Applied Economics Journal Vol. 25 No. 1 (June 2018): 65-78

ISSN: 2586-9124 (PRINT)
ISSN: 2586-9132 (ONLINE)

Received: 22 February 2018
Received in revised form: 12 April 2018
Accepted: 30 April 2018

How Often Does the Exchange Rate Granger Cause the Stock Market in Pakistan? A Bootstrap Rolling Window Approach

Khalid Khan[1], Chi-Wei SU[2], Adnan Khurshid[3] and Ashfaq U. Rehman[4]

[1]School of Finance, Qilu University of Technology, China

[2]Department of Finance, Ocean University of China, China

[3]Abbottabad University of Science and Technology, Abbottabad, Pakistan

[4]Department of Political Science Women University of Sawabi, Pakistan

Abstract

This paper investigates the causal link between the stock market (SM) and the exchange rate (EXR) in Pakistan, using the bootstrap Granger causality and sub-sample rolling window estimation. The full sample Granger causality test indicates no causality between the SM and the EXR. The stability of the parameters is examined by taking into the account structural changes for individual series as well as the VAR. The full sample Granger test shows the absence of causality. The rolling window approach shows the uni-directional positive and negative relationship between the SM and the EXR. The study gives some suggestions to the government and policy makers that a well-coordinated policy implementation and execution regarding the SM and the EXR are crucial in attracting foreign investors and developing a sound financial system in the country complementary to the development of the economy.

Keywords: Rolling Window; Bootstrap; Granger causality; Stock market; Exchange rate
JEL Classification: C22, C32, F32

---

[1]Assistant Professor, School of Finance, Qilu University of Technology, No.3501, Daxue Road, Changqing District Jinan, 250353, Shandong, China. shah_khan884@yahoo.com

[2] Professor, Ocean University of China, Department of Finance, No. 238 Songling Rd., Qingdao, Shandong, China

[3] Assistant Professor, Abbottabad University of Science and Technology, Abbottabad, Pakistan

[4] Assistant Professor, Department of Political Science Women University of Sawabi, Pakistan

Introduction

The purpose of this paper is to examine the dynamics relationship between the stock market (SM) and the exchange rate (EXR) in Pakistan. Over the last few years, it has received an extensive attention given their considerable impact on the development of the economy (Neih and Lee, 2001). The dynamic relationship is crucial for investors and policy makers to devise their portfolio strategies and to predict the impact of their decisions (Sensoy and Sobaci, 2014). Portfolio risk diversification also requires the understanding of the link between stock price and exchange rate. The changing global environment characterized by less barriers to the free capital flow has provided opportunities for investments giving a significant consideration to the relationship between SM and the EXR (Kutty, 2010). The impetus behind the great interest to investigate the linkages between the SM and the EXR resides in recent developments, such as: globalization, emergence of the new capital markets, relaxation in the capital inflow, and the adoption of flexible exchange rate systems (Phylaktis and Ravazzolo, 2005; Yucel and Kurt, 2013).This combination is important for economic development, and the future trend of the economy (Tsagkanos and Siriopoulos, 2013). The connection between the SM and the EXR, has a strong implication for economic policies and international capital budgeting given contagious effects (Chkili and Ngyuen, 2014).

In the last two decades, Pakistan introduced numerous financial and institutional reforms intended to achieve financial stability and enhance the efficiency of the financial market. The stock exchange was opened for foreign investors and a flexible exchange rate system paved the way for a massive influx of foreign portfolio investments which has a positive impact on the stock market. In the 2000s, Pakistan economy grew at an average rate of 7% and attracted $8.4 billion foreign investments. The exchange rate remained stable due to the foreign inflows in the shape of worker remittances and portfolio investments. In May 2007, the KSE-100 index crossed the all-time high value which was accompanied by a growth in market capitalization of 35%. The growth of the stock market was driven by the progress of economic reforms, market-based policies and exchange rate stability. This time of stability was followed by a sudden 21% depreciation of the exchange rate in 2008. The main cause was the state of political instability, capital outflows and speculative activities. In the same period, foreign investments declined due to the dismal performance of the stock market, legal elements and order situations. This loss in value continued after the 2008 election given the fact that the Pakistani economy was influenced by political uncertainty and rising militancy. However, the market gradually regained its position, and this process continued steadily until 2011. By 2014, the KSE-100 Index rose to a new record high. All the above-mentioned factors motivate our research question for the case of Pakistan.

This study proceeds as follows. Section 2 explains literature review. Section 3 describes the methodology. Section 4 describes the corresponding data. Section 5 presents the empirical results. Section 6 concludes.

Literature review

Over the past few decades, a substantial literature has focused on the relationship between the stock price and exchange rate. Phylaktis and Ravazzolo (2005) find a positive relation between the SM and the EXR. Lean *et al.* (2006) report weak evidence of long-run equilibrium relationship between EXR and SM in the Asian markets. Umoru and Asekome (2013) analyse the interaction between the SM and EXR and observe a positive relationship. Ullah and Jamil (2013) report both long and short-term connection between the EXR and SM. Ezeji (2014) detects a short-term positive and a negative long-run association between EXR and the SM. Ali and Chisti (2013) find the positive link between the SM and EXR. Kose and Doganay (2010) show that SM effect the EXR. Chen *et al*, (2009) show that EXR has negative influences on SM.Kutty (2010) discovers a short-term relationship between SM and the EXR. Agrawal (2010) reports a negative correlation. Agrawal and Srivistava (2011) find a negative uni-directional relationship. Subair and Salihu (2013) show that EXR have a negative impact on the SM. Amid and Dharmaratne (2014) indicate that the EXR lead the SM. Dimitrova (2005) reveals the positive impact of currency appreciation on the SM. Nath and Samanta (2003) find no correlations between SM and the EXR in India. Tabak (2006) find no evidence of relationship between the EXR and SM. Alagidede *et al.* (2010) find no interaction between the SM and EXR. Hussain and Liew (2004) demonstrate a uni-directional causality link between the SM and EXR in Malaysia and Thailand. Parsva and Lean (2011) report a bi-directional causality between the SM and EXR in both short and long term for Iran, Egypt, and Oman before the crisis, and at the same time report a lack of connections in Jordan and Saudi Arabia. Malarvizhi and Java (2012) detect a bi-directional causality between the EXR and SM.Tavakoli and Dadashi (2013) confirm a bidirectional relationship for the case South Korea and a unidirectional one for Iran. On the same pattern, Kollias and Mylonidis (2012) report time-varying causality between the two markets. Soeng (2013) observes a bi-directional causality between SM and the EXR, while Kofi and Kwabena (2013) fail to determine a causal relationship between the two variables. Amid and Dharmaratne (2014) show that the EXR influences SM and Aslam (2014) notices a negative bi-directional causality between the two.

Focusing on the case of Pakistan, Naeem and Rasheed (2002) conclude that there is not a short-term relationship exit for Pakistan. Mustafa and Nishat (2008) analyze the relationship between the exchange rate and stock price in Pakistan by using the cointegration and error correction model. The results detect the short-term negative relationship between the SM and the EXR. Ali *et al*. (2010) and Zia and Rahman (2011) also report a lack of long-term connection between the two variables Similarly, Shah and Bhat (2015) find a long run relationship and bidirectional causality.

It is evident from the previous literature that the full sample Granger Causality test is the standard instrument for the investigation of the link between the SM and the EXR, but despite this tractability the full sample Granger causality has the drawback of parameter instability (Balcilar *et al*., 2010). In order to overcome this, the present paper makes a contribution to the existing literature by allowing time variation in the causality relationship. The Pakistan economy has undergone structural changes with respect to the exchange rate and the stock market. Pakistan has adopted a floating system in the context of external factors such as; the Asian financial crisis, the atomic explosion of 1998, and the global financial meltdown. In the presence of structural changes; the two series shows instability in different sub-samples (Balcilar *et al*., 2010). This issue is addressed by including the bootstrap full sample and sub-sample rolling window estimation to revisit the causal link between the SM and the EXR. The bootstrap rolling window approach has a unique feature that resides in its identification of the full sample and the sub-sample relationship between the series and it discloses the variation in the relationship over the time. There is an important number of empirical studies that show the evidence of misappropriating results in the presence of structural changes (Balcilar *et al*., 2013). This canbe addressed by allowing the causal relationship between the two series to be time-varying instead of using a full-sample data that assume the single causality holds in every period. The time-varying nature that may exist in the causal link between stock market and the exchange rate has been taken into consideration in this paper. Instead of just testing for causality on the full-sample, which assumes a permanent causal relationship, we also test for causality on the rolling sub-sample with a fixed-size window, thus allowing us to capture structural changes in the model and the evolution of causality among sub-periods. The results show that there are bidirectional causal relationships between EXR and SM within the sub-sample rolling window estimation. The EXR has both a positive and negative impact on the SM in several sub-periods vice versa.

Methodology

The Granger causality statistic assumes that underlying time series are stationary and may not have standard asymptotic distribution when the stationary assumption does not hold. The estimation of the VAR model (Vector autoregressive model) is difficult in the absence of standard asymptotic distribution (Sims, Stock and Watson, 1990) and Toda and Phillips (1993; 1994). Toda and Yamamoto (1995) come up with modified Wald test to find the asymptotic distribution using the augmented VAR 1(1) variables. Shukur and Mantalos (1997a) use Monte Carlo simulation to study the power and size properties of the revised Wald test and explore that it lacks in the correct dimension in small and medium size. Shukur and Mantalos (1997b) state that the residual-based bootstrap (RB) method solves the size and power issue. Numerous studies have established a better performance of *RB* method over the standard asymptotic distribution irrespective of co-integration or not (Mantalos and Shukur, 1998; Shukur and Mantalos, 2000; Mantalos, 2000; Hacker and Hatemi-J, 2006; Balcilar, Ozdemir and Arslanturk, 2010). In this respect, the most significant effort of Shukur and Mantalos (2000) recognised that *LR* test with small sample size gives better power. This paper uses the *RB* based modified-*LR* statistic to find the causality between EXR and SM in the Pakistan.

The bivariate VAR (*p*) need to calculate *RB* based modified-*LR* causality test as follow.

$$x_t = \varphi_0 + \varphi_1 x_{t-1} + \ldots + \varphi_p x_{t-p} + \varepsilon_t\,,\ t = 1,\ 2,\ \ldots,\ T \qquad (1)$$

where $\varepsilon_t = (\varepsilon_{1t},\ \varepsilon_{2t})'$ is a white noise process with zero mean and covariance matrix $\sum$. The Schwarz Information Criteria (*SIC*) provides the optimal lag length. On the basis of equation (1) $x_t = (x_{1t},\ x_{2t})'$ are divided into two sub-vectors, x_{1t} and x_{2t} . $\begin{bmatrix} EXR_{1t} \\ SM_{2t} \end{bmatrix} = \begin{bmatrix} \varphi_{10} \\ \varphi_{20} \end{bmatrix} + \begin{bmatrix} \varphi_{11}(L)\varphi_{12}(L) \\ \varphi_{21}(L)\varphi_{22}(L) \end{bmatrix} \begin{bmatrix} EXR_{1t} \\ SM_{2t} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$ (2)

where X_{1t} denotes EXR and X_{2t} show SM respectively. In the empirical section, the latter variable is a stock market index $\phi_{ij}(L) = \sum_{k=1}^{p+1} \phi_{ij,k} L^k$, $i, j = 1,2$ and L is the lag operator defined as $L^k x_t = x_{t-k}$. Considering the specifications found in Equation (2), the null hypothesis is that SM does not Granger cause the EXR. This hypothesis is tested by imposing the restriction, $\phi_{12,k} = 0$ for $k = 1,2,....,p$.

Parameter stability test

The standard Granger non-causality test for full sample size assumes that the parameter of the *VAR* model remains constant over the time. This assumption is violated when the full sample size series exhibits structural changes. Structural changes are a most challenging problem in empirical studies (Granger, 1996). The causality test of full sample data becomes invalid and unstable in the presence of structural changes. To avoid the problem of parameter non-constancy and structural changes, we conducted rolling bootstrap estimation and rolling window Granger causality test which also uses the modified bootstrap.

To examine the short run relation Andrews (1993) and Andrews and Ploberger (1994) study the short-run parameters stability by using the *Sup-F, Mean-F and Exp-F* tests. The VAR model in the first difference is misspecified in the presence of co-integration which requires to be amended by error correction methods. It is therefore needed to test the long-term relationship and parameter stability of the long relationship. Phillips and Hansen (1990) evaluate the parameter of co-integration by using fully modified ordinary least squares (FM-OLS). Thestability of the long-term parameter is examined by L_c test proposed by Nyblom (1989) and Hansen (1992).

The above test is calculated from the sequence of *LR* statistics, which test parameter constancy against one-time structural change at each possible point of time in the full sample. The bootstrap process is used to compute the *P*-values and the critical values. Furthermore, according to Andrews (1993), a 15-percent trimming from both ends of the sample is required for the *Sup-F, Mean-F and Exp-F.* Therefore, these tests are applied to the fraction of the sample in (0.15, 0.85). The L_c tests are calculated in this study for the equations and VAR system separately by applying the *FM-OLS* estimator.

Sub-sample Rolling-window Causality Test

Structural changes cause instability in the model which is a daunting task in present empirical investigations. In order to avoid the problem of structural changes it is necessary to implement various techniques such as: including dummy variables and sample splitting. However, the above-mentioned techniques may lead to the pre-test biases. In order to compensate these shortcomings, we incorporate a modified bootstrap estimation in a rolling window subsample Granger framework.

The non-consistency and instability of the sub-sample data justify the use of the rolling window method. The rolling window technique is based on fixed-size sub-samples rolling sequentially from the beginning to the end of the full-sample (Balcilar *et al*., 2010). A fixed rolling window with *l* observation of full size is transformed into a sequence of *T* – *l* sub-samples, that is, $\tau - l + 1$, $\tau - l$, ..., *T* for $\tau = l, l + 1, ..., T$. Then, each subsample's causality is determined based on the *RB* based modified-*LR* causality test. The bootstrap *p*-values of the observed LR-statistic rolling through *T-l* sub-samples provide the variation and magnitude of the relationship between EXG and SM in Pakistan.

The impact of EXG on SM is equivalent to the average of the whole bootstrap estimates and is obtained by formula, S $N_b^{-1}\sum_{k-1}^{p}\hat{\varphi}_{21,k}^{*}$, where N_b denotes the number of bootstrap recurrences. Likewise, $N_b^{-1}\sum_{k-1}^{p}\hat{\varphi}_{12,k}^{*}$ is the formula showing the influence of SM on the EXG. Both $\hat{\varphi}_{21,k}^{*}$ and $\hat{\varphi}_{12,k}^{*}$ are bootstrap estimates from the VAR models in Equation (2).The 90-percent confidence intervals are also computed, where the lower and upper limits equal 5th and 95th quantiles of each of the $\hat{\phi}_{21,k}^{*}$ and $\hat{\phi}_{12,k}^{*}$ (Balcilar *et al*., 2010).

In order to undertake the rolling window estimation, it is mandatory to specify the interval and size of the window. It is known that a large size of the estimation window will lead to an improved accuracy, but this comes at a cost of representation. On the opposite spectrum, a small window minimizes the heterogeneity, and this enhances the representativeness of the parameter, but it reduces accuracy given the fact that the standard error of the estimates increases. Given the above-mentioned arguments, the window size should be selected in a way that accounts for both accuracy and representativeness. The specific literature does not offer a rule of thumb in obtaining the size of the rolling window, but hints to the fact that it is computed from the mean square root process (Pesaran and Timmerman, 2005).

Data

The study investigates the linkage between the EXR and the SM for Pakistan using monthly data from 1992 to 2014:06. The stock market is represented by the KSE-100 stock exchange index. The SM data attained from the Karachi stock exchange and the economic survey of Pakistan. The EXR data obtained from State Bank of Pakistan (SBP) and the International Financial Statistics developed by the International Monetary Fund (IMF). The financial reforms, the adoption of various exchange rate system and the global financial turmoil have increased the importance of the correlation between the stock market and the exchange rate. The Karachi stock index KSE-100 declined from 1746 points to 766 points in July 1998. The main factors of this decline include the South Asian financial crisis, the imposition of sanctions due to the nuclear test of May 1998, and the freezing of foreign accounts. Due to the adverse impact of the economic sanctions, a dual exchange rate system was adopted from July 1998. The dual exchange rate system was replaced by the unified floating exchange rate system in May 1999. The Karachi stock exchange KSE-100 index increased from 1,521 in 2000 to 12,130, in 2008. The period of 2001-2007 witnessed economic prosperity and growth. An average 7 percent GDP growth rate was recorded. On the other hand, the EXR showed a general trend of stability. In the 2007-2008 remained volatile, and the SBP intervened. In May 2008 the rupee reached an all-time low of Rs 68 per Dollar because of speculative dollar buying in the market. The foreign direct and portfolio investments fell due to the stagnant economic growth rate. In the last few years, the EXR was under pressure, and continued to depreciate. At the same time SM capitalization, trading volume and market index have shown tremendous growth. The inflow of foreign direct investment in Pakistan improved the stability of the EXR. We consider that the above-mentioned events may have a temporary impact on the relationship between the variables included in the present study.

Empirical Results

This study evaluates the association between the SM and the EXR in Pakistan. In the first step, we test the stationary of the data, using several tests such as: Augmented Dickey-Fuller (1981),Phillips Perron (1988) and the *KPSS* test proposed by Kwiatowski *et al*. (1992). The results of the test indicate that the SM and the EXR are stationary at the first difference, which implies that both series are integrated at 1(1).Given this aspect, we can test the full-sample causal relationship between the two variables using the VAR model. In order to do so, we first need to calculate the lag structure of the bivariate VAR model. We compute the optimal lag structure using the Schwarz Information Criteria (SIC). We notice the fact that all length criteria select three (3) for our bivariate model.

Table 1. Unit root test

Variables	Levels			First Differences		
	ADF	PP	KPSS	ADF	PP	KPSS
EXR	-0051(1)	-0.082(6)	017(12)***	-13.672(0)***	-13.928(5)***	0.081(6)
SM	3.404(0)	.356(3)	1.750(12)***	-15.013***	-15.170(5)***	0.702(

*** and ** indicate significance at the 1% and 5% levels, respectively.

The *LR* test uses the *p*-values obtained with 10000 bootstrap approximation replications. The results of the bootstrap *LR* test show the failure to reject the null hypothesis which stated that the EXR does not Granger cause the SM and vice versa. The full sample bootstrap Granger causality test shows that neither the EXR nor the SM has any predictive power for each other. This is consistent with existing literature (Nath and Samanta, 2003; Tabak, 2006).

Table 2: full sample Granger causality tests

Tests	H_0: EXR does not Granger cause SM		H_0: SM does not Granger cause EXR	
	Statistics	*p*-values	Statistics	*p*-values
Bootstrap *LR* Test	4.612	0.280	7.069	0.110

To obtain valid and reliable results of the Granger causality of our full sample period, it is essential that our parameter estimate exhibits stability over the entire sample period. In the absence ofstability, the Granger causality procedure would return unreliable results. However, there is a default assumption in the previous literature that there is only a single causal relationship across the entire sample period (Balcilar *et al*., 2013). In the presence of structural changes, the parameters in the above VAR models estimated by full-sample will shift in time. The causal relationship between the EXR and SM will accordingly be unstable. Therefore, the assumptions of full sample Granger causality across the entire sample period does not hold, and the results of the test lack relevance (Zeileis *et al*., 2005). This instability in the parameter estimates is due to structural breaks, which cause parameter variability and deviation in the relationship. As discussed in the previous sections, different studies with different samples report various findings. To avoid such conflicting results, it is, therefore, essential to test parameter stability and to identify the possible causes of such variations in parameters. The *Sup-F, Mean-F, Exp-F* tests are suggested to measure the short run parameter stability. They test the null hypothesis of parameter constancy against the parameter non-constancy. The *Sup-F* test is utilised to detect whether the regime shift occurred or not whereas the *Exp-F, Mean-F,* focus on model stability over time (Balcilar *et al*., 2010). The overall parameter of the system is examined with the L_c test developed and introduced by Nyblom (1989) and Hansen (1992).

The temporal stability of the coefficient of the VAR model formed by the EXR and the SM is examined using the parameter constancy test. Table 3 presents the results of the EXR equation and we notice the failure to reject the null hypothesis of parameter constancy at 10% level. The *p*-values are obtained from the bootstrap approximation to the null distribution of the test statistics, by Monte Carlo simulation using 2000 samples obtained from the VAR model constants parameters. The *Sup-F* test under the null hypothesis of parameter constancy against a one-time sharp shift is examined. The results indicate one-time sharp shift in the SM equation, whereas EXR and the *VAR* system show stability. Table 3 reports the results of *Mean-F and Exp-F* tests which suggest that the equation of SM and the VAR may change with time, whereas the equation for the EXR follows martingale process. The L_c statistics tests against the alternative that the parameters follow a random walk process indicative of parameter non-constancy in the overall VAR models. These results validate the conclusion that the parameters of the estimated VAR model using full-sample data exhibit short-run instability.

Table 3. Parameter Stability Tests

	EXR Equation		SM equation		*VAR* (1) System	
	Statistics	bootstrap p-values	Statistics	bootstrap p-values	Statistics	bootstrap p-values
Sup-F	15.35	0.32	20.56*	0.07	50.16***	0.000
Mean-F	7.611	0.34	11.88**	0.04	14.45	0.401
Exp-F	5.391	0.25	2.395*	0.07	21.03***	0.001
L_c^b					4.14***	0.005

We calculate *p*-values using 10,000 bootstrap repetitions.

*, ** and ***denote significance at 10, 5 and 1 percent, respectively.

An alternative test of co-integration between the SM and the EXR is estimated using the FM-OLS estimator to notice the co-integration and the parameter stability of the long-run relationship. The L_c test rejects the null hypothesis of parameter constancy. The *Mean-F, Exp-F* also reject the null hypothesis of parameter constancy. The results show the gradual shifting of the parameter with time. The *Sup-F* rejects the parameter constancy and confirms the one-time shift. Given these findings we conclude that there is not a long-term relationship between the variables included in this study.

Table 4: Parameter Stability Tests in Long-run Relationship FM-OLS

SM = α + β*EXR	*Sup-F*	*Mean-F*	*Exp-F*	L_c
	20.26***	11.06***	7.30***	1.99***
Bootstrap *p*-value	0.001	0.000	0.001	0.005

Notes: We calculate *p*-value using 10,000 bootstrap repetitions.

*** indicates significance at the 1 percent level.

The stability test shows the structural changes in the full sample test. These structural changes determine instability in the sub-sample. To overcome this problem, the rolling-window causality test with sub-sample data is performed to verify the causality between the stock market and the exchange rate. This approach tests the causal relationship between two variables more accurately in the context of time-varying across different sub-samples. In the sub-sample causality test of the rolling window, we use the *RB* bootstrap-based modified-*LR* causality test to check the causal relationship between the variables included in our study. The null hypothesis of the tests indicates that SM does not Granger cause the EXR and vice versa. The bootstrap *p*-values of *LR*-statistics can be estimated from the VAR models in Equation (2) using the rolling sub-sample data including 24-month observations. The rolling window captures the structural changes in the model. As explained above, the rolling window has the advantage of determining how the model evolves (Balcilar *et al*., 2010).

Figure 1 illustrate the results for subsample Ganger causality test. The SM Granger cause the EXR in the subsample including 2008:08 to 2009:09, 2010:09 to 2011:06, and 2013:08 to 2014:06. Figure 2 describes the direction of causality between the SM and EXR. In subsample 2008:08 to 2009:09 and 2010:09 to 2011:06 SM has a negative impact on the EXR. In 2009 the foreign reserve reached to 11 billion which stabilized the EXR. In 2008-2009 the SM touched the highest level 15676 points. Whereas in the subsample 2013:08 to 2014:06 SM has positive impact on the EXR. In 2013 the EXR reached its highest level in the history of Pakistan. The massive depreciation has a positive impact on the SM in term of high profitability to the investors

Figure 1. Bootstrap *p*-value of rolling test statistic testing the null hypothesis that SM does not Granger cause EXR

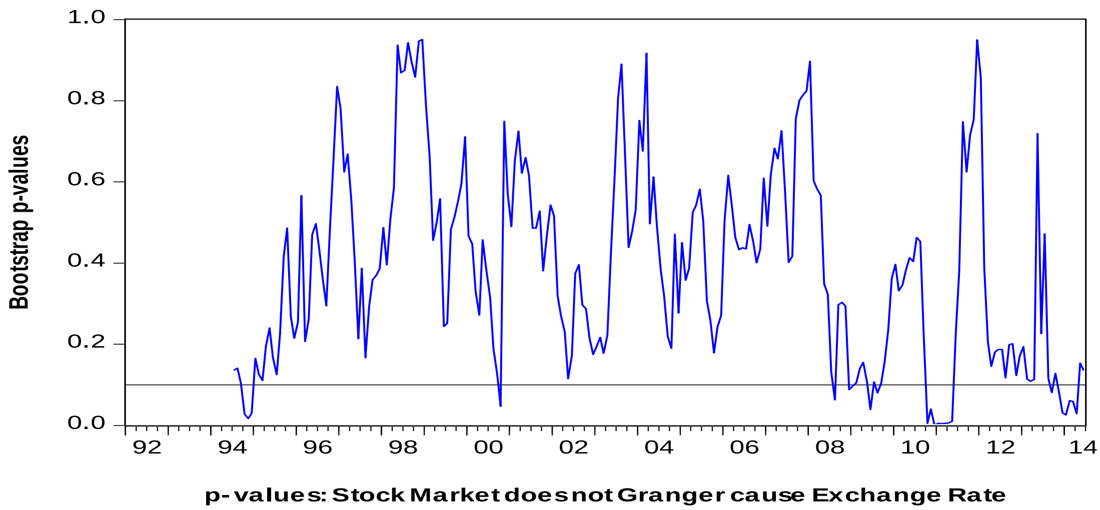


Figure 2. Bootstrap estimates of the sum of the rolling window coefficients for impact of SM to EXR

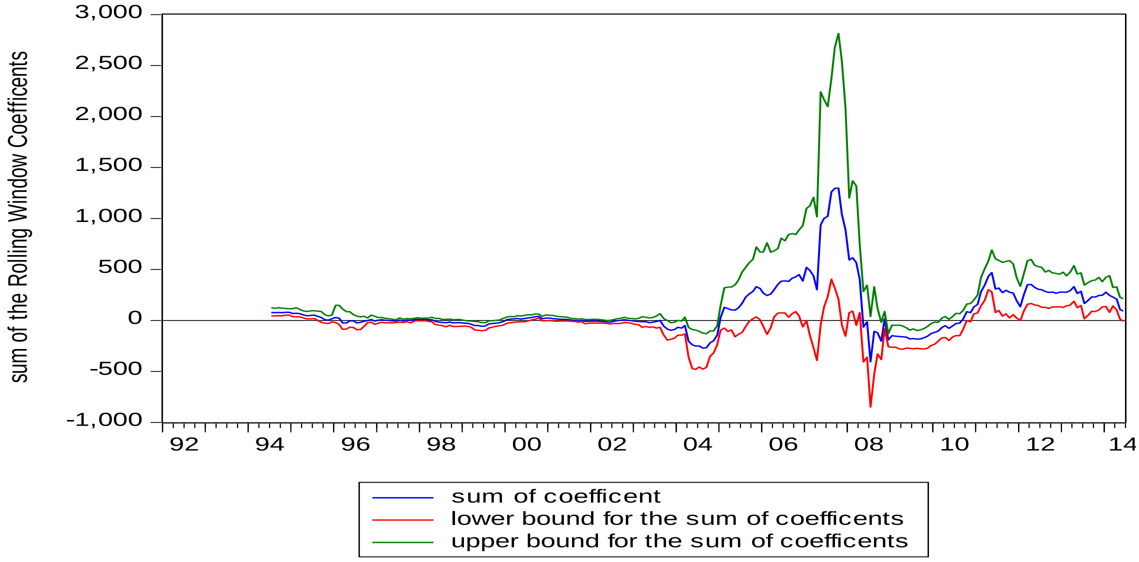


Figure 3 below, the entire rolling estimate for each sub-sample is shown. The null hypothesis that the EXR does not Granger cause the SM is rejected at 10% level in several sub-sample periods of 2004:02 to 2004:11 and 2013:03 to 2013:08. In these sub-sample periods of 2004:02 to 2004:11, the EXR has negative impact on the SM. Whereas in the subsample 2013:03 to 2013:08, the EXR has a positive effect on the SM. In the period the currency kept on depreciating due to the political uncertainty and trade related outflow. In 2013 the rupee depreciated against the Dollar, that had a positive influence on the stock market. The rupee depreciation provides the investors with an opportunity of a highreturn on stock.

Figure 3. Bootstrap *p*-value of rolling test statistic testing the null hypothesis that EXR does not Granger cause SM

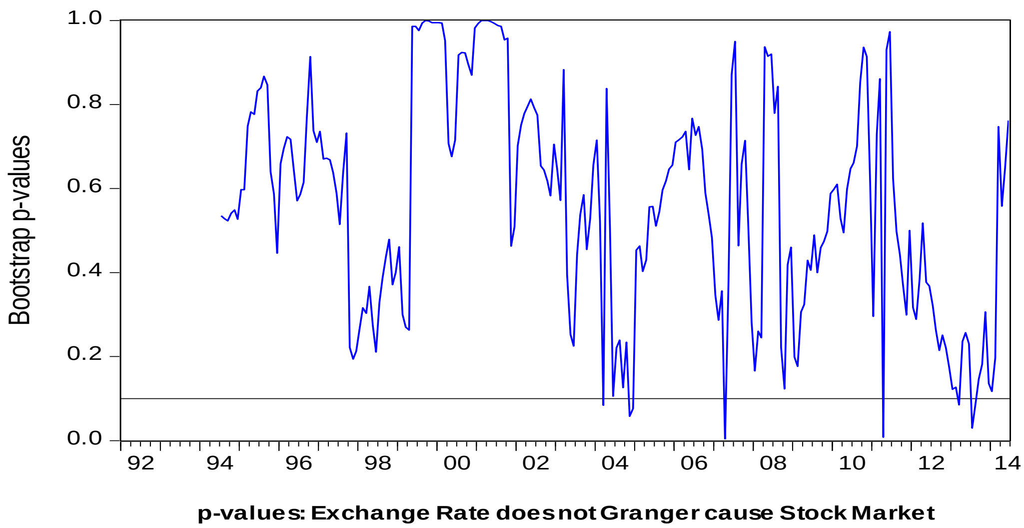
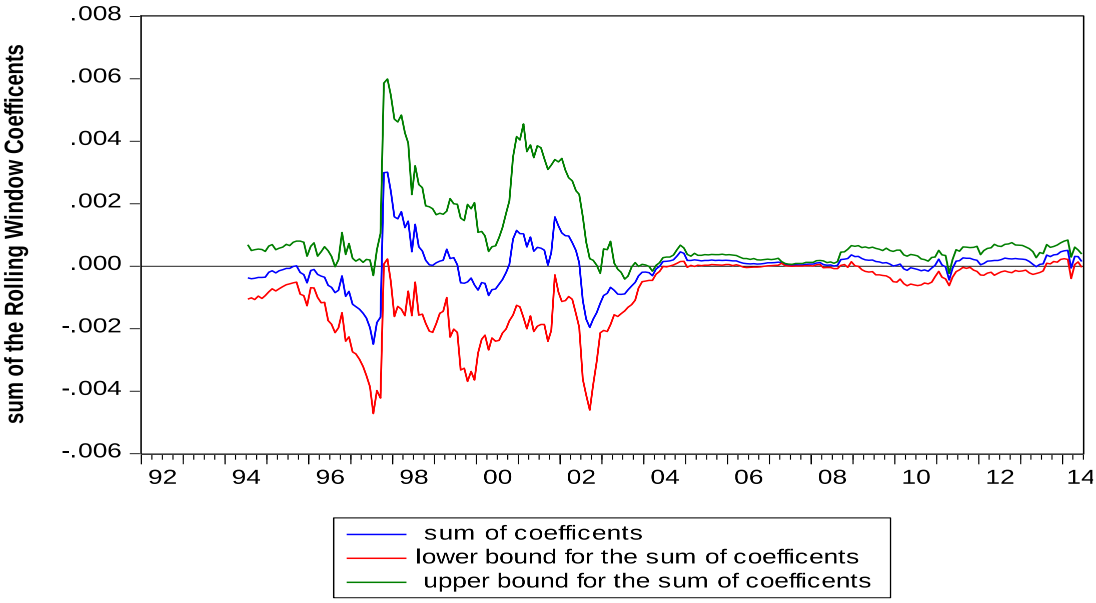


Figure 4. Bootstrap estimates of the sum of the rolling window coefficients for impact of EXR to SM



CONCLUSION

The purpose of this study is to examine the relationship between the SM and the EXR in Pakistan by using the full sample Granger causality test and sub-sample rolling window test. The full sample size Granger causality test shows that there is no causal link between the two series. The parameter stability in the EXR equation was detected in the short run and we did not find traces of a long-term relationship. In the SM equation, we did not observe parameter stability for neither in the short nor in the long. We notice the fact that on the short term the model is unstable as the parameter full sample (FM-OLS) indicates the absence of long-term stability for the models. The rolling window approach reveals the bidirectional causality between the EXR and SM over the different subsample and demonstrates the deviation of the short term. The study provides some recommendations to the government and policy makers that a well-coordinated policy implementation and execution concerning the SM and the EXR are vital in enticing foreign investors and evolving a sound financial system in the country harmonizing to the development of the economy.

REFERENCES

Amid, A. Dharamratne. (2014). The dynamic relationship between exchange rate and stock return: Empirical evidence.*International Journal of Liberal Arts and Social Science,* 2, 129-137.

Andrews, D. W. K. (1993). Tests for parameter instability and structural change with unknown change point. *Econometrica*, 61, 821-856.

Alagidede. P., Panagiotidis, T., & Zhang. (2010). Causal Relationship between Stock Prices and Exchange Rates. *stirlingeconomics discussion paper*.

Aslam. (2014). Relationship between stock market volatility and exchange rate of KSE*Journal of Public Administration, Finance and Law*, 5, 62-72.

Agrawal, G., &Srivistava, A. (2010). A Study of Exchange Rates Movement and Stock Market Volatility. *International Journal of Business and Management*, 5, 62-73.

Balcilar, M., Ozdemir, Z.A., &Arslanturk,Y. (2010). Economic growth and energy consumption causal nexus viewed through a bootstrap rolling window. *Energy Economics*, 32, 1398-1410.

Chen, B. J., Wang. L., & Cheng.T. (2009). Empirical Study of Relations between Stock Returns and Exchange Rate Fluctuations in China. *Communications in Computer and Information Science,* 35, 447–454.

Dayyat, R. A. (2008). The relationship between the Amman Stock Exchange Index and the Exchange Rate using Granger Causality. *Jordan Journal of Business Administration,* 4, 357-365.

Lean, H.H. (2005). Bivariate causality between exchange rates and stock prices on major Asian countries. *Discussion paper,* department of Economic, 1441-5429.

Kollias, C., & Paleologou, M. (2010). The nexus between exchange rates and stock markets: evidence from the euro-dollar rate and composite European stock indices using rolling analysis *Journal Economic Finance,* 36, 136–14.

Kutty. G, (2010). Relationships between Exchange Rate and Stock Prices. The case of Mexico. *North American Journal of Finance and Banking Research, 4, 1-12.*

Mantalos, P., &Shukur. G. (1998). Size and power of the error correction model co integration test: a bootstrap approach.*Oxford Bulletin of Economics and Statistics*, 60, 249-255.

Naeem. M., & Rasheed. A. (2002).Stock Prices and Exchange Rates: Are they Related? Evidence from South Asian Countries. *The Pakistan Development Review,* 41, 535–550.

Pesaran, M. H., &Timmermann, A. (2005).small sample properties of forecasts from autoregressive models under structural breaks. *Journal of Econometrics*, 129, 183-217.

Phillips, P. C. B.,& Hansen, B.E. (1990). Statistical inference in instrumental variables regression with me (1) processes, *Review of Economics Studies*, 57, 99-125.

Phylaktis. K., & Ravazzolo. (2005). Stock prices and exchange rate dynamics Journal of International Money and Finance. *Journal of International Money and Finance* 24, 1031 -1053.

Shukur, G., &Mantalos, P. (1997a). Size and power of the RESET test as applied to Systems of equations: a bootstrap approach. *Working paper*, Department of Statistics, University of Lund, Sweden.

Shukur, G.,& Mantalos, P. (1997b). Tests for Granger causality in integrated-cointegrated VAR systems. *Working paper*, Department of Statistics, University of Lund, Sweden.

Subair. K., & Salihu, M.O. (2004). Exchange Rate Volatility and the Stock Market: The Nigerian Experience, *Kwara state university.*

Stavarek, D. (2004). Stock Prices and Exchange Rates in the EU and the USA: Evidence of their Mutual Interactions.*Finance an úvěr - Czech Journal of Economics and Finance,* 55, *141-161.*

Tavakoli, A.,&Dadash, D. (2013). Dynamic Linkages between Exchange Rates and Stock Prices: Evidence from Iran and South Korea, *International Economic Studies*, 42, 23-32.

Tsagkanos, A., &Siriopoulos, C. (2013). A long-run relationship between stock price index and exchange rate: A structural nonparametric cointegrating regression approach. *Journal of International Financial Markets, Institutions & Money*. 25, 106– 118.

Toda, H.Y., &Phillips, P.C.B. (1993). Vector auto regressions and causality. *Econometrica,* 61, 1367-1393.

Ullah. N., & Jamil, M. (2013). Impact of exchange rate on the stock price. *Journal of Business and Management,* 7, 2278-487.

Umoru, D., & Asekome, M. (2013). Stock prices and exchange rate variability in Nigeria econometric analysis of the evidence. *European Scientific Journal,* 9, 262-285.

Yucel, T., & Kurt, G. (2013). Foreign Exchange Rate Sensitivity and Stock Price: Estimating Economic Exposure of Turkish Firms. Madrid: European Trade Study Group.

Zia, Q. Z., & Rahman, Z. (2011). The Causality between Stock Market and Foreign Exchange market of Pakistan, *interdisciplinary journal of contemporary research business* 3, 906-919.

Zubair, A. (2013). Causal relationship between stock market index and exchange rate: evidence from Nigeria.*CBN journal of applied statistics, 4, 87-110*