Vesna Prorok

Faculty of Economics Pale,
University of East Sarajevo,
BiH

✉ vesna.prorok@gmail.com

Slađana Paunović

Faculty of Economics Pale,
University of East Sarajevo,
BiH

✉ sladjanapaunovic11@gmail.com

COINTEGRATION BETWEEN STOCK MARKET INDICES AND NOMINAL EXCHANGE RATES: EVIDENCE FROM TRANSITION COUNTRIES

KOINTEGRACIJA IZMEĐU TRŽIŠNIH INDEKSA I NOMINALNIH DEVIZNIH KURSEVA: ISKUSTVA ZEMALJA U TRANZICIJI

Summary: *This paper analyzes the interdependence between stock market indices and exchange rates in four transition countries: Croatia, Serbia, Hungary and the Czech Republic. The analysis is based on monthly data for the nominal exchange stock market indices and nominal exchange rates over the period from March 2010 to March 2015. The main objective of this work is to determine whether the exchange rates had a significant impact on future trends in the capital markets and vice versa. Empirical analysis has shown that the series are stationary in the first differences, and using both Engle-Granger cointegration and Granger causality test it has been shown, as well, that there is neither long-run nor short-run relationship between these two variables. In other words, it means that prediction of movement of one variable cannot be based on past values of other variable*

Key words: *stock market indices, nominal exchange rates, Augmented Dickey-Fuller test, Engle-Granger cointegration test, Granger causality test*

JEL classification:: *G11, C51*

Rezime: *U ovom radu se analizira međuzavisnost berzanskih indeksa i deviznih kureseva četiri tranzicione zemlje: Hrvatska, Srbija, Mađarska i Češka. Posmatraju se mjesečni podaci za nominalne devizne kurseve i mjesečni podaci vrijednosti berzanskih indeksa od marta 2010. do marta 2015. godine. Glavni cilj rada je da utvrdi da li su devizni kursevi imali značajan uticaj na buduće tnedencije na tržištima kapitala i obrnuto. Empirijska analiza je pokazala da su serije stacionarne u prvoj diferenci, a primjenom Engle-Granger-ove metode pokazano je da ne postoji kointegraciona veza između posmatranih varijabli. Dakle, pokazano je da ne postoji ni kratkoročno ni dugoročno zajedničko kretanje ovih varijabli, te da se kretanje jedne varijable ne može predvidjeti na bazi prošlih vrijednosti druge varijable.*

Ključne riječi: *indeks tržišta kapitala, nominalni devizni kurs, prošireni Dickey-Fuller test (ADF), Engle-Grangerov test kointegracije, Grangerov test uzročnosti*

JEL klasifikacija:*G11,C51*

1. INTRODUCTION

Changes in exchange rates and stock market indices have a significant impact on a country's economy, and therefore a great public attention has been drawn on the analysis of these variables. This is particularly important for countries with floating exchange rate regime and liberalized capital markets due to the increasing interest of investors for international diversification. Significant changes in the international financial system such as the emergence of new capital markets, the abolition of capital barriers, free movement of capital, and adoption of flexible exchange rate regimes in developing countries and countries in transition, have led not only to expansion of investment opportunities, but, as well, to increase of investment risk as a result of high volatility in exchange rates. The global economic and financial crisis, that in 2008 shook emerging markets the most, has undoubtedly led to dramatic fluctuations on both the stock exchange and foreign-exchange markets of these countries. Such developments have induced that the relationship between the stock market index

and nominal exchange rate become one of the main research subjects of a large number of financial analysts, whose researches have unquestionably contributed to good investment decision making.

There is currently no theoretical and empirical consensus concerning the relationship between exchange rates and stock market indices. According to the traditional approach, exchange rate movements affect the movements of stock market index. Namely, due to the depreciation of the domestic currency, domestic companies become more competitive, their exports increase what leads to the increase of their stock prices, and ultimately to the stock market index increase. On the other hand, the appreciation of the domestic currency reduces the profits of domestic companies, as it reduces the foreign demand for goods, and as a result causes a decrease in exports. This further leads to the decrease of a company's values and of its shares as well.

The second, so called the portfolio adjustment approach, claims that stock market index movements affect the movements of exchange rates. In this case, the crisis in the capital markets can be prevented by the control of exchange rate, and developing countries can use it in order to attract portfolio investments. More specifically, if the value of stock market index increases it will lead to the increase of domestic currency demand as well, and further to the appreciation of domestic currency. The increase in the price of domestic assets gives rise to a large increase in wealth. This leads to an increase of money demand causing interest rates to rise, and thereby attracting the foreign capital and affecting the exchange rate appreciation.

In the previous period, poorly developed and emerging markets have started more and more to draw attention of a large number of world investment companies. In intention to carry out more efficient allocation of their resources and provide a better diversification of their portfolio investments, they have found the solution in orientation toward the markets which have a higher level of volatility comparing to the world's most developed markets.

In this paper, using the monthly data in the period from March 2010 to March 2015, we analyze the relationship between exchange rate and stock market index of four countries: Serbia, Hungary, Czech Republic and Croatia.

2. LITERATURE REVIEW

Although theory emphasizes the existence of a causal-consequence relationship between exchange rate and stock market index, the empirical analysis provides different results. In this paper we will mention only some of the results of researches on the existence of cointegration between exchange rates and market indices which were conducted in the last decade, mostly in the U.S., Asian and European markets, using Engle-Granger as well as other test of cointegration. On the one hand, the results of analysis carried out in developed markets, which are primarily characterized by the efficiency in terms of turnover, liquidity, the number of available securities, legislation, openness compared to other markets, etc. and whose exchange rate movements are characterized as free-floating, confirm the hypothesis of the existence of statistically significant long-run relationship between the stock exchange and foreign exchange rate markets. On the other hand, the studies conducted on real markets of the developing and less developed countries, among which are, as well, those analyzed in this paper (Serbia, Hungary Czech Republic and Croatia), have shown that theoretical macroeconomic assumption of the existence of cointegration between two mentioned variables does not exist. Many authors state in their papers that the results of researches on the existence and level of cointegration between exchange rates and stock market indices are mixed, regardless of the level of market development, and that, to a large extent, they depend on the time within which the analysis was conducted. Here we have a brief look at just some of the researches conducted in the last decade.

Neda Bashiri (Bashiri 2011), by testing the hypothesis of existence of relationship between two mentioned variables, using monthly data in the period from January 2006 to March 2011, has come to the conclusion that there is neither a long-run nor a short-run causal relationship between exchange rate and stock market index movements on none of these two Asian markets.

The authors of the paper "*Cointegration between stock prices and exchange rates in Asia-Pacific countries*" (Abidin et al. 2013) have examined on a sample of seven countries (New Zealand, Hong Kong, Japan, Australia, South Korea, Thailand and Indonesia), in the period from 2006 to 2008, the hypothesis of the existence of cointegration between exchange rates and stock market indices.

During the analysis phase, the markets of Thailand and Hong Kong are excluded from the sample, due to the fact that the exchange rates of these countries are not characterized as free-floating. The results of research show that there is no statistically significant long-run relationship between these two variables on the mentioned markets. On all markets, except for the Japanese, the application of Engle-Granger test, and then Granger causality test, has revealed the instability of cointegration. The existence of cointegration, which was evident only on the Japanese market, is characterized as an anomaly that might occur as a result of the "wrongly" selected period of time for a series of data on which the analyses were conducted.

The research conducted by Md. Lutfur Rahman (Rahman and Uddin 2009) on three South Asian markets (Bangladesh, India and Pakistan) has led up to similar results, by observing the average monthly nominal value of foreign exchange rates USD/Bangladeshi Taka, USD/Indian Rupee and USD/Pakistani Rupee and monthly value of stock market indices Dhaka Stock Exchange General Index, Bombay Stock Exchange Index and the Karachi Stock Exchange, respectively. By applying the Augmented Dickey-Fuller test (ADF) for these variables in the period from January 2003 to June 2008, it was concluded that all variables are stationary in first differences. Then, empirical results, using Johansen cointegration test, showed that the cointegration between exchange rates and stock market indices on these three markets is not present. It was also confirmed, using the Granger causality test, that there is no causal relationship between these variables, as seen from both directions.

Compared to Asian markets, there are much less published papers dealing with these issues in Southeastern Europe. A significant contribution in terms of research on European soil has the paper of Nazlioglu et al. (Nazlioglu et al. 2014) in which he analyzed the nature of the causal relationship between exchange rate and stock market index in 9 transition economies (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Russia). Analysis was performed on annual data in the period from 1995 to 2011, where the application of Granger causality test demonstrated that a linear causal effect exists running from foreign exchange rate to stock market index in four countries (Czech Republic, Hungary, Poland and Romania), while a bidirectional causal relationship between both variables appears only on the Russian market, where both linear and nonlinear Granger causality tests were applied.

Not to such a large extent, but better results as expected were observed when analyzing the relationship between exchange rates and stock market indices of 6 world's most developed economies: USA, Great Britain, Canada, Japan, Euro zone and Switzerland, using weekly data in the period from January 6th, 2003, to December 28th, 2011 (Caporale et al. 2014). The considered period was divided into 2 consecutive sub periods: the pre-crisis and crisis period in order to be shown that even these markets were not so much immune to the global financial and economic crisis. The estimated bivariate GARCH-BEKK models have clearly shown that the impacts running from stock market spilled over into the foreign exchange market in the United States and Great Britain, while such spillovers in the opposite direction occurred in the Canadian market. Euro zone and the Swiss market were exposed to spillover impacts in both directions.
On the basis of the results of the above studies conducted on both developed and emerging markets, it can be concluded that the past decade was a really uncertain period from the viewpoint of investors who were very limited in terms of opportunities to diversify their assets.

3. METHODOLOGIES AND ANALYSIS

In this paper, the hypothesis of the existence of cointegration between exchange rates and stock market indices in four transition economies of East and Southeast Europe (Serbia, Hungary, Czech Republic and Croatia), will be tested on historical monthly data of nominal exchange rate movements of domestic currencies against euro and stock market index movements in the period from March, 2010 to March, 2015. The list of the countries, their currencies and stock market indices, which have been the subject of analysis in this paper, are given in the following table, while the time series data for all variables has been obtained through Quandl database https://www.quandl.com/.

Table 1: The list of the countries, their currencies and stock market indices

Country	Stock market index	Currency
Srbija	BELEXLINE	Dinar (RSD)
Mađarska	BUX	Forinta (HUF)
Češka	PX	Kruna (CZK)
Hrvatska	CROBEX	Kuna (HRK)

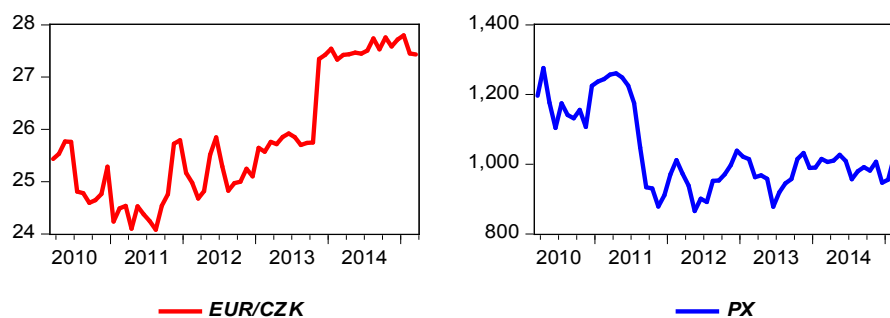The following graphs (1-8) present time series data of the variables from Table 1.

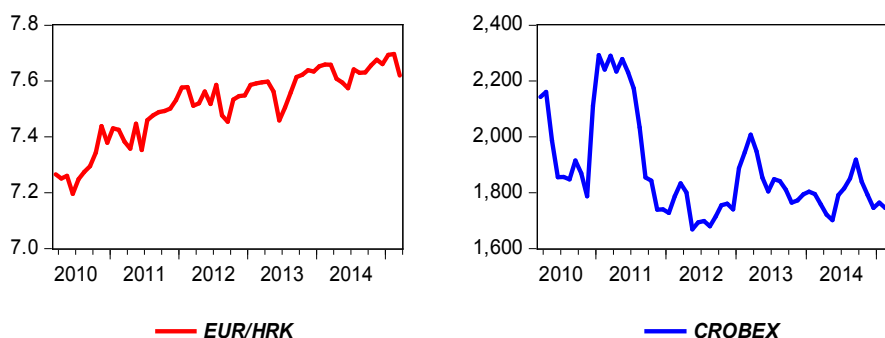*Graph 1-2: Serbian market (EUR/RSD and Belexline index)*
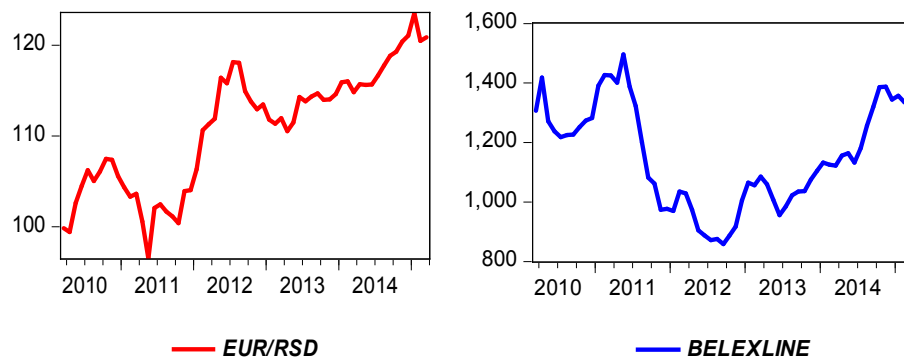
Graph 3-4: Hungarian market (EUR/HUF and BUX index)
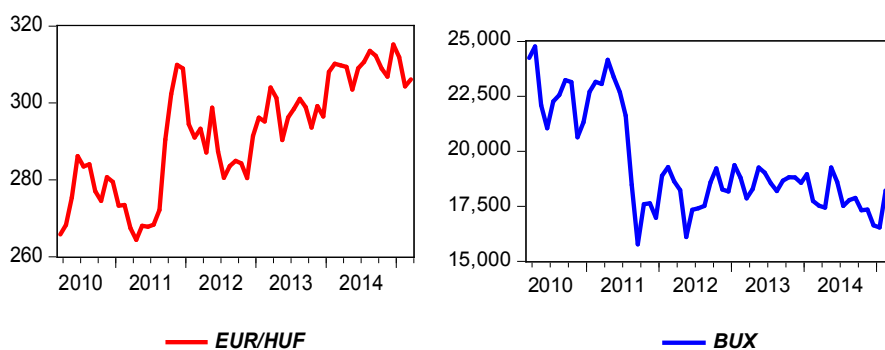
Graph 5-6: Czech Republic's *market (EUR/CZK and PX index)*

Graph 7-8: Croatian market (EUR/HUF and BUX index)

Source: Author's calculations

3.1. Unit root test

The stationary level for each time series of the variables represented in Table 1 is determined by using Augmented Dickey-Fuller unit root test. The optimal number of lags for autoregressive time series model, for which the stationary assumption is to be tested, is examined by application of Schwartz criteria. It should be noted that in addition to Schwartz criteria, there are a number of other criteria for determining the optimal number of lags in AR model. Some of these criteria reasonably presume in advance the maximum number of lags that gradually reduces by testing, until it comes to the number for which all lags are statistically significant. In addition, there are also criteria which start from the minimum possible number of lags, and each time the test of residuals is supposed to be carried out in order to determine whether there is autocorrelation between them or not. The existence of autocorrelation between residuals indicates that the number of lags is to be increased, wherein the process is repeated until it reaches the optimal number of lags in AR model. In other words, adding lagged values of the variable to an autoregressive model stops at the moment when the existence of autocorrelation between residuals is completely removed (Mahadeva ans Robinson 2004.).
Augmented Dickey-Fuller unit root test implies the following expressions

$$\Delta y_t = \gamma y_{t-1} + \sum_{p=1}^{p} \phi_p \Delta y_{t-p} + \varepsilon_t \,,$$

$$\Delta y_t = \phi_0 + \gamma y_{t-1} + \sum_{p=1}^{p} \phi_p \Delta y_{t-p} + \varepsilon_t \,,$$

$$\Delta y_t = \phi_0 + \delta_1 t + \gamma y_{t-1} + \sum_{p=1}^{p} \phi_p \Delta y_{t-p} + \varepsilon_t$$

The above expressions comprise the unit root test, the unit root test with intercept and unit root test with intercept and trend. The null hypothesis of the existence of unit root is the hypothesis of non-stationarity, or in other words, the hypothesis of the existence of unit root in a time series, what implies that the coefficient γ is equal to zero ($\gamma = 0$). This test should be very simple if the distribution of $\hat{\gamma}$ possessed standard normal distribution when checking the null hypothesis.. However, the distribution of $\hat{\gamma}$ under the null hypothesis is not a standard normal, because y_{t-1} is the unit root and variance of such process increases as the number of observations increases (Sheppard, 2012). For this reason, when making conclusion about the value of the t test, it is necessary, instead of standardized normal to use Dickey-Fuller distribution. The results of ADF test indicate whether the null hypothesis should be rejected or not. In the case that the null hypothesis is rejected, the alternative to the null hypothesis (hypothesis of stationarity of a time series) is accepted ($\gamma < 0$) for all data on the level, while accepting the null hypothesis leads to a repetition of the test procedure for differentiated data series, until it comes to the level of difference in which the condition of stationarity is fulfilled. The following expressions

$$\Delta^2 y_t = \gamma \Delta y_{t-1} + \sum_{p=1}^{p} \phi_p \Delta^2 y_{t-p} + \varepsilon_t \,,$$

$$\Delta^2 y_t = \phi_0 + \gamma \Delta y_{t-1} + \sum_{p=1}^{p} \phi_p \Delta^2 y_{t-p} + \varepsilon_t \,,$$

$$\Delta^2 y_t = \varphi_0 + \delta_1 t + \gamma \Delta y_{t-1} + \sum_{p=1}^{p} \varphi_p \Delta^2 y_{t-p} + \varepsilon_t$$

comprise the equations for time series of first differences, where the application of Augmented Dickey-Fuller unit root test, for most economic variables, indicates the existence of stationarity of the time series. It will be shown below that the time series of nominal exchange rates and stock indices, for countries analyzed in this paper, are also stationary at the first level of difference $I(1)$.

In Table 2, the results of ADF test show that none of the tested variables is not stationary at level with significance of 5% (critical value of ADF test for significance of 5% is -2.910860).

However, stationarity for all tested variables is achieved for first-differentiated time series, what represents the basis for the use of Engle Granger cointegration test.

Table 2: Results of ADF unit root test of observed variables for individual time series data

Variables	ADF	I(d)
BELEXLINE	-1,743729	I(1)
d(BELEXLINE)	-6,091699[*]	I(0)
EUR/RSD	-1,170600	I(1)
d(EUR/RSD)	-7,485658[*]	I(0)
BUX	-2,492757	I(1)
d(BUX)	-7,2443790[*]	I(0)
EUR/HUF	-2,029068	I(1)
d(EUR/HUF)	-6,988954[*]	I(0)
PX	-2,576028	I(1)
d(PX)	-7,184420[*]	I(0)
EUR/CZK	-0,917299	I(1)
d(EUR/CZK)	-7,923641[*]	I(0)
CROBEX	-2,134584	I(1)
d(CROBEX)	-5,926218[*]	I(0)
EUR/HRK	-1,986252	I(1)
d(EUR/HRK)	-9,574617[*]	I(0)

Source: Author's calculations

3.2. Engle-Granger cointegration test

Even in the second half of the last century, the emergence of spurious regression phenomenon, as a result of the non-stationary time series that were the subject of regression analysis, was the main problem of empirical analysts. Some researchers have found the solution to the problem in the application of regression analysis on differentiated data series, provided that the differentiation was performed up to the level on which the stationarity of the time series is achieved. However, these solutions are quickly met with criticism, because it was found that the regression analysis of the differentiated data leads to the loss of a significant long-term information contained in the actual series.

There was a large shift in the study of time series analysis in 1981, when Granger introduced, for the first time in econometric theory, the concept of cointegration. Shortly after, Engle and Granger in 1987 presented a solid theoretical basis for testing, evaluation and modeling of cointegration between non-stationary time series. Cointegration analysis allows that the non-stationary time series can be used in a way that spurious regression is avoided (Utkulu 2015). This approach has enabled analysts to test the long-run relationship between the variables, based on the actual value of the time series.

It should be noted that Engle-Granger cointegration test is used for variables that are stationary at the same level, while for the variables of different levels of stationarity some other tests are mainly used, such as Johansen cointegration tests. In the case of analyzing the existence of cointegration between more than two variables, Engle-Granger test would show its drawbacks, meaning that it does not provide information about the number of cointegration relationships between variables, but only information about whether cointegration is present or not. However, in our case, where we consider the existence of cointegration between two variables, the nominal value of exchange rates and market indices, the application of Engle-Granger cointegration test will undoubtedly provide satisfactory results.

Engle-Granger procedure consists of the evaluation of cointegration regression in both directions by using OLS estimation method. In other words, it is necessary to form two cointegration regression models of the form:

$$y_t = \beta_0 + \beta_1 x_t + e_t$$

The first examines the dependence of the nominal value of exchange rate on the stock market index, while the second one examines the dependence in opposite direction. After estimating the

regression models, we test the stationarity of residuals, in order to determine whether there is cointegration between two analyzed variables, as seen from both directions. Under cointegration we consider a long-run relationship between two variables, by preventing the value of residuals over a longer period of time from getting greater. Testing the stationarity of the residuals is performed using Augmented Dickey-Fuller test, where the residual regression equation has the form:

$$\Delta \widehat{e}_t = \alpha_1 \widehat{e}_{t-1} + \sum_{p=1}^{k} \alpha_{p+1} \Delta \widehat{e}_{t-p} + \varepsilon_t$$

The null and alternative hypotheses are the same as for testing stationarity of time series of variables. The result of ADF test of residuals will provide information about the existence of cointegration between considered variables, what in other words means that the acceptance of the null hypothesis would indicate the lack of cointegration and vice versa.

The following table shows the results of ADF test of residuals from all regression models in both directions for all analyzed markets.

Table 3: Engle-Granger cointegration test

Cointegrating regressions	ADF of residuals	Critical value for significance of 5%
$BELEXLINE_i = 1947{,}706 - 7{,}1689 \cdot EUR/RSD_i$	−1,261121	−2,911730
$EUR/RSD_i = 123{,}0823 - 0{,}01061 \cdot BELEXLINE_i$	−0,662329	−2,911730
$BUX_i = 55482 - 123{,}7154 \cdot EUR/HUF_i$	−2,6903207	−2,911730
$EUR/HUF_i = 390{,}934 - 0{,}005112 \cdot BUX_i$	−2,539548	−2,911730
$PX_i = 2005{,}986 - 37{,}65646 \cdot EUR/CZK_i$	−2,607513	−2,911730
$EUR/CZK_i = 30{,}12508 - 0{,}004182 \cdot PX_i$	−1,013468	−2,911730
$CROBEX_i = 7077{,}691 - 692{,}3210 \cdot EUR/HRK_i$	−2,359676	−2,911730
$EUR/HRK_i = 8{,}245183 - 0{,}000390 \cdot CROBEX_i$	−2,173154	−2,911730

Source: Author's calculations

The results from the above table show that there is no a long-run relationship between nominal exchange rate and stock market index on none of the four markets. Therefore, in further analysis we will apply Granger causality test in order to determine whether a short-run relationship between the aforementioned variables is presented or not. Otherwise stated, it is necessary to determine whether the value of the variable x from the previous period helps in predicting the value of the variable y in the current period, taking into account, in the same time, the value of the variable y from the previous period.

3.3. Granger causality test

Granger causality refers to the ability of one variable to predict the movement of other variables. Variable x in Granger's sense does cause the variable y if the variable y can be more accurately described using the previous (lagged) value of the variable x. Specifically, Granger causality test examines how much of the dynamics of variable y in the current period can be explained by the dynamics of its lagged values and if the dynamics of variable y can be better explained if included in the analysis of lagged values of the variable x. When Granger test indicates that one variable does cause the other, it does not mean that one of them is a cause and another one is a consequence, but that in this way we can only determine whether the variable x provides statistically significant information about the variable y.

The presence of Granger causality is tested by the application of the following VAR model:

$$y_t = \alpha_t + \sum_{i=1}^{p} \beta_i x_{t-i} + \sum_{j=1}^{m} \gamma_j y_{t-j} + e_t$$

If the variables are not stationary in levels, it is necessary to establish a model based on differentiated data series of the order in which the stationarity is met.

In the case that there is no a causal relationship between the variable, all β_i coefficients will be equal to zero. We test the following hypothesis:

$$H_0 : \beta_1 = \beta_2 = \cdots = \beta_p = 0$$

$$H_1 : \text{at least one } \beta_i \neq 0$$

We, now, estimate both VAR model without restrictions and VAR model obtained under the restriction of the null hypothesis. After that, testing the validity of the null hypothesis can be made on the basis of the following F test:

$$F = \frac{(SR_R - SR)/m}{SR/(n-k)}$$

where: RS_R - sum of squared residuals of restricted model (assumption that all β_i coefficients are equal to zero),

SR - sum of residuals of model without restrictions.

If the F statistic is greater than the critical value for a given level of significance, then the null hypothesis is rejected, which means that the variable x does not cause y in Granger's sense.

The following table shows the results of Granger causality test between two variables for each country, where AIC criteria is used to suggest the optimal lag length.

Table 4: Pairwise Granger causality test

Null hypothesis	F-test	Probability
Serbia		
$d(EUR/RSD)$ **does not cause** $d(BELEXLINE)$	00,00103	0,9745
$d(BELEXLINE)$ **does not cause** $d(EUR/RSD)$	10,05062	0,8228
Hungary		
$d(EUR/HUF)$ **does not cause** $d(BUX)$	0,32647	0,7229
$d(BUX)$ **does not cause** $d(EUR/HUF)$	1,49061	0,2345
Czech Republic		
$d(EUR/CZK)$ **does not cause** $d(PX)$	0,4914	0,6145
$d(PX)$ **does not cause** $d(EUR/CZK)$	0,89587	0,4143
Croatia		
$d(EUR/HRK)$ **does not cause** $d(CROBEX)$	0,04858	0,8264
$d(CROBEX)$ **does not cause** $d(EUR/HRK)$	1,28822	0,2612

Source: Author's calculations

Based on the conducted empirical research we have shown that, in any case, there is no causal relationship in Granger's sense among the variables, with a significance level of 5%.

4. CONCLUSION

This paper examines the existence of long- and short-run relationship between the exchange rates and stock market indices in four transition countries: Serbia, Hungary, Czech Republic and Croatia. The results show that such kind of relationship does not exist in analyzed countries, which is in contrast with both traditional and portfolio approach to explaining the relationship between these variables. This implies that the exchange rate cannot be used as an instrument of policy to attract foreign portfolio investments, and it is necessary to work through controlling other mechanisms such as: interest rates, reducing political uncertainty, strengthening the legal system, etc.

When it comes to emerging market countries such results are not surprising, given that the financial sector is designed to ensure financial stability and flows of private capital. Monetary

authorities are trying to control the movement of the exchange rate, although such movement is characterized and presented to public as free-floating. Through foreign exchange reserves, the monetary authorities, largely, artificially maintain the exchange rate at a certain level. The result of creating a distorted picture of the level of the exchange rate in the economy is reflected by the fear that any business with foreign companies can lead to endangering its own existence.

On the other hand, the poor efficiency of stock market and its isolation in relation to the world and European markets indicates the necessity of further reforms in order to provide modern and efficient financial system. Adequate access to government regulation within the financial system and ensuring transparency of information, would undoubtedly contribute to the spread of healthy competition and creating the conditions for attracting foreign investors.

REFERENCES

Abidin, Sazali., Chase Walters, Kwan Lyn Lim and Azilawati Banchit. 2013. ''Cointegration between stock prices and exchange rates in Asia-Pacific countries'', *Investment Management and Financial Innovations, Volume 5, Issue 2*: 142-146

Altin, Hakan. 2014. "Stock price and exchange rate: The case of BIST 100". *European Scientific Journal,* Vol. 10, No.16.: 65-78

Bashiri, Neda. 2011. The Relationship between Stock Prices and Exchange Rates: Evidence from Iran and Armenia, accessed March 2015 http://www.fineco.am/pdfs/ Neda_Bashiri_2.pdf

Caporale, Guglielmo Maria, John Hunter Feak Menla. Ali, F.M. 2014. ''On the linkages between stock prices and exchange rates: Evidence from the banking crisis of 2007–2010''. *International Review of Financial Analysis,* Volume 33, May 2014: 87-103

Dougherty, Christopher. 2007. *Introduction to econometrics,* Oxford

Fomby, Thomas B. and Dek Terrell, ed. 2006. *Econometric Analysis of Financial and Economic Time Series.* Bingley :Emerald Group Publishing Limited

Gourieroux, Christian and Joann Jasiak. .2001. *Financial Econometrics: Problems, Models, and Methods.* Princeton: University Press

Maddala, Gangadharrao Soundalyarao. 1992. *Introduction to Econometrics,* New York :Macmillan Publishing Company,

Mahadeva, Levan and Paul Robinson. 2004. *Unit Root Testing to Help Model Building.* Center for Central Banking Studies, Bank of England, accessed March 2015
http://www.bankofengland.co.uk/education/Documents/ccbs/handbooks/pdf/ccbshb22.pdf

Moore, Tomoe. 2007. ''The Euro and Stock Markets in Hungary, Poland, and UK''. *Journal of Economice Integration*, 22(1), March 2007: 69-90

Morales, Lucia. 2007. ''The Dynamic Relationship between Stock Prices and Exchange Rates: Evidence from Four Transition Economies'', *Dublin Institute of Technology, Conference paper,* Accessed February 2015 http://arrow.dit.ie/cgi/viewcontent.cgi ?article=1007&context=buschaccon

Gunay Akel. 2014. ,'Relationship between exchange rates and stock prices in transition economies evidence from linear and nonlinear causality tests''. *2nd Economics & Finance Conference, Vienna*: 391-402

Parsva, Pardis and Hooi Hooi Lean. 2011. "The Analysis of Relationship between Stock Prices and Exchange Rates: Evidence from Six Middle Eastern Financial Markets". Inernational *Research Journal of Finance and Economics*, *Issue 66*: 157-171

Utkulu, U Utku. 2015. How to estimate long-run relationship in economics: an overview of recent development. Accessed March 2015 http://www.deu.edu.tr/userweb/utku.utkulu/dosyalar/How_to_estimate.DOC

Quandl database.2015. Accessed February 2015https://www.quandl.com/

Rahman, Md.Lutfur and Jashim Uddin. 2009. ,'Dynamic Relationship between Stock Prices and Exchange Rates: Evidence from Three South Asian Countries''. *International Business Research,* Vol. 2, No.2: 167-174

Sheppard, Kevin. 2012. *Financial Econometrics Notes.* Oxforf: University of Oxford