
30. Yartey, C. A., & Adjasi, C. K. (2007). *Stock Market Development in Sub-Saharan Africa: Critical Issues and Challenges*. IMF Working Paper, 07/209.
31. Refinitiv (2022). Available at: https://eikon.thomsonreuters.com/index.html [Accessed: 24 January 2022]