The Relationship Between Stock Prices and the Real Exchange Rate Index in BRICS Countries: Symmetric and Asymmetric Causality Analysis

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ABSTRACT

This study investigates the causality relationship between the real exchange rate index and stock prices in Brazil, Russia, India, China, and South Africa (BRICS) countries over the period from March 2003 to June 2018. The relationship between the variables was made with symmetrical and asymmetrical causality tests within the framework of traditional approach and portfolio balance approach. Accordingly, Hacker-Hatemi-J (2006) test was used for symmetric analysis and Hatemi-J (2012) causality test was used for asymmetric analysis. According to the results of the analysis, the causality relationship between the mentioned variables is different in BRICS countries. The findings do not provide definitive evidence in favor of the traditional approach or portfolio balance approach. Also, it can be stated that there are noisy transactions in these two markets

Key Words: *BRICS, Stock Prices, Real Effective Exchange Rate, Symmetric and Asymmetric Causality Analysis*

JEL Classification: *C32, F31, G10, G15*

BRICS Ülkelerinde Hisse Senedi Fiyatları ile Reel Döviz Kuru Endeksi Arasındaki İlişki: Simetrik ve Asimetrik Nedensellik Analizi

ÖZ

Bu çalışma, Brezilya, Rusya, Hindistan, Çin ve Güney Afrika (BRICS) ülkelerinde reel döviz kuru endeksi ile hisse senedi fiyatları arasındaki nedenselliği Mart 2003- Haziran 2018 dönemi boyunca araştırmaktadır. Değişkenler arasındaki ilişki geleneksel yaklaşım ve portföy dengesi yaklaşımı çerçevesinde simetrik ve asimetrik nedensellik testleri ile yapılmıştır. Buna göre, simetrik analiz için Hacker-Hatemi-J (2006) testi ve asimetrik analiz için ise Hatemi-J (2012) nedensellik testi kullanılmıştır. Analiz sonuçlarına göre BRICS ülkelerinde söz konusu değişkenker arasındaki nedensellik ilişkisi farklıdır. Elde edilen bulgular, geleneksel yaklaşım ya da portföy dengesi yaklaşımı lehine kesin bir kanıt sağlamamaktadır. Ayrıca söz konusu iki piyasada gürültücü işlemlerin olduğu ifade edilebilir.

Anahtar Kelimeler: *BRICS, Hisse Senedi Fiyatları, Reel Efektif Döviz Kuru, Simetrik ve Asimetrik Nedensellik Analizi*

JEL Sınıflandırması: *C32, F31, G10, G15*

INTRODUCTION

The world economy has experienced many big and small crises in the last fifty years. The 1973 oil crisis, 1987 stock market crisis, 1994 Mexican currency crisis, 1997 Asian crisis and 2007-2009 global financial crisis are the main ones.

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These turbulent periods have largely resulted in negative asset returns. This greatly increased the fluctuations in exchange rates and stock prices. Any risk in international portfolios exposes stock exchange investments and exchange rates to risk. Therefore, the relationship between exchange rates and stock markets has been examined extensively by economists.

Although empirical evidence for the relationship between exchange rate and stock price is different, theories demonstrated that there is a causal relationship between these variables. (Ajayi and Mougoue, 1996; Granger et al, 2000; Phylaktis and Ravazzolo 2005; Lin, 2012; Tsai, 2012). Theoretically, however, it is difficult to find a common idea of the relationship between stock prices and exchange rates.

This relationship is explained by two basic approaches. The first one is "flow-oriented models". This model is also known as the traditional approach (Dornbusch ve Fischer, 1980). The traditional approach focuses on current account and trade balance. Accordingly, since exchange rates will affect international competition and trade balance, the real production of the country and hence stock prices will be affected. Therefore, a decrease in the real exchange rate will increase firms' export competitiveness and increase their sales to other countries. The more exports, the more profit the firms will make. This will increase the stock prices of firms. In this case, the depreciation in the real exchange rate increases the stock price; valuation of the real exchange rate will lower the stock price. Accordingly, in the traditional approach, the exchange rate changes the stock prices. In this approach, it is assumed that there is a positive relationship between exchange rate and stock prices. There are a number of studies that prove this relationship (Fang, 2002; Wongbangpo, and Sharma, 2002; Phylaktis and Ravazzolo, 2005; Ülkü and Demirci, 2012; Bahmani-Oskooee and Saha, 2016). The second approach is stock-oriented model. This model is also known as the portfolio balance approach (Branson, 1983; Frankel, 1983). In this approach, a change in stock prices affects portfolio investments and changes the exchange rates. Accordingly, there will be capital inflows from abroad to invest in capital markets of a developing economy. With the capital inflow, stock demand will increase and stock prices will increase. Firms with increased production and sales will have more capital inflows into the country as the total demand in the economy increases. The real exchange rate will increase with the increase in stock prices. On the other hand, if the stock prices decrease, the real exchange rate will depreciate. Shortly, under this model, if a persistent upward trend in stock prices occurs, inflow of foreign capital rise. However, a decrease in stock prices would induce a reduction in domestic investor wealth, leading to a fall in demand for money and lower interest rates, causing capital outflows that would result in currency depreciation. As a result, while the causality relationship is positive in the traditional approach and from exchange rates to stocks; In the portfolio balance approach, the causality relationship is negative and from stocks to exchange rates (Tian and Ma, 2010; Tsai, 2012; Chkili and Nguyen, 2014; Moore and Wang, 2014; Wong, 2017).

Our study has contributed to the literature in many respects. First of all, in our study, the relationship between real exchange rates and stock prices was

analyzed with the symmetric (Hacker-Hatemi-J, 2006) and asymmetric (Hatemi-J, 2012) causality tests, which is quite new in the literature. The main reason why these two analysis methods are preferred in our study is that the results of the analysis are convenient to compare with these methods. Because, asymmetric analysis as well as symmetrical analysis of shocks in markets with high volatility, such as stock and exchange rates, can provide better results. On the other hand, BRICS countries were used in our study. Because these countries are considered as the fastest developing emerging market economies among the developing countries. According to economic indicators, in the near future, these economies will increase their weight in the world economy and take global leadership (Frank and Frank, 2010; Kannaiah, and Murty, 2017). Finally, our findings may provide guidance to many institutions or organizations, particularly policy makers and national and international investors, to learn more about the relationship between exchange rates and stock prices. In this context, the first part of the study presents the theoretical framework of the relationship between stock markets and exchange rates. In the second part, a comprehensive literature summary of the study is given. In the third part, the method and limits of the study are mentioned. In the fourth chapter, econometric findings of the study are given. Finally, in the 5th and 6th chapters, the discussion and conclusion part of the study is mentioned.

I. LITERATURE REVIEW

Over the past two decades, a wide literature has emerged to investigate the relationship between exchange rates and stock markets. However, although there is extensive literature on this subject, consensus about the relationship between the two variables has not been achieved. When the studies in the literature are examined, it is seen that different results are obtained on different time and countries. Depending on the data set and method used, some studies have not found a long-term relationship between exchange rates and stock prices (Alagidede et al. 2011), while other studies have found a positive (Ülkü and Demirci, 2012) or negative relationship (Tsai, 2012; Wong, 2017). It is seen that the studies carried out in recent years are mostly focused on developing countries. In this context, some basic studies and findings will be included in our study.

Ajayi and Mougoue (1996) analyzed the causality between stock prices and exchange rates within different time frames. Accordingly, changes in exchange rates are attributed to changes in stock prices in the short and long term. On the other hand, On the other hand, changes in stock prices have an impact in the short term. Phylaktis and Ravazzolo (2005) studied a group of Pacific countries and found a positive correlation between exchanges and foreign exchange markets using US stock exchanges for their exchanges. Pan et al., (2007) discussed the causal relationship between exchange rates and stock prices for some east and south east Asian countries for the period of January 1988 - October 1998. According to empirical findings, a causal relationship from stock prices to the foreign exchange market has been identified for Hong Kong, Korea and Singapore. In addition, no country showed any significant causality from stock prices to exchange rates in the Asian crisis. In addition, a causal relationship from exchange rates to stock prices

was not found for countries outside Malaysia. Kutty (2010) analyzed the relationship between stock prices and exchange rates in Mexico. The study found no short-term relationship between stock prices and exchange rates. Granger causality test revealed no long-term relationship between these two variables. Likewise, Ali and Sun (2017), taking daily data for January 2009 - June 2015 period, applied the dynamic relationship between stock price and exchange rate to Bangladesh, Pakistan and India. The empirical findings of the study provided no conclusive evidence in favor of the traditional approach or portfolio balance approach.

Studies on BRICS countries revealed different findings. Yılancı and Bozoklu (2015) examined the BRICS countries and Turkey in stock prices and exchange rates between symmetric and asymmetric non-linear causal relationship in the framework of the Mackey-Glass model. The findings revealed the presence of noisy tradings and speculative behavior in the foreign exchange and stock markets. On the other hand, Dahir et al. (2018) analyzed the dynamic links between exchange rates and stock returns in BRICS countries based on the wavelet analysis. The results show that the relations between exchange rates and stock returns are positive in the medium and long term. This shows that exchange rates are driving stock returns in Brazil and Russia. South Africa has a more bilateral causality. The Chinese index did not show any correlation.

Aladwani (2017) analyzed the relationship between exchange rates and stock prices for 6 Gulf countries (Kuwait, Bahrain, Oman, Saudi Arabia, Qatar, United Arab Emirates). Empirical results show that there is cointegration between stock prices and exchange rates in Kuwait, Bahrain and Oman. Lim and Sek (2014) analyzed the relationship between exchange rate volatility and stock returns by examining the period 1990-2012 for 4 Asian countries (Thailand, Korea, Endozenia, Philippines). According to results, there is not a long-term cointegration relationship between the two variables. However, there is a two-way, short-term relationship between exchange rate volatility and stock returns in all countries. On the other hand, interest rate, money supply and international reserves, in most cases, have a significant impact on the determination of exchange rate volatility and stock return movements. Yang (2017) examined the short-term and long-term dynamics of exchange rate and stock prices and monetary policy shocks on the four open economies (Taiwan, Singapore, South Korea, Hon Kong) in the Asia-Pacific region in the period 1999-2016. Empirical results showed that monetary policy shocks caused significant changes in stock prices. However, the impact is relatively high in countries with economic openness. On the other hand, Zhao (2010) analyzes the relationship between Renminbi (RMB) real effective exchange rate and stock price in China monthly by using the vector autoregressive model from January 1991 to June 2009. Empirical results show that there is no long-term relationship between RMB real effective exchange rate and stock price. Chen and Lin (2014) provided some evidence for the existence of a causal relationship between exchange rate and stock exchanges for the six Pacific Coastal economies. Within the framework of symmetric and asymmetric Granger causality analysis, two financial markets are

tried to be explained within the framework of competing theories. The findings show a one-way causality from exchange rates to stock prices in Japan, Taiwan, and India, which suggests that its traditional model applies to these countries. On the other hand, the foreign exchange market and stock exchanges of South Korea, Singapore and Indonesia are in the same direction. This shows that both traditional and portfolio approaches are valid in these countries. Kumar (2009), on the other hand, analyzed the dynamic relationship between daily data and stock index and exchange rate for India. In the study using Mackey-Glass model, it was concluded that there are bidirectional linear and nonlinear Granger causality between stock prices and exchange rates.

Bahmani-Oskooee and Sohrabian (1992) analyzed the relationship between stock prices and exchange rates in the US economy with cointegration and causality tests. Findings suggest that there is no long-term relationship between these variables, but a short-term bilateral relationship. Hatemi and Irandoust (2002) investigated the causal relationship between monthly nominal effective exchange rates and stock prices in Sweden for the period 1993-1998. Empirical results show that granger causality is one-way from stock prices to exchange rates. The results also show that the increase in Swedish stock prices is related to the appreciation of the Swedish krona. Bahmani-Oskooee and Saha (2016), a significant and positive relationship between exchange rate and stock returns using non-linear ARDL approach in a number of countries such as Brazil, Canada, Chile, Indonesia, Japan, Korea, Malaysia, Mexico, UK for export-oriented firms is finding a relationship. In another study, Bahmani-Oskooee and Saha (2018) used the nonlinear ARDL method for 24 countries to demonstrate that the effects of exchange rate changes on stock prices may be asymmetrical. The results showed that the effect of exchange rates on stock prices may be asymmetrical. Accordingly, the relationship between exchange rates and stock prices should be considered in both directions.

Katechos (2011) uses a new approach to investigate the relationship between stock exchanges and exchange rates. In the study, which uses 16 different exchange rate pairs, empirical findings show that exchange rates and global stock returns are strongly linked. Koulakiotis et al. (2015) discussed the effect of stock market news on the exchange rates for the USA, Canada and the UK with the help of the cointegration and error correction model. Accordingly, asymmetric threshold model results revealed that the relationship between stock markets and foreign exchange markets is sensitive to short-term good or bad news and short-term small or big news. Luqman and Kouser (2018) analyzed the symmetric and asymmetric relationship between exchange rate and stock markets with the help of a linear and nonlinear distributed autoregressive (ARDL) model, using daily data for 14 developed and developing countries. Empirical findings have shown that there are asymmetric connections between money and stock markets. Akdogu and Birkan (2016), on the other hand, tried to determine the relationship between stock exchange price indices and exchange rates by using monthly observations for 21 countries included in the MSCI emerging markets index. Accordingly, the direction

of causality varies from country to country. This revealed that economies are subject to the influence of more than one factor depending on their characteristics.

As a result, when the studies considered are examined, it will be seen that the findings between the two variables differ due to factors specific to time, country, methodology and sectoral structures. At the same time, it is seen that the literature on the relationship between the two variables is more concentrated in Asia and Pacific countries in recent years.

II. DATA AND METHODOLOGY

A. Data

In this section, the relationship between stock prices and real effective exchange rate for BRICS countries is analyzed empirically. In this context, monthly stock index (stock) and real exchange rate index (reer) (2007=100) data for 2003: 3-2018: 6 period are used. The data set for stock prices is compiled from Investing Database. On the other hand, real exchange rate index is taken from Bruegel Database. Natural logarithms of both series were taken and included in the analysis.

Table 1: Stock Market Indices Used in the Study

Country	Stock market index
Brazil	Bovespa (BVSP)
Russia	RTSI (IRTS)
India	BSE Sensex 30
China	Shanghai Composite
South Africa	FTSE/JSE Top 40

B. Causality Tests

The unit root properties of the series should first be investigated in the analyzes performed with time series. In this context, the study were used the extended Dickey-Fuller (ADF) (1981) and Phillips-Perron (PP) (1988) unit root tests.

Both symmetric and asymmetric causality tests were used in the study. Boostrapt Based Toda-Yamamoto Causality Test developed by Hacker and Hatemi-J (2006) was used in symmetric analysis. This test is based on the Toda-Yamamoto (1995) Causality Test. The most important feature of the test is that it is included in the analysis without taking the difference of the series when the variables are not stationary at the level. Hacker and Hatemi-J (2006) showed that the error term would produce biased results in rejecting the null hypothesis when the error term had autoregressive conditional varying variance (ARCH) and normal non-dispersive properties. In this case, they recommend the use of bootstrap distribution. Thus, the MWALD test approaches the actual value even in different situations.

Granger causality test and Toda-Yamamoto causality test are used frequently to investigate the causality relationship between variables. However, the causality relationships between positive and negative shocks of variables cannot be

determined using these tests. Granger and Yoon (2002) stated that the cointegration relationship among the variables may differ when examined separately for positive and negative shocks. On the other hand, Hatemi-J (2012) developed the Asymmetric Causality Test by indicating that the positive and negative shocks may also differ in the causality relationship.

Based on Hatemi-J (2012), we can show random walk processes for lnstock and lnreer which take into account the positive and negative components, respectively.

$$\text{lnstock}_t = \text{lnstock}_{t-1} + e_{1t} = \text{lnstock}_0 + \sum_{i=1}^{t} e_{1i} \quad (1)$$

$$\text{lnreer}_t = \text{lnreer}_{t-1} + e_{2t} = \text{lnreer}_0 + \sum_{i=1}^{t} e_{2i} \quad (2)$$

In line with Granger and Yoon (2002), Positive and negative shocks can be shown as following, respectively:

$$e_{1i}^{+} = \max(e_{1i}, 0) \quad (3)$$

$$e_{1i}^{-} = \min(e_{1i}, 0) \quad (4)$$

$$e_{2i}^{+} = \max(e_{2i}, 0) \quad (5)$$

$$e_{2i}^{-} = \min(e_{2i}, 0) \quad (6)$$

Within the framework of these equations, the equalities of lnstock and lnreer can be expressed by arranging as follows:

$$\text{lnstock}_t = \text{lnstock}_{t-1} + e_{1t} = \text{lnstock}_0 + \sum_{i=1}^{t} e_{1i}^{+} + \sum_{i=1}^{t} e_{1i}^{-} \quad (7)$$

$$\text{lnreer}_t = \text{lnreer}_{t-1} + e_{2t} = \text{lnreer}_0 + \sum_{i=1}^{t} e_{2i}^{+} + \sum_{i=1}^{t} e_{2i}^{-} \quad (8)$$

The negative and positive shocks of each variable in cumulative form can be shown as follows:

$$\text{lnstock}_t^{+} = \sum_{i=1}^{t} e_{1i}^{+}, \text{lnstock}_t^{-} = \sum_{i=1}^{t} e_{1i}^{-}, \text{lnreer}_t^{+} = \sum_{i=1}^{t} e_{2i}^{+}, \text{lnreer}_t^{-} = \sum_{i=1}^{t} e_{2i}^{-} \quad (9)$$

Under the assumption that the causality relationship between positive shocks of stock and of reer $[y_t^{+} = (\text{lnstock}_t^{+}, \text{lnreer}_t^{+})]$ is examined, the causality relationship between the two variables can be expressed with the Vector Autoregressive (VAR_p) Model as follows:

$$y_t^{+} = v_t + A_1 y_{t-1}^{+} + \cdots + A_p y_{t-p}^{+} + \cdots + A_{p+d} y_{t-p-d}^{+} + \epsilon_t^{+} \quad (10)$$

Where d represents the maximum degree of integration. This model can be abbreviated as in Eq.

$$Y = DZ + \delta \quad (11)$$

where,

$$Y \coloneqq (y_1^+, \dots, y_T^+)(nxT) \text{ matrix,} \quad (12)$$

$$D \coloneqq \left(v, A_1, \dots, A_p, \dots, A_{p+d}\right) (nx\left(1 + n(p + d)\right)) \text{ matrix,} \quad (13)$$

$$Z_t \coloneqq \begin{bmatrix} 1 \\ y_t^+ \\ y_{t-1}^+ \\ \vdots \\ y_{t-p+1}^+ \end{bmatrix} ((1 + np)x1) \text{ matrix, for } t = 1, \dots, T, \quad (14)$$

$$Z \coloneqq (Z_0, \dots, Z_{T-1}) ((1 + np)xT) \text{ matrix and,} \quad (15)$$

$$\delta \coloneqq (\epsilon_1^+, \dots, \epsilon_T^+) (nxT) \text{ matrix.} \quad (16)$$

The null hypothesis of non-Granger causality, $H_0: C\beta = 0$, is tested by the following test method:

$$MWald = (C\beta)'[C((Z'Z)^{-1} \otimes S_U)C']^{-1}(C\beta), \quad (17)$$

Where $\otimes$ represents the Kronecker product, S_U is the variance-covariance matrix of the unrestricted VAR model and C is a $pxn(1 + np)$ indicator matrix with elements ones for restricted parameters and zeros for the rest of the parameters. The MWALD test statistic has asymptotically χ^2 distribution. It is also assumed that the error term is normally distributed. Finally, the optimum lag length is determined by HJC (Hatemi-J Criterion) (Hatemi-J, 2003).

$$HJC = \ln\left(Det\widehat{\Omega}_j\right) + J\left[\frac{n^2 \ln T + 2n^2 \ln(\ln T)}{2T}\right] \quad (18)$$

In the study, causality relationship was also analyzed within the framework of time-varying symmetric and asymmetric causality. Tang (2008) stated that the causality relationship may change over time due to economic and political events. The stability of the causality relationship between the variables can be examined in the context of time-varying causality analyzes. In this context, firstly, the sub-sample size to which the analysis will be applied should be determined. In this study, the number of sub-sample observations was determined as 20. In time-varying causality analysis, symmetric and asymmetric causality tests are applied primarily for the first 20 observations. Then, the first observation is discarded and a new observation is added to the last observation. Symmetric and asymmetric causality tests are applied separately to the newly created 20 observational intervals. This process is continued until the last 20 observation intervals. In order to test the significance of the obtained test statistics, each observation is normalized with time-varying bootstrap critical values. Later, the Wald Test results obtained from the analysis are converted to graph.

III. EMPIRICAL FINDINGS

Table 2 shows the results of the ADF and PP unit roots tests. According to results of both tests, the maximum integration degree of series was found to be 1 in all countries.

Table 2: ADF and PP Unit Root Test Results (Constant Term Only)

lnreer				
	ADF Test		**PP Test**	
Country	**Level**	**First Difference**	**Level**	**First Difference**
Brazil	-2.215	-10.331***	-2.855*	-10.251***
Russia	-2.671*	-10.046***	-2.367	-7.092***
India	-1.145	-11.286***	-1.143	-11.169***
China	-0.396	-9.948***	-0.356	-10.064***
South Africa	-2.236	-11.369***	-2.077	-11.276***
lnstock				
	ADF Test		**PP Test**	
Country	**Level**	**First Difference**	**Level**	**First Difference**
Brazil	-3.364***	-11.196***	-3.389***	-5.712***
Russia	-2.784*	-10.278***	-3.016**	-10.262***
India	-2.687*	-12.247***	-2.567	-12.377***
China	-1.658	-4.194***	-2.144	-12.279***
South Africa	-2.480	-15.207***	-2.473	-15.131***

Note: ***, ** and * represent 1%, 5% and 10% of significance levels respectively. Critical values for the unit root tests are -3.466, -2.877 and -2.575 at the 1%, 5% and 10% levels, respectively.

Table 3 shows the results of symmetrical causality between stock prices and the real effective exchange rate in BRICS countries. The findings show that the real effective exchange rate in Brazil is the cause of stock prices. On the other hand, stock prices in Brazil are not the cause of the real effective exchange rate. In Russia, there is a reciprocal causal relationship between stock prices and the real effective exchange rate. However, there is no causal relationship between the variables in India, China and South Africa.

Table 3: Hacker-Hatemi-J Causality Test Results

Country	H_0	***Wstat***	***k***	***Bootstrap Critical Values***		
				%1	***%5***	***%10***
Brazil	lnreer ⇏ lnstock	5.216**	1	6.891	3.889	2.728
	lnstock ⇏ lnreer	0.001	1	6.818	3.877	2.660
Russia	lnreer ⇏ lnstock	4.865*	2	9.339	6.071	4.636
	lnstock ⇏ lnreer	8.794**	2	9.734	5.969	4.544
India	lnreer ⇏ lnstock	1.476	1	6.615	3.877	2.708
	lnstock ⇏ lnreer	0.580	1	6.429	3.817	2.702
China	lnreer ⇏ lnstock	1.320	1	6.645	3.837	2.697
	lnstock ⇏ lnreer	0.426	1	6.770	3.876	2.762
South Africa	lnreer ⇏ lnstock	0.714	1	6.948	3.897	2.728
	lnstock ⇏ lnreer	0.807	1	7.177	3.932	2.835

Note: k shows lag lengths. The lag lengths were determined according to the Hatemi-J information criterion. ***, ** and * represent 1%, 5% and 10% of significance levels respectively. Critical values are obtained from 10000 bootstrap replications.

Table 4 shows the results of the Hatemi-J asymmetric causality test. Looking at positive shocks, the real effective exchange rate in Brazil, China and South Africa is the cause of stock prices. Again for positive shocks, stock prices are the cause of the real effective exchange rate in Russia and South Africa. Looking at the negative shocks, while the real effective exchange rate is the cause of stock prices in Brazil and China, only in Brazil, stock prices are the cause of the real effective exchange rate. For other cases, no causal relationship was found between the variables.

The graphs of the findings obtained from time-varying symmetric and asymmetric causality test results are presented in the Appendix. The fact that the

series in the graph is above a value means that the null hypothesis, which suggests that "there is no Granger causality" at the time for the variables in question, is rejected. In other words, it shows that there is a causal relationship between variables.

Table 4: Hatemi-J Asymmetric Causality Test Results

Country	H_0	*Wstat*	*k*	*Bootstrap Critical Values*		
				%1	*%5*	*%10*
Brazil	$lnreer^+ \nRightarrow lnstock^+$	19.266***	3	15.302	10.379	8.266
	$lnstock^+ \nRightarrow lnreer^+$	3.250	3	12.576	8.602	6.841
	$lnreer^- \nRightarrow lnstock^-$	9.658***	1	9.351	5.271	3.676
	$lnstock^- \nRightarrow lnreer^-$	4.912**	1	8.450	4.781	3.363
Russia	$lnreer^+ \nRightarrow lnstock^+$	4.567	2	13.154	9.130	7.374
	$lnstock^+ \nRightarrow lnreer^+$	5.186*	2	10.389	6.494	4.909
	$lnreer^- \nRightarrow lnstock^-$	3.589	1	9.511	6.152	4.661
	$lnstock^- \nRightarrow lnreer^-$	0.740	1	9.331	5.203	3.560
India	$lnreer^+ \nRightarrow lnstock^+$	9.606	2	16.007	11.858	9.750
	$lnstock^+ \nRightarrow lnreer^+$	0.833	2	11.356	7.751	5.962
	$lnreer^- \nRightarrow lnstock^-$	6.065	2	15.903	11.562	9.589
	$lnstock^- \nRightarrow lnreer^-$	0.828	2	11.677	7.559	5.791
China	$lnreer^+ \nRightarrow lnstock^+$	10.309**	2	11.589	7.373	5.661
	$lnstock^+ \nRightarrow lnreer^+$	2.954	2	10.892	7.088	5.482
	$lnreer^- \nRightarrow lnstock^-$	11.402***	1	9.810	5.533	3.927
	$lnstock^- \nRightarrow lnreer^-$	2.682	1	8.798	5.062	3.567
South Africa	$lnreer^+ \nRightarrow lnstock^+$	10.451**	3	13.372	9.213	7.322
	$lnstock^+ \nRightarrow lnreer^+$	13.985**	3	15.263	10.914	8.816
	$lnreer^- \nRightarrow lnstock^-$	0.665	3	13.824	9.423	7.626
	$lnstock^- \nRightarrow lnreer^-$	8.639	3	17.090	12.121	9.883

Note: k shows lag lengths. The lag lengths were determined according to the Hatemi-J information criterion. ***, ** and * represent 1%, 5% and 10% of significance levels respectively. Critical values are obtained from 10000 bootstrap replications.

IV. SUMMARY AND DISCUSSION

Our findings have revealed several results. First, in BRICS countries, there is no definitive evidence in favor of the traditional approach or portfolio balance approach relationship between stock markets and the real effective exchange rate index. The results showed that investor behavior in stock and exchange rate markets is not based on basic economic analysis and indicators and the presence of noisy transactions in these two markets (Delong et al., 1990). Both symmetric analysis results and asymmetric analysis results differed across BRICS countries. These differences may be due to various reasons. The foreign trade structure of the countries discussed, the level of development of stock and foreign exchange markets and the depth of financial markets may be different. Therefore, the evidence that suggests which approach (the traditional approach and the portfolio balance approach) is relevant for the countries subject to the study remains weak. On the other hand, the presence of asymmetric effects in the financial markets can change the expectations of the participants. Thus, participants may have different expectations in different countries. This makes it difficult to reach a common judgment for all countries. In this respect, empirical findings show that investor behaviors in stock and foreign exchange markets are not based on basic economic analysis and indicators.

Noisy trading are the existence of traders who operate in very short periods of time and act according to the psychology of investors and the statements of politicians rather than economic indicators. Noisy trading refers to transactions performed by investors based on false subjective beliefs or information that has little to do with the underlying value of the asset (Verma and Verma, 2007; Qiang and Shu-e, 2009). Noisiers do not have enough information about the markets. They are mostly affected by positive returns in the past and make investment decisions.

Our analysis findings (Yılancı and Bozoklu, 2015; Akdogu and Birkan, 2016; Ali and Sun, 2017) coincide with the studies of (Kutty, 2010; Dahir et al., 2018) are similar to the results of the analysis. In addition to, China, which is the subject of the study, is in a fixed exchange rate regime, that some other countries do not develop sufficiently and that these countries are exposed to speculative capital movements may have been effective in this way. As a result of our findings, investors can better understand the dynamic links between the foreign exchange and stock markets. Particularly in emerging market economies such as BRICS, where volatility is high, investors can develop better strategies against exchange rate risk.

CONCLUSIONS

For companies, borrowing in foreign currency or carrying out their activities in foreign exchange requires a foreign currency management. Because the change of exchange rates affect both the companies and the whole economy. Therefore, the fact that the domestic currency changes against foreign currencies directly affects both the companies' activities and their balance sheets. In this way, a profit or loss situation may arise for companies in the face of a change.

The opening up of developing countries in recent years and the growth of financial markets over time have made these countries more important. In this study, the relationship between real effective exchange rate and stock indices in BRICS countries is analyzed. 2003: 3-2018: 6 period is examined monthly symmetrical (Hacker-Hatemi-J (2006)) and asymmetric (Hatemi-J (2012)) causality analysis was used.

According to the findings of Hacker-Hatemi-J (2006) symmetrical causality, it has been shown that the real effective exchange rate in Brazil is the cause of stock prices. On the other hand, stock prices in Brazil are not the cause of the real effective exchange rate. In Russia, there is a reciprocal causal relationship between stock prices and the real effective exchange rate. However, there is no causal relationship between the variables in India, China and South Africa. According to the Hatemi-J asymmetric (2012) causality test results, when the positive shocks in Brazil are analyzed, the real effective exchange rate is the cause of stock prices in Brazil, China and South Africa. Again for positive shocks, stock prices are the cause of the real effective exchange rate in Russia and South Africa. Looking at the negative shocks, while the real effective exchange rate is the cause of stock prices in Brazil and China, only in Brazil, stock prices are the cause of the real effective exchange rate. For other cases, no causal relationship was found between the variables. This proves the existence of noisy trading in the BRICS

countries. In other words, according to the noisy trading model (Delong et al. 1990), the basis of some activities in financial markets is not based on economic fundamentals. These transactions cause stock prices to deviate from the equilibrium value in the short term.

Our study may offer different perspectives for similar studies in the future. For example, the relationship between stock markets and exchange rates can be applied in different periods, in different countries and in different sectors. The results can also be used as an indicator for technical analysis. This may make it easier for investors and policy makers to anticipate the future movement of stock prices and exchange rates.

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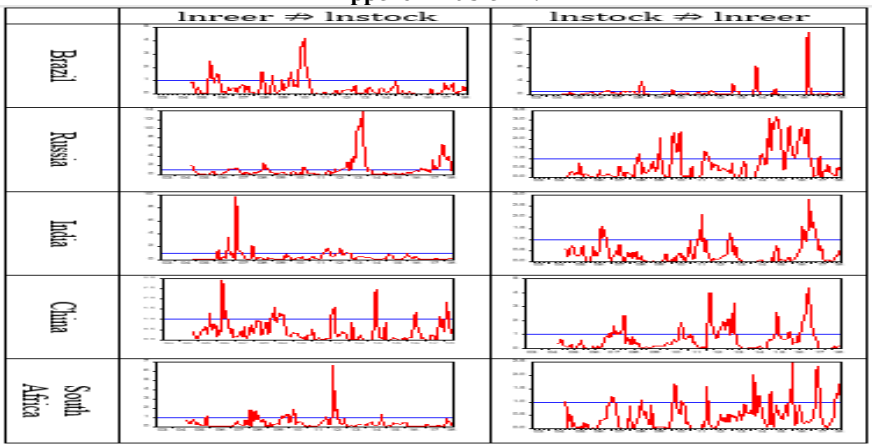
Appendix Table A1.



Appendix Table A1 (Continued).