Exchange Rates and Stock Prices Nexus in Pakistan

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Abstract

This study examines interrelationship in two financial variables of Pakistan i.e. stock prices and exchange rates during the period April 2001 to March 2009. Three exchange rates i.e. NEER, REER and Rs/US Exchange rate as well as Stock Prices of Karachi Stock Exchange are used to explore the causal link. No long run relationship is found in all three cases which is consistent with the previous studies. No evidence of short run causality is observed in NEER – Stock prices and REER – Stock Prices cases whereas unidirectional causal link from Rs/US$ to Stock prices prevails in Pakistan which implies that information of exchange rate market helps the investors to foresee the trends of stock market prices.

Keywords: Exchange Rates; Vector Autoregressive; Cointegration; Ganger Causality

Relationship of stock prices and exchange rates remain inconclusive theoretically and empirically although this topic has been discussed widely by the researchers since long. On theoretical side, numbers of theories are in vogue. Traditional approach suggests causality from exchange rate to stock prices with positive relationship. This theory proposes that depreciation in domestic currency gives room to the local firms and these firms become competitive. Thus their exports increase which leads to raise the stock prices. Portfolio Balance approach asserts negative relationship causality link from stock prices to exchange rate. This theory postulates that individuals hold foreign and domestic assets along with money. With the increase in domestic stock prices the individuals rush to sell foreign stocks and get domestic stocks. Obviously, due to the reason, the demand of domestic money increases that leads to appreciation of domestic currency hence exchange rate (domestic price of foreign currency) decreases (Granger, Huang, & Yang, 2000; Muhammad & Rasheed, 2002; and Aydemir & Demirhan, 2009). Another way through which stock prices may change exchange rates is inflow or outflow of foreign capital. The wealth of the domestic investors increases due to increase in stock prices which enhance money demand hence interest rates rise. This increase in interest rates attracts foreign capital which ultimately appreciates the domestic currency (Liu, 2009). Besides that, a market may become under the influence of both these models/approaches. If this situation prevails then feedback trend occurs in the market (Granger et al., 2000).

In addition to Traditional and Portfolio Approaches, another model i.e. Asset Market Approach has also been discussed in the literature (Muhammad & Rasheed; 2002; Liu, 2009). This approach implies that there is weak or no linkage in these variables because these may be driven by different factors. Hence there may be no any relationship in variables.

Empirical studies have also disagreement about the relationship of these variables. Numbers of studies carried out to check the inter-relationship, however, the results varied from country to country (see, Smyth & Nandha, 2003; Ajayi, Friedman, & Mehdian, 1998; Pan, Fok, & Liu, 2007; and Yau, & Nieh, 2006). Moreover, different studies gave different results about the relationship of these two variables even for the same country (e.g., Abdalla. & Murinde, 1997; Muhammad and Rasheed (2002)).

Karachi stock market is one the leading and fast growing emerging stock markets in the region which was established in September 1947, soon after the inception of Pakistan. KSE-100 index is a benchmarked of Karachi Stock Market. The performance of stock markets during the years from 2000 to 2008 was very impressive in Pakistan's stock market history where KSE-100 index which was at 1521 points in June 2000 reached on more than 12000 points in May 2008. Likewise, Aggregate Market Capitalization increased from Rs.392 billion to Rs.3746 billion during the same time span. However, the fiscal year 2008-9 experienced negative growth in KSE-100 index which was around 50%.

Pakistan experienced different exchange rate regimes in its history. Fixed exchange rate system was followed from 1947 to 1982 and subsequently managed exchange rate regime was prevailed from 1982 to 1998. During the period started from July 1998 to May 1999 multiple exchange rate was exercised which was converted into market-based floating exchange rate system from May 1999 and this system still prevails. In the early time span of floating exchange rate regime Pakistan Rupees was depreciated against US dollar up to September 2001. But during the calendar years 2002-2003 exchange rate (Rs/US$) became strengthened and appreciated. During the year period 2004 to 2007 the exchange rate was more or less stable but with the dawn of 2008 once against Pak Rupees faced depreciation pressure and (Rs,/US$) exchange rate moved from 62.37 in January 2008 to Rs.80.42 in March 2009[1].

Moreover, it is also pertinent to mention that Pakistan's domestic foreign exchange market is dominated by US Dollar because around two third trade of Pakistan is linked with US dollar. Likewise, foreign

[1] The facts and figures were extracted from Economic Survey of Pakistan (various issues) and SBP's Annuals Reports (various issues).

currency deposits are also dominated by US dollars with the ratio of more than three fourth[2].

This relationship is also empirically examined for Pakistan but no consensus prevails. Abdalla and Murinde (1997) illuminated uni-directional causal link from exchange rate to stock price index in Pakistan. Rasheed, Baloch &Raheem (2014) confirms that share turnover is dependant upon exchange rates which implies there exists positive and significant relationship between the variables. Surprisingly, Farooq and Keung (2004) found unidirectional causality from stock prices to exchange rate. The study of Muhammad and Rasheed (2002) revealed that both the variables are independent. Smyth and Nandha (2003) found independence of these variables for Pakistan.

The purpose of this study is to further envisage the evidence about the relationship in these variables for Pakistan as this issue is still inconclusive. This study departs from the previous studies due to the following reasons. *First*, we have used the latest data available to find the current scenario on the concerned subject. This study covers the period from April 2001 to March 2009. Farooq and Keung (2004) and Aydemir and Demirhan (2009) explicate that results can be varied with the changed time period. Moreover, dynamic geo-political changes have occurred in the world which might have direct or indirect effects on Pakistan[3]. *Second*, in all the previous studies, used the time periods where different types of exchange rates regimes have been exercised in Pakistan. But this paper used the data of only single exchange rate system i.e. market-based floating exchange rate system. *Third*, for the first time, three Exchange Rates i.e. Rs./US$ Exchange Rate (domestic price of US Dollar), Real Effective Exchange Rate (REER) and Nominal Effective Exchange Rate (NEER)[4] are used to envisage the linkage. Previously, Abdalla (1997) used REER variable whereas Muhammad and Rasheed (2002) and Smyth and Nandha (2003) used Rs/US$ exchange rate.

This study is organized as follows: Section-II throws light on selected concerned literature. In Section-III methodological issues and data are discussed. In Section-IV empirical results are presented whereas summary and conclusion are presented in the Section-V.

Literature Review

[2] See; State Bank of Pakistan's Annual Report 2006-07

[3] For example, 9/11 incidence, war on terrorism, USA's invasion on Iraq and Afghanistan have been affecting different sectors of Pakistan's economy for the last more than eight years. So, these factors might have some impact on these two important financial variables.

[4] Base year of NEER and REER is the year 2000. These indices are trade weighted indices and are calculated by SBP.

Abdalla and Murinde (1997) studied the causal linkage in these variables by using real effective exchange rate for four countries They applied bivariate vector autoregressive model. The results are mixed i.e. they found causality from exchange rate to stock prices in three countries and reverse causal link in one country.

Ajayi et al., (1998) employed granger causality test by using daily as well as weekly data on exchange rates and stock market indexes of seven advanced market for the period from 1985:04 to 1991:08 and of eight Asian emerging markets from 1987:12 to 1991:09. Their results reveal that there is uni-directional causality from stock indexes to exchange rate, however, as far as emerging economies are concerned there is no consistent causal relation.

Granger et al., (2000) envisaged the relationship between these variables using for nine Asian countries. The results are mixed e.g. Philippines economy's results are in line with portfolio approach, South Korean economy faces traditional approach's prediction. In Indonesia and Japan, both these variables are independent and remaining five countries observe strong feedback relations.

Muhammad and Rasheed (2002) applied cointegration test to check the linkage in four South Asian economies. Time span used in this study was from 1994:01 to 2000:12. They concluded that both these financial variables are independent in South Asia.

Smyth and Nandha (2003) also assessed this relationship for South Asian countries. They used daily data for the period 1995-2001 and found that causality from exchange rate to stock prices in Sri Lanka and India and whereas there was no relationship between these variables in Pakistan and Bangladesh.

Farooq and Keung (2004) checked the linkage between stock prices and exchange rate for Pakistan for the period 1994:01-2003:12 and concluded that stock prices caused Rs./US$ in Pakistan.

Tabak (2006) analyzed this linkage for Brazil by using data 1994-2002 and applied linear and nonlinear causality tests. No long-run relationship was found in this study. Moreover linear causal tests revealed that causal link from stock prices to exchange rates whereas nonlinear causality was as per the traditional approach.

Vygodina (2006) studied this relationship of by using the data 1987-2005 of US and applied time series econometric methodology This research revealed large-cap stocks causes exchange rate, however, no linkage found when small-cap stocks variable is used.

Yau and Nieh (2006) explored the short term and long term interaction among the stock prices of Taiwan & Japan and NTD/Yen exchange rate. For this purpose, they used data for the period of 1991-2005and their results revealed that Taiwanese financial market is consistent with portfolio approach for the short term whereas for the log-

term traditional approach is applicable. On the other side, Japanese stock market did not support portolio approach assertions.

Aydemir and Demirhan (2009) exploited daily data for the period 2001-2008 in order to check the causality in nominal exchange rate and stock indices of five sectors in Turkey. They applied Toda Yamamoto Causality method and confirmed bi-directional causation in stock market indices and exchange rate.

Liu (2009) investigated the interaction between these two variables by using weekly data of seven years (from January 1995 to December 2001) of the Hong Kong economy. Usual time series tests i.e. unit root, Johansen Co-integration and Granger Causality test were performed. The prime findings of this study are; no long run relationship between the variables whereas in the short run, causality runs from exchange rate to stock prices was asserted.

Research Methodology

Data

In this study monthly data series of exchange rates i.e. Rs/US$, NEER, REER and KSE-100 index are used. Data on exchange rate (Rs./US$), NEER and REER are obtained from Handbook of Statistics on Pakistan Economy 2005, annual reports (various issues) of State Bank of Pakistan and Economic Survey of Pakistan (2009) whereas KSE-100 index data is obtained from various issues of Economic Survey of Pakistan. These are Monthly data and time period starts from April 2001 to March 2009 except NEER data which starts from April 2001 to June 2008. All these variables are converted into natural logarithm form. Explanations of the variables are mentioned below: -

LEX = Natural logarithm of Rs./US$ Exchange Rate
LREER = Natural logarithm of Real Effective Exchange Rate
LNEER[5] = Natural logarithm of Nominal Effective Exchange Rate
LSE[6] = Natural logarithm of KSE-100 Index
DLEX = First differenced of LEX
DLREER = First differenced of LREER
DLNEER = First differenced of LNEER
DLSE = First differenced of LSE

[5] The data on NEER covers the period from April 2001 to June 2008 due to the availability.

[6] For analysis of stock prices between nominal exchange and REER time period is from April 2001 to March 2009 where for the case of stock prices and NEER time period starts from April 2001 to June 2008. This variable is separately selected because of matching this with NEER indices for analysis.

Methodology

It is widely admitted that generally a time series can be non-stationary. The series are to be non-stationary if time variations prevail in means and variance of the series. To make the series stationary, difference of the series should be take upto '*d*' times. In this way, it is called as integrated of order (d). So before going to check the causality in the concerned variables, stationarity of the data should be examined because non-stationary data can give spurious results. Numbers of econometric tests are devised to examine the stationarity. We used Augmented Dickey Fuller (ADF) as well as Phillips and Peron (PP) test to examine unit root.

If both the variables (as in our case) have no unit root then the series are called stationary more technically the variables are; $Y_t \sim I(0)$. In this case, Granger Causality test can be performed either through Ordinary Least Square (OLS) method or in Vector Autoregressive framework at level.

Nevertheless, If both the variables contain unit roots at level and become stationary at order one then linear combination of two non-stationary series may prevail i.e. there may be cointegration relationship in variables. To test cointegration, Johansen and Juselius, (1990) is used in this study. This methodology is briefly explained below: -

Consider:

$$\Delta Y_t = \Pi Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t \qquad (1)$$

Where

$$\Pi = -(I - \sum_{i=1}^{p-1} A_i)$$

$$\Gamma_i = -\sum_{j=i+1}^{p} A_j$$

The prevalence cointegration depends upon existence of ranks in the matrix Π and ranks are sorted with the help of values maximum eigen value and trace statistics. Usually three type of situation are occurred during the test i.e. rank is zero then no co-integration exists, however, rank $\leq$ (n-1) means (n-1) co-integration relationships (Ender, 2004).

Once it is established that cointegration exists between/among the concerned variables then causal link be examined within VECM framework. In case of no cointegration, simple VAR method at first difference can be applied or equations can be solved with OLS method. As in this study, we did not find cointegration, therefore, causality can be tested with simple VAR method which is based on the following equations at first difference.

$$\Delta X_t = \alpha_1 + \sum_{i=1}^{m} \varphi_i \, \Delta X_{t-i} + \sum_{j=1}^{n} \gamma_i \, \Delta Y_{t-j} + \varepsilon \quad (2)$$

$$\Delta Y_t = \alpha_2 + \sum_{i=1}^{m} \eta_i \, \Delta X_{t-i} + \sum_{j=1}^{n} \vartheta_i \, \Delta Y_{t-j} + \varepsilon \quad (3)$$

Lag length selection is of paramount importance because fewer lags may not remove autocorrelation from error terms and more than optimal lags consumed degree of freedom. Moreover, causality results are also sensitive to lag length. Therefore, utmost care is needed for selection of lags and certain lag selection criteria should be considered for this purpose.

Data Analysis and Results

This study applied both ADF as well as PP on all the series to test unit roots. The results of ADF tests are given at Table 1 which shows that all the series are non-stationary at level, however, non-stationarity vanish at first difference. Moreover, the results of PP test are shown at Table 2. Both the tests show that all variables become stationary when these are first differenced.

Table 1. *Unit Root Test (Augmented Dickey Fuller Test)*

Variable	Level	First Difference	Level	First Difference
	With intercept		With trend and intercept	
LER	0.176112	-3.874928*	-1.003496	-4.780453*
LREER	-2.442922	-9.302878*	-2.546525	-9.255217*
LSE	-1.925212	-8.444572*	0.192922	-8.826126*
LNEER	0.311998	-10.89301*	-2.632592	-10.99495*
LSE	-1.411980	-9.177451*	-1.135064	-9.297440*

Note: * shows the negation of null hypothesis of unit roots at 1% significance level. The optimal lag length of ADF test was automatically chosen according to SIC.

Table 2. *Unit Root Test (Phillips-Perron test)*

	Level	First Difference	Level	First Difference
	With intercept		With trend and intercept	
LER	1.408628	-6.106514*	0.268785	-6.668310*
LREER	-2.545611	-9.320385*	-2.656022	-9.274231*
LSE	-1.892928	-8.413977*	0.589796	-8.765428*
LNEER	-0.049899	-10.89301*	-2.660069	-10.98618*
LSE	-1.520702	-9.222871*	-1.040683	-9.625394*

Note: * shows the negation of null hypothesis of unit roots at 1% significance level. Bandwidth was based on automatically selected with Newey-West using Bartlett kernel.

To assess cointegration, we applied Johansen cointegration technique. Prior to this, lag length was selected according to FPE and AIC criteria for VAR model. Moreover, the residuals have been checked as to whether autocorrelation exists or not? If the residuals in any model proved to be non-white, we chose a higher lag until they were whitened. The results of Johansen cointegration tests are presented in Table 3. These results reveal that we cannot reject the null hypothesis of no cointegration at 5% significance level in all three cases. So, we can conclude that there is no log run relationship between the variables in all the cases.

Table 3. *Johansen Cointegration Test Statistics*

Null Hypo	Alt. Hypo	Maximum Eigen Statistics	5% C.V	Trace Test Statistics	5% C.V.
		LNEER and LSE			
r=0	r=1	5.8909	14.2646	7.7881	15.4947
r ≤1	r=2	1.8972	03.8414	1.8972	03.8415
		LREER and LSE			
r=0	r=1	9.4441	15.8921	16.3626	20.2618
r ≤1	r=2	6.9186	9.1645	6.9186	9.1645
		LER and LSE			
r=0	r=1	11.3865	14.2646	12.6931	15.4947
r ≤1	r=2	1.3066	03.8415	1.3066	3.8415

As it is evident from the results of Table 3, there is no cointegration in any case, therefore, estimations of the VAR in first difference can provide valid results of Granger Causality in all three sets. Again prior to estimation of Granger Causality, lag lengths in VAR for the three pairs have to be determined. Besides that, it is also necessary that the residuals of the VAR should be free from autocorrelation. Resultantly, lag length is 1 according to FPE and AIC in NEER and Stock Prices case at first difference whereas residuals depicted serial correlation but at lag 2 serial correlation problem resolved. Hence Granger Causality test at lag 2 is presented at Table 4. This table reveals both NEER and stock prices are independent and do not have any causality from any direction. As far as, causality between REER and stock prices is concerned, lag length of REER and stock prices VAR is zero according to FPE, AIC, SIC as well as HQ[7] criterions. It means that there is no causality between REER and Stock Prices.

[7] FPE: Final prediction error, AIC: Akaike information criterion, SIC: Schwarz information criterion, HQ: Hannan-Quinn information criterison.

Table 4. *Results of Causality Tests - NEER and Stock Prices*

Null Hypothesis	Lag	χ^2 Value	*p*-Value	Remarks
DLSE ≠> DLNEER	2	0.0461	0.9772	H_o is accepted
DLNEER ≠> DLSE	2	2.510	0.2851	H_o is accepted

Table 5. *Causality Tests - Rs/US$ Exchange rate and Stock Prices*

Null Hypothesis	Lag	χ^2 Value	*p*-Value	Remarks
DLSE ≠> DLER	6	5.605	0.469	H_o is accepted
DLER ≠> DLSE	6	40.869	0.000	H_o is rejected

Table 6. *Causality Tests - Rs/US$ Exchange rate and Stock Prices*

Null Hypothesis	Lag	*F*-Stat	*p*-Value	Remarks
DLSE ≠>DLER	2	0.73970	0.480	H_o is accepted
DLER ≠> DLSE	2	7.05860	0.001	H_o is rejected
DLSE ≠>DLER	4	1.04541	0.389	H_o is accepted
DLER ≠>DLSE	4	8.32626	1.1E-05	H_o is rejected
DLSE ≠>DLER	6	0.93413	0.476	H_o is accepted
DLER ≠>DLSE	6	6.81149	8.3E-06	H_o is rejected
DLSE ≠>DLER	8	0.84048	0.57041	H_o is accepted
DLER ≠>DLSE	8	6.05601	6.6E-06	H_o is rejected
DLSE ≠>DLER	10	0.96044	0.486	H_o is accepted
DLER ≠>DLSE	10	3.84256	0.000	H_o is rejected
DLSE ≠>DLER	12	0.71601	0.730	H_o is accepted
DLER ≠>DLSE	12	3.27137	0.001	H_o is rejected
DLSE ≠>DLER	14	0.61276	0.842	H_o is accepted
DLER ≠>DLSE	14	2.66714	0.005	H_o is rejected
DLSE ≠>DLER	16	0.59636	0.870	H_o is accepted
DLER ≠>DLSE	16	2.93468	0.002	H_o is rejected
DLSE ≠>DLER	18	0.70751	0.783	H_o is accepted
DLER ≠>DLSE	18	2.74687	0.004	H_o is rejected
DLSE ≠>DLER	20	0.55271	0.918	H_o is accepted
DLER ≠>DLSE	20	2.40762	0.012	H_o is rejected
DLSE ≠>DLER	22	0.54755	0.924	H_o is accepted
DLER ≠>DLSE	22	1.88097	0.058	H_o is rejected

We have checked the Causality in Exchange Rate (Rs/US$) and Stock prices (KSE-100 Index) at first difference within the lag lengths up to 20 and the results are presented at Table 6 which reveals that throughout the twentieth lags, Stock Prices don't cause Exchange Rate whereas, Rs/US$ Exchange Rate causes Stock Prices. In order to be specific to a lag length that has minimum value of a certain criteria e.g. AIC or SIC etc. VAR framework has been used so that a parsimonious model can be selected. For this purpose, FPE and AIC criterions have been used which suggest a lag length as 4 but lag length 6 is selected because it is free from residual's autocorrelation. The result of Granger Causality in VAR framework is presented at Table 5. The results of this table show that Stock Prices don't cause Exchange Rate whereas Exchange Rate causes Stock Prices. It shows unidirectional causal link from exchange rate (Rs/US$) to stock prices during the period from April 2001 to March 2009. These results contradict with the findings of previous studies of Muhammad and Rasheed (2002); Smyth and Nandha (2003) and Farooq and Keung (2004). Aydemir and Demirhan (2009) explains the reasons that the contradictions in results from one study to the other studies can be occurred due to difference in time period of data and economic policies of the concerned country.

Conclusion

This study attempts to find the interaction between stock prices and exchange rate in Pakistan during the period from April 2001 to March 2009. We used KSE-100 and three exchange rates i.e. bilateral exchange rate (Rs./US$), REER and NEER. As we used time series data, so it was appropriate that causality had to be found with time series methodology hence we use unit roots test, Johansen's co-integration Approach and VAR model to find bivariate causality in all three cases. No co-integration found in all the three cases i.e. stock prices & NEER, stock prices & REER and Stock prices and Rs./US$ Exchange Rate which are consistent with the pervious studies' findings. The results regarding short run causality between REER and stock prices are different from the results of Abdalla & Murinde (1997) results. We found that both these variables are independent whereas Abdalla & Murinde (1997) claims that short run causality exist from REER to stock prices. Moreover, NEER and stock prices are found independent. this study empirically claims that unidirectional link from exchange rate (Rs/US$) to stock prices exists in the short run. Again, our results do not match with the results of Muhammad and Rasheed (2002). Aydemir and Demirhan (2009) elucidates this phenomenon with the reasons that the difference in results from one study to the other studies can be occurred due to difference in time period of data and economic policies of the concerned country. With the above mentioned arguments of Aydemir and Demirhan (2009), it can be argued that in this study such a time period is considered where Pakistan is experiencing flexible exchange

rate hence this may have some impacts on the results. This paper suggests that in order to avoid the crisis in stock market government has to take care about the exchange rate (Rs./US$).

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