RELATIONSHIP BETWEEN STOCK MARKET VOLATILITY AND EXCHANGE RATE: A STUDY OF KSE

Waseem ASLAM
Department of Finance and Economics, Foundation University Rawalpindi, Pakistan
seem_aslam@yahoo.com

Abstract: *This paper guides us about the impact of Exchange rate Pakistan rupee in terms of US Dollar and KSE 100 index. We take the data of period comprises from January 01, 2006 to December 31, 2012 excluding year 2013due to general elections of Pakistan, which held in May 2013 after which stock market took a boom. We applied different statistical tools to analyze the obtained data. We also analyze the causal relationship between both the time series. First of all we carry out normality test and found that both PKR-USD exchange rate and KSE 100 index are non-normally distributed. We conclude through unit root test that both series are stationary at the level form. Furthermore we found negative correlation in between KSE100 indices and USD-PKR exchange rate though very weak relationship exists. Furthermore we check for causal relationship between two time series through Granger Causal Test and found that bidirectional relationship exists between KSE 100 indices and Exchange Rate.*
Keywords: *KSE 100 (Karachi Stock Market Index 100), Exchange Rate, Normality Test, Unit Root Test, Correlation, Granger Causality Test.*

1. INTRODUCTION

The Karachi Stock Exchange or KSE is located in Karachi. KSE 100 index was introduced on November 01, 1991 and it represent the whole economy of Pakistan because it is comprises of 86% of market capitalization. Whenever we want to measure Pakistani economy we generally accept KSE 100 index as an indicator.

We can explain currency exchange rate as if we take currencies of two different countries and compare one of them in terms of other country currency. Like in this paper we took USD of US against PKR of Pakistan, talking about PKR in terms of USD we need around PKR100/- to get USD 1/-. This ratio of one currency in terms of other currency is known as exchange rate. Talking about stock market fluctuations, exchange rate also fluctuates over a period of time.

Factors like exchange rate, interest rate, GDP of a country, employment rate, and companies business listed on stock market, state bank policies and other information can influence stock market, or causes stock market to fluctuate (Kurjhara, 2006). And Index is comprises of those stock prices. In general if we talk about the effect of exchange rate on economy of a country (KSE index) or their relationship, by increase in exchange rate importers will get positive impact and a negative effect on exporters. As exporter are

unable to compete or we can say meet international trade standard and importers get benefit because they can compete better in local or domestic market as compared to others which results in increase of their profitability (Yau and Nieh,2006).The stock market and exchange rate relationship and individually both variable get importance because they directly affect economy of any country. Economist and investors utilize both variable to predict future prices and etc (Kim, 2003). International competitiveness of firms directly get influenced by change in exchange rate on either way if they import inputs or exports output (Joseph, 2002).

After the formation of new government in May 2013 and as now they unleashed their economic policies of which a major part is multinational organization investing in country. Multinational companies always take care of exchange rate as it directly affects their profitability. Recently Finance Minister Mr. Ishaq Dar emphasizes on controlling devaluing currency of Pakistan in order to get economy back on track. The exchange rate relationship with economy (KSE) is very important but in current scenario of country it becomes more concern for economist. In this paper we try to analyze the impact of exchange rate on economy and its magnitude and direction. We didn't include year 2013 because due to formation of new government and huge expectations of nation stock market record a boom period.

2. LITERATURE REVIEW

Some studies show significant positive relationship between the two markets (Cheung and Westermann, 2000). According to (Solnik, 2000) he analyzed stock market (KSE100) and home currency and found correlation between, significant negative correlations. There are studies which have found weak or no relationship between the two markets (Bodart&Reding, 1999).

When we studied Agarwal G., Kumar S., &Sirivastava A. 2005, they examined Nifty returns with Indian rupees-US Dollar exchange rate. They went for causal relationship between Nifty returns and Indian-USD exchange rate. Daily closing prices of stock and daily exchange rate have been taken by them. Then they converted them into natural logarithm. They found data non normal, furthermore they tested for stationarity of data and found the two time series stationary at level. After confirming for stationary they examined correlation and found weak negative correlation between two variables. To check the causal relationship authors used Granger Causality Test. They come up with result that there is cause and effect relationship between Nifty returns and exchange rate which is running for former to later (Agarwal G., Kumar S., & Sirivastava A. 2005).

Whenever exchange rate of any currency increases it have negative impact on local/domestic markets because it reduces the advantage of export for that particular country (Yucel and Kurt, 2003). Vice versa if a country is dominated by its imports and exchange rate of that country increases then it may have positive impact on country economy, stock market (Adjasi et.al; 2008).

Different researchers used multiple aspects to figure out if there is any relationship exists between stock market return and exchange rate. Booth (1997) and Chan (2003) highlighted few significant factors of economy which can impact stock

market. According to them exchange rate, money supply, currency control by state bank, foreign exchange reserves and interest rate. Brown (1990) and Mukherjee in (1995) used different factors i.e. inflation, money supply, government bonds and call money rates to figure out the if there is any bond exists between stock market and macroeconomic variables.

According to Maysamhi-Koh (2000), after studying three variables exchange rate, interest rate and stock market he discovered bond between them. According to them both interest rate and exchange rate effect stock market returns. In 1992 Oskoee and Sorabhian concluded that there is bidirectional relationship exists between two variables by using cointegration test for the first time. But there was no long term relationship found by researchers. Abdallah and Murinde (1997) plotted their research for Pakistan, India, Korea and Philippines and concluded that except Philippine other countries Exchange rate granger causes stock market while Philippines stock market granger causes exchange rate.

Nieh and Lie (2001) studied G7 countries for relationship between stock market and exchange rate. According to their results by using data from 1993 to 1999 there is no long run chemistry or relationship exists between two variables. Though short run significant relationship exists between few G7 countries with USA having no relationship in between their stock market and exchange rate. In year 2006 Vygodina and Ozair carried out same research by taking USA data. Ozair (2006) found no co integration and no causal relationship between two under studied variables.

To draw a verdict for relationship between stock market and exchange rate from existing literature is not possible. There was every possible outcome from empirical studies of different researchers. Some showed relationship and some does not, according to few there is causal relationship and for some there were nothing, few concluded that unidirectional relationship exists and few went for bidirectional. So this study tries to examine the stock market of Pakistan (KSE) and exchange rate and we will try to conclude if there is any causal relationship exists between two variables or not.

3. DATA AND METHODOLOGY

In this article we tried to study different dynamics and bonds between stock market returns and exchange rate. And for this purpose we study KSE 100 index and US Dollar and Pakistan Rupee exchange rate. We kept frequency of data at daily level because daily returns are more accurate and can capture better results between KSE 100 index and USD-PKR exchange rate. The time span of current study is from January 01, 2006 to December 31, 2012. And data consists of two variables, 05 days in a week closing prices of KSE100 index and 05 days in a week ratio of USD-PKR. Data has been taken from Oanda, the currency site and Yahoo Finance, to get stock market return. Natural logarithm of both the time series taken before testing several statistical tests and tools. And natural logarithm has been taken as:

Return = ln CP (t)/ CP (t-1) … whereas cp (t) is the closing price of $t^{th\ day.}$

Exchange = ln ER (t)/ ER (t-1) … whereas ER (t) is the exchange rate of $t^{th\ day}$

After reviewing the existing literature and to get the objective of current study following hypothesis have been formulated:

Hypothesis 1: KSE100 index and Exchange Rate (USD-PKR) are not normally distributed.
Hypothesis 2: KSE100 index and Exchange Rate (USD-PKR) both series are non-stationary (unit root exists).
Hypothesis 3: There is Correlation in between KSE 100 index and Exchange Rate (USD-PKR).
Hypothesis 4: There is no cause and effect relationship or bond exists between two studied variables.

To check the above mentioned hypothesis we run different statistical tools and tests on software like SPSS version 16 for windows and EViews version 7. To analyze the relationship between KSE100 index and exchange rate we took following tests:

a. Normality Test:

Following (Gujarati, 2003) we used the Jarque-Bera (JB) test to check the normality of data. We compute descriptive statistics of individual variables to check normality. We take values of skewness and kurtosis from descriptive statistics. The scale of normally distributed data is that its skewness must b equal to 0 and kurtosis equals to 3. So we assumes our null hypothesis that our variable have S=0 and K=3, and in case of rejection of null hypothesis we drives that variables are not normally distributed.

$$JB = n\,[S^2/6 + (K-3)^2/24]$$

Here no denotes no. of observation s is skewness and k is kurtosis.

b. Unit Root Test:

To check whether a time series is stationary or non-stationary we used unit root test. Any data series is said to be stationary if its mean and variance remain constant over a period of time. After under taking unit root we further confirms stationary of KSE 100 index and Exchange rate by carrying out ADF Test.

c. Augmented Dickey–Fuller (ADF) Test:

Augmented Dickey-Fuller test is a modified version of Dickey Fuller Test. In order to statistically check whether our time series variables are stationary or not we used Augmented Dickey Fuller test. In this test we compare the T-Stat with critical value of studied variable to determine stationary in its time series.

a. Correlation Test:

Then we carried out correlation test through Eviews version 7 in order to check whether there is any correlation, positive or negative, weaker or stronger exists between KSE100 index and Exchange Rate or not.

b. Granger Causality Test:

After presence of correlation we wanted to check whether any causal relationship exists between KSE100 index and Exchange Rate or not. To check the causal relationship we carried out Granger Causality Test by using EViews. According to the concept of Granger's causality test (1969, 1988), a time series x is said to be causing y when past values of x can predict future values of y. In this case we can say that x granger causing y. What we used to say generally about cause and effect relationship is known as Granger Cause Relationship in statistics.

As we know that our time series of KSE100 index and exchange rates are stationary so we can carry out Granger Cause Test.

4. EMPIRICAL ANALYSIS

As we discussed five steps in Methodology, the empirical analysis of carried out tests are follows:

First of all we checked our variables for normality test. This test was conducted with the help of JarqueBera concept. We individually compute descriptive statistics of both variables by using Eviews version 7. From there we can easily check for normality test by taking kurtosis and skewness values. Any variable to have normally distributed must have skewness value equals to 0 and kurtosis equals to 3. In our case skewness values of KSE100 index and exchange rate are -1.104176 and 0.271766 respectively whereas kurtosis values of tested variables are 13.35747 and 13.727 respectively. Descriptive statistics of both the variables are given below under Table 1.1. Hence we can conclude that our variables, KSE100 index and exchange rate are non-normally distributed.

After affirming the non normal distribution of our variables, we wanted to know if our both time series are stationary or not. There are two ways by which we checked stationarity of time series. The first and simplest method to check stationarity of any time series is to draw conclusion from its graph. In this case we plotted normal log values of KSE100 index and Exchange rate on line plot graph by using Eviews. By visual conclusion we can say that our time series are stationary, because we observe same trend in mean and variance of variables. The graphs for both the variables are shown in Fig 1.1 and Fig 1.2. As we can see there is not much fluctuations shown in graphs so we can say that both the series are stationary at level.

After confirming through simple graph method we also checked stationarity of our time series data i.e. KSE100 index and Exchange rate through Augmented Dickey-Fuller Test.We individually run Augmented Dickey Fuller test for KSE 100 index and

Exchange rate by using E-views software. The results of ADF test are shown under against Table 1.2.1 for KSE100 and 1.2.2 for Exchange rate.Our null hypothesis for this test is that unit root exists in KSE100 series and exchange rate series but if we compare results of test our T Stats for KSE100 and exchange rates are -40.37542 and -21.39268 which are considerably less than critical value of -3.433335 at significant level 1%. So we can reject our null hypothesis and conclude that our time series are stationary at level.

Now it comes the step of Correlation between KSE index and Exchange Rate. Correlation result is given under Table 1.3 which shows negative correlation between two variables having value -.017. This is obviously very weak relationship between KSE 100 index and Exchange rate. Now it comes the question of casual relationship between two time series. To check the direction of this relationship we carried out Granger Causal Test. Granger Causality Test was conducted. The output of granger causality test is given under against table 1.4. We can easily reject our both hypothesis because according to the obtained values of F Stats 0.63367 and 0.61595 respectively for KSE100 index and Exchange rate both are well above the critical value. We can conclude that there is a two way cause and effect relationship between KSE100 index and exchange rate. So the causality is bidirectional.

5. CONCLUSION

We empirically examine the dynamics between exchange rate and KSE index in terms of their relationship and causality between them. First of all we converted the closing values into natural logarithm to get the log values. After getting two natural logarithm, time series we checked for normality of data by using Jarque-Bera test.After confirming the non normal distribution of data we went for stationary or non stationary time series. For checking and confirming stationarity we used two methods; first we used simple graph method and then Augmented Dicket-Fuller Test. Both test showed stationarity of time series data at level. The results of coefficient of correlations tells us that there is negative relationship exists between KSE100 index and PKR-USD exchange rate. After affirming correlation we tested for cause and effect relationship by implementing Granger Causality Test which proved bidirectional causal relationship between KSE index and exchange rate.

References

[1] Agarwal G., Kumar S., &Sirivastava A. (2005). A Study of Exchange Rates Movement and Stock Market Volatility. International Journal of Business and Management, Vol5 No.12 December 2010.

[2] K. Kim (2003), Exchange Rate and Stock Prices Relationship: Evidence from Cointegration model, A review of Financial Economics,12,300.

[3] Lieh F. &Nieh C. (2001), The Dynamics between Stock Prices and Exchange Rate for G-7 Nations.The Quarterly Review of Finance and Economics.

[4] Abdulla R. & Naeem. M, (2002) Bond between Stock Prices and Exchange Rate: Evidence from SouthAsian Nations, IBA, Karachi.

[5] Seifert B. &Najanj. (1992), The Volatility of Exchange Rate, Stock Market and Interest Rate, Multinational Financial Management, 2.
[6] N. Joseph (2002), The Impact of Interest Rate and Exchange Rate on Stock Market of UK.
[7] A.Ozair (2006), A US study of Causality between Stock Prices and Exchange Rates.
[8] Hennigar.E&Sonen.L (1988), An Analysis of Stock prices and Exchange Rates in USA.
[9] D. Staravak (2005), The study of Exchange rate and Stock prices in US and EU: Evidence of their mutual relation.
[10] Gujarati, (2003). Basic Econometrics. McGraw Hill, Pakistan.

Internet References:

[1] www.oanda.com exchange rate url
[2] www.financeyahoo.com yahoo finance used to get kse100 index prices

Appendix

Table 1.1 Descriptive Statistics

	KSE	EXCHANGE
Mean	0.000271	0.000228
Median	0.000280	0.000000
Maximum	0.082547	0.058747
Minimum	-0.164302	-0.044875
Std. Dev.	0.014436	0.005674
Skewness	-1.104176	0.271766
Kurtosis	13.35747	13.72317
Jarque-Bera	9631.232	9899.833
Probability	0.000000	0.000000
Sum	0.558345	0.470004
Sum Sq. Dev.	0.429271	0.066319
Observations	2061	2061

Tale 1.2.1 ADF Test KSE

Null Hypothesis: KSE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=25)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-40.37542	0.0000
Test critical values:	1% level	-3.433326	
	5% level	-2.862741	
	10% level	-2.567455	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(KSE)

Method: Least Squares
Date: 02/10/14 Time: 00:02
Sample (adjusted): 2 2061
Included observations: 2060 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
KSE(-1)	-0.883897	0.021892	-40.37542	0.0000
C	0.000235	0.000316	0.743035	0.4575

R-squared	0.442000	Mean dependent var	-4.72E-06
Adjusted R-squared	0.441729	S.D. dependent var	0.019197
S.E. of regression	0.014343	Akaike info criterion	-5.650092
Sum squared resid	0.423395	Schwarz criterion	-5.644625
Log likelihood	5821.594	Hannan-Quinn criter.	-5.648087
F-statistic	1630.174	Durbin-Watson stat	2.006878
Prob(F-statistic)	0.000000		

Table 1.2.2 ADF Test Exchange Rate:

Null Hypothesis: EXCHANGE has a unit root
Exogenous: Constant
Lag Length: 6 (Automatic - based on SIC, maxlag=25)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-21.39268	0.0000
Test critical values:	1% level	-3.433335	
	5% level	-2.862745	
	10% level	-2.567458	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXCHANGE)
Method: Least Squares
Date: 02/10/14 Time: 00:05
Sample (adjusted): 8 2061
Included observations: 2054 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXCHANGE(-1)	-1.997136	0.093356	-21.39268	0.0000
D(EXCHANGE(-1))	0.680064	0.084157	8.080880	0.0000
D(EXCHANGE(-2))	0.475891	0.073255	6.496325	0.0000
D(EXCHANGE(-3))	0.302228	0.061728	4.896132	0.0000
D(EXCHANGE(-4))	0.151142	0.049510	3.052792	0.0023
D(EXCHANGE(-5))	0.003708	0.036504	0.101581	0.9191
D(EXCHANGE(-6))	-0.085450	0.022043	-3.876554	0.0001
C	0.000458	0.000119	3.846346	0.0001

R-squared	0.649013	Mean dependent var	3.99E-06
Adjusted R-squared	0.647812	S.D. dependent var	0.008940
S.E. of regression	0.005306	Akaike info criterion	-7.636199
Sum squared resid	0.057595	Schwarz criterion	-7.614281
Log likelihood	7850.376	Hannan-Quinn criter.	-7.628162
F-statistic	540.4670	Durbin-Watson stat	1.999088
Prob(F-statistic)	0.000000		

Table 1.3.

Correlations

		EXCHANGE	KSE
EXCHANGE	Pearson Correlation	1	-.017
	Sig. (2-tailed)		.429
	N	2060	2060
KSE	Pearson Correlation	-.017	1
	Sig. (2-tailed)	.429	
	N	2060	2060

Table 1.4 Granger Causality Test:

Pairwise Granger Causality Tests
Date: 02/09/14 Time: 15:49
Sample: 1 5000
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
KSE100 does not Granger Cause FX	2061	0.63367	0.4261
FX does not Granger Cause KSE100	0.61595	0.4326	

Figure 1.1 Line Plot of KSE Return

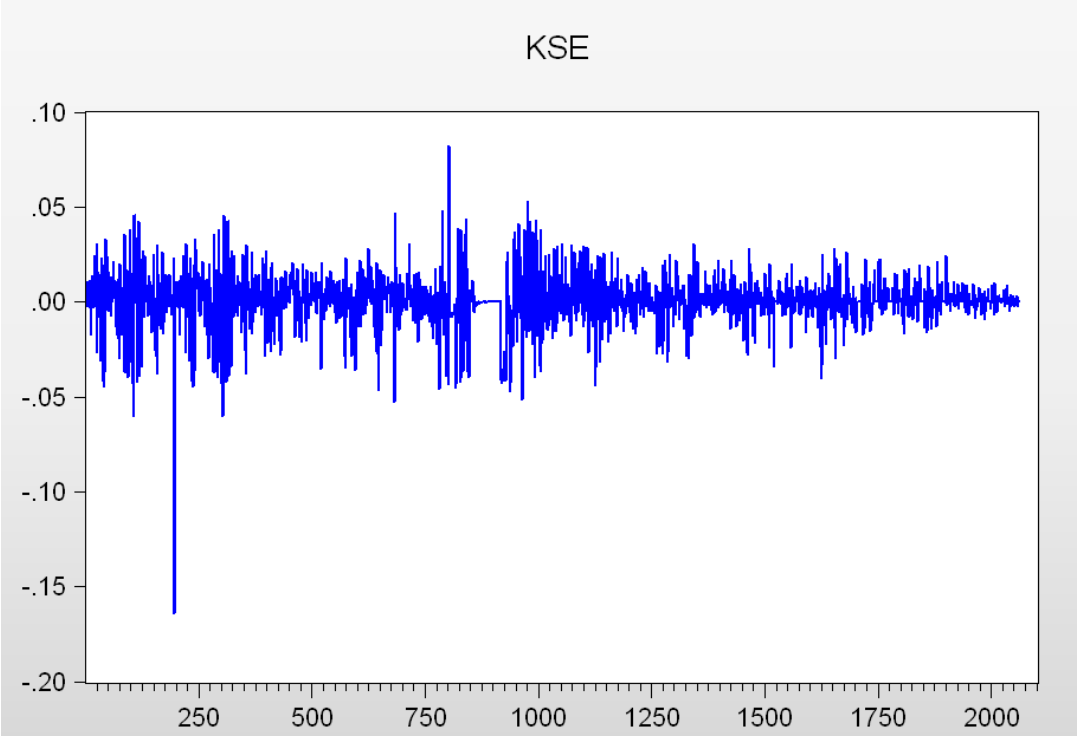

Fig 1.2 Line Plot of Exchange Rate