NON-LINEAR DYNAMIC RELATIONSHIP BETWEEN EXCHANGE RATE AND STOCK PRICE OF PAKISTAN FROM 1965 TO 2015

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***Abstract*- This study aims to determine the dynamic association between stock prices and exchange rates of Pakistani currency (PKR) from 1965 to 2015, including the war era. Long and short-run associations are explored between these variables. Vector Autoregressive Model has been used to examine the association between the stock prices and exchange rate of PKR. Daily time series data of Pakistan from 1 Jan 1965 to 31 May 2015, from Thomson Reuter's software, is used. The Johansson co-integration approach reveals that two co-integration factors are existing between the two series, which shows that these two-time series have long-run movement. Nevertheless, the Granger causality test reveals that bi-direction causality exists among the variables. While the Vector Error Correction Model reveals that there is a short-run association among the series.**

Keywords: Exchange rate, Stock price, Co-Integration Vector Auto Regressive and Vector Error Correction Model.

I. INTRODUCTION

Movements of exchange rates and the stock market are a hot topic for economists. Both factors have a significant influence on any country's development. The movement of the exchange rate affects a company's financial aspects such as profit, company's assets, liabilities, and cash flows. It is not easy for companies to estimate exchange rate movements and thus they suffer this downside risk. This risk affects a company's value and stock prices, and hence the stock prices of the companies changes[1]. Two diverse theories are commonly used to regulate the association of exchange rate and stock prices, both theories provide conflicting results. The first theory is "Flow-Oriented" which states that any change in exchange rate directly affects a company's revenue and also has an impact on a company's stock price[2]. The second theory is "Stock-Oriented". This theory states that capital market activity affects stock market return, that is increase in capital flow increases the domestic demand of domestic currency and thus affects the exchange rate[3].

Many empirical kinds of research have been carried out to regulate the long-period pattern and causality of the stock prices and exchange rate. However, all previous results are clashing with each other. Numerous analysts have experimentally examined the trade rate and stocks return relationship and have established a long-run association between them[4][5][6]. However, other researchers have found conflicting results concerning the long-period association of the two[7][8]. Similarly, conflicting results exist regarding the causality test. Many researchers have found that there is a cause and effect connection among the exchange rate and stock return[6][4][8]. On the other hand, numerous researchers have shown contradictory consequences in the causality test, that is say, there is no causal link among the exchange rate and the equity yield[7][9].

Asian markets constitute a big portion of the world economic market. Numerous foreign investors invest in these markets through foreign direct investment and use the US dollar as currency.

In this research, we try to answer two questions, is there any long-run or short-run association between the exchange rate and stock prices, including the war era?. Does any causality of exchange rate and stock prices exist in Pakistan?

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II. LITRATURE REVIEW

2.2. Theoretical Framework

Numerous theories practice to the stock costs and exchange rate link, as an example, some of the theories are Efficient Capital Market, Capital Assets Pricing Model, Arbitrage Pricing Theory (APT), Purchasing Power parity, Flow-Oriented Model, Stock-Oriented and Monetary theory. All above theories are used in investigation, though, in this work, only two theories such as the flow-oriented model and the stock-oriented will be deliberated. This is because these two theories are related to our problem and determine the directions and relationships among the variables and also determine the impact of one variable on other variables.

2.2.1. Flow-Oriented Theory

With the help of flow-oriented theory, an association amid stock prices and the exchange rate will be determined. This theory proposes that the amendment in the exchange rate will automatically change stock prices[10]. This theory assumes that competition among the companies also affect the exchange rate, fluctuates a company's earnings, value, and stock prices. This theory also assumes that exchange rate fluctuation can be determined by the existing account of the state and the trade performance of the country. But stock prices frequently define the current situation of the company and also define the future cash flow of the company[11]. Exchange rate movement also affects future company's receivable. When local currency value increases, profit also increases, and when local currency value decreases, the profits of every firm also decrease. The conclusion of this is that stock price effect exchange rate movement[12]. Hekman used the foreign exchange market model and concluded that the exchange rate affects stock prices[11]. Sercu and Vanhulle also determined that when the increased exchange rate has a positive effect, exporting firms stabilizes, volume and exchange rate[13]. Another author investigated the connotation amid exchange rate and stock costs with the help of econometric approach like unit root test, co-integration method, Granger causality approach, and impulse response function. He determined that exchange rate leads to stock costs and stock price leads to exchanging rate with undesirable correlation[14]. Adler and Dumas conducted research and concluded the result that local companies depend on international business, and the exchange rate is a risk factor for local companies, if there is any adjustment in the exchange costs it will disturb the local company's efficiency, price, and demand. International business influences exchange rate movements and stock price[15].

To sum up, when the exchange rate changes, it automatically changes the stock prices. The influence of the stock costs calculation is difficult and the correlation sign amid stock costs and the exchange rate is not easy to discovery. As per the flow-oriented theory, there may be optimistic connection amid stock costs and exchange rate, and when the exchange rate rises it rises in stock price[16]. In causal conditions there may be a optimistic association amid the variable mean, causal condition can also be applied to the case of exchange rate and stock price[17].

2.2.2 Stock-Oriented or Portfolio Balance Theory

The stock-oriented theory is also known as portfolio theory[18][19][20]. This theory was developed by three authors namely Branson, Halttunen, and Masson[21]. This theory defines the movement of the exchange rate and how it affects movements of stock price.

As per the flow-oriented theory, exchange rate movement's leads to the stock costs activities, although the stock-oriented theory proposes, when fluctuation occurs in stock prices, it affects the exchange rate movement with a negative correlation. The stock-oriented theory claim is that the stock costs has an adverse association with the exchange rate, when the stock price declines, domestic wealth also deteriorates.

Given indication regarding stock prices, stock costs performance has a significant influence on the exchange rate, domestic investor, wealth, and influence of money, Gavin investigated the research and concluded that the effect on the equity market has a important consequence on investor's wealth and money demand[22]. Tabak investigated the dynamic association among stock costs and exchange rate, for this purpose he nominated the Brazilian economy and he used unit root test co-integration approach and Granger causality approach. He determined that there is no long-period link among the variable then he found a linear relationship using the Granger causality test between stock costs and exchange rate. Both the stock costs and exchange rate had aadverse correlation. Additionally, he also found a nonlinear relationship using the Granger causality approach amid exchange rate and stock costs[23]. Qiao indicated that capital outflows have a important consequence on the exchange rate, meanwhile, stock prices are stable[24]. According to the stock-oriented theory, Granger asserts, because there is a link amid stock costs and exchange rate, when stock price increase, the value of domestic currency also increases. Similarly, when a decrease in stock price occurs, a decrease also occurs in the exchange rate[25]. According to economic analysis, the value of a company is associated with exchange range movement. This statement is confirmed by Shapiro and concluded that when a decrease in a domestic company's value occurs, there is a decrease in domestic currency[26]. This experimental analysis shows that there is a link amid stock costs and exchange rates. There are numerous sorts of investigation to estimate the link amid the exchange rate and stock costs. But these two theories, stock-oriented and flow-oriented suggest that there exists a link and evidence from the literature review suggests, this problem has a mixed conclusion[27].

Numerous researches have been lead to determine the association amid stock costs and exchange rate. When we take into consideration developing and developed countries we get conflict results. Frank and Young investigated the association amid the stock costs and exchange rate and it was concluded that there is no link among these variable[28][29][30][31][32].Phylaktis and Ravazzolo investigated the long and short-period association amid stock costs and exchange rate with the help of co-integration and multivariate Granger causality approach. For this purpose, he selected the period from 1980 to 1998. He found some evidence and concluded that stock costs and foreign exchange rate have a positive link and he also found out that economic crunch had a limited effect on long-period fluctuation[33].

Diamandis and Drakos investigated the long and short-period assertion among stock costs and exchange rate, for this cause he decided data from January 1980 to February 2009. They used the data of four countries in Latin America, Argentina, Brazil, Chile, and Mexico. They used co-integration test and multivariate Granger causality approach. They concluded that stock costs and exchange rate are conclusively correlated, but this is correlation is independent of exchange rate restriction[34].

Nieh and Lee investigated long and short-period associations among stock costs and exchange rate. They discovered two major results from this investigation. The first result that they found is that there is no long-period association amid stock costs and exchange rate in G-7 states. And the second result that they found during this investigation is that there is a short-period link between stock costs and exchange rate in G-7 states[1].

Murinde and Sunil investigated the relationship amid exchange rate and stock costs in emerging markets of India, Pakistan, Korea, and the Philippines. He used a bivariate vector autoregressive approach for this purpose and he selected the era from the period of 1985 to 1994 of these countries. He concluded that unidirectional causality exists among the exchange rate and stock costs of all the emerging markets[35].

Pan et al. studied the dynamic association amid the exchange rate and stock costs of seven countries in Asia such as Hong Kong, Japan, Korea, Malaysia, Singapore, Taiwan, and Thailand. For this purpose, he selected era from January 1988 to October 1988 and he used econometric techniques such as Granger causality approach, variance decomposition test, and impulse response function. It was concluded that there is causal link between exchange rate and stock costs in Hong Kong, Japan, Malaysia, and Thailand before the 1997 economic disaster. He also found out that no country showed any causality amid stock costs and exchange rate throughout the Asian financial crisis, no causal relation existing between exchange rate and stock costs except Malaysia[36].

Inci and Lee investigated the association amid stock return and exchange rate in five European states (France, Germany, Italy, Switzerland, and UK). He concluded that the exchange rate had a major influence on stock return and also found that Granger causality approach, results in a link that is in a reverse direction[37].

III. RESEARCH PROBLEM

Determination of dynamic association amid stock costs and exchange rates in the short and long-period is a progressively significant study issue. In Pakistan, the stock market, as well as stock prices, are highly volatile. The main reason for this volatility is exchange rates. The exchange rate not only affect the stock costs, according to the portfolio approach, automatically increases investment in the domestic and international market by the local and foreign investor and also increase the money supply. The problem of this research is to determine the dynamic association amid stock costs and exchange rate in the long and short-period including the war period in Pakistan. In the earlier research, the different period was used, regarding stock costs and exchange rate.

IV. METHODOLOGY

4.1 Data and Data Source

Secondary data for two variables namely exchange rate and stock price are used in this research paper. The data has been extracted from Thomson Reuters Software by the website (https://www.psx.com.pk/). The exchange rate is taken against the US dollar and stock price and daily closing prices are considered.

Research hypothesis:

a) Is there any long and short-run association amid exchange rate and stock price?
b) Is there any causal association amid exchange rate and stock price?

During the empirical analysis, many steps are performed; these steps are performed in econometric software E-views 7. The steps are given below:

4.2 The Model

In time-series data, mean and variance are not constant all the time. Time series data have non-stationary patterns and the results may be surprising. The vector error correction technique is a classical model to determine the long-run and short-run associationamong the variables. Time series data may lose useful information when taken the difference of the variable. When we take the difference of time series variable the order of integration of the variable is larger than zero, this situation can be solved by a simple time series model but the VECM model can deal with this situation without risking surprising results. This model usesthe time series variable at the level of first difference and the same order of integration.

4.3 Methodology

The methodology consists of the following steps:

Step 1 Stationary test: to examine that the time series are stationary.

Step 2 Determination of optimal lag selection for the model (AIC, SC, HQIC, etc.)

Step 3 Perform Johansen co-integration with lags.

Step 4 On the basis of step3, if the co-integration Vector Auto-Regressive (VAR) model is not effective; Vector Error Correction Model (VECM) is used.

Step 5. Diagnostic test of residuals (normality, serial correlation, heteroscedasticity, etc.)

Step 1 Stationary test

Step one in our evaluation is to assess whether or not the series is stationary or not. We use the unit root test to test the stationarity of the two series. It is notable that majority economic and financial time series are non-stationary at level[38][27][28], however, they attain stationarity after the first difference. There are two our selected variables, exchange rate, and stock prices. The Augmented Dickey-Fuller test and Philips-Perron (pp) approach are employed forth unit root test. Unit root approach can be used with the assistance of the direction of integration of the series. Order of integration as denoted as I (d). The mathematical form of the Augmented Ducky-Fuller (ADF) test is
given below:

$$\Delta y_t = \beta_0 + \beta_1 trend + \gamma_1 y_{t-1} + \beta_i \sum_{i=1}^{n} \Delta y_{t-1} + \epsilon_t$$

Where Δy_tdenote the first difference of the variable and n denotes the number of lags, ϵ_t is the error term.

We test the following hypothesis:

H_0: series has a unit root (it's mean series is non − stationary).

H_1: series has no unit root (it's mean series is stationary).

Another unit root test is the Phillip-Perron test. This is a parametric test. This test aims to check the accuracy of the Augmented Ducky-Fuller test, correct serial correlation, and heteroscedasticity in the series. It is the updated version of ADF.

$$\Delta y_{t-1} = \gamma_0 + \alpha y_{t-1} + e_t$$

Where α is the coefficient of AR (1) regression equation which explains any serial correlation in residual.

Step 2 Determine the optimal lag selection for the model

The next step in this research is to regulate the optimal lag measurement for the model because empirical analysis needs standard error terms in the model. The standard error is affected by any type of autocorrelation. For this case, the analysis used is Vector Auto Regression (VAR) approach, by using EViews software. This model is based on five dissimilar conditions which are extensively used in literature to determine optimal lag measurement, namely the sequential modified ratio (LR) test statistics, the final prediction error criteria (FPE), the Akaike information criteria (AIC), the Schwarz information criteria (SIC), the Hannan-Quinn information criteria (HQ)[39][40][41].

Step 3 Co-integration test

Co-integration approach is the status where two or more different series are related to each other with respect to time. Both series move together and have the same difference. The co-integration test aims to regulate, whether the order of co-integration among the sequence is the same or not. If there is any association among the sequence it means that there is a long-run association among the series. This problem is highlighted by Granger[42], but in the Granger test, there are some drawbacks. Johansen (1988) and Johansen and Juselius (1990) introduced different approaches and overcame the deficiency in Granger's test. With the help of these two tests, we can easily regulate the number of co-integration trajectories. The names of these two approaches are the Trace and Maximal Eigen value tests.

$$J_{trace\ statistics}(r) = -n \sum_{i=r+1}^{k} \ln(1 - \lambda_i)$$

$$J_{Maximal\ Eigenvalue\ statistics}(r, r+1) = -nln(1 - \lambda_{r+1})$$

As per the above equation, 'n' denotes the number of observations, 'r' denotes the number of co-integration and 'λ' denotes the eigenvalue. In some of the cases, there is a conflict in the result between trace statistics and maximum eigenvalue. In this type of situation, Alexander recommends using trace statistics[43].

Step 4 Vector error correction model determine optimal lag selection for the model

Engle and Granger, stated that when two different series are co-integrated it means that there is an error correction in the series[42]. This model is called the Vector error correction approach. This is a very famous approach in econometrics. The purpose of this model is to capture any dynamic association among the variable with the first difference. The standard mathematical form of VECM is given below:

$$\Delta y_t = c + \phi_1 \Delta y_{t-1} + \phi_2 \Delta y_{t-2} + \cdots \phi_p \Delta y_{t-p} + ECT_t + \varepsilon_t$$

In the above equation, ECT is denoted error correction term in the equation; this is the product of two-factor α which denotes the adjustment factor and the co-integration vector β. Co-integration factor denotes the long term association among the variable, on the other hand, adjustment factor show speed of adjustment, to reach equilibrium.

4.4 Granger Causality

Casual association between the two different series can be determined by the Granger Causality test[44]. This approach is established on the VAR model. Granger test also can predict one variable based on another variable [45].

H_0: No Granger causal relationship exists among the variables.

H_1: Granger causal relationship exists among variables.

Step 5 Diagnostic tests of residuals (normality, serial correlation, heteroscedasticity, etc.)

Histogram-Normality (Jarque-Berra)

H_o= residuals do not follow a normal distribution

H_a= residuals follow a normal distribution

Result of Jarque-Berra test

	STOCK_PRICE	EXCHANGE_RATE
Jarque-Bera	2.70E+10	8.78E+09
Probability	0.000000	0.000000
Sum	42064.46	104.2903
Sum Sq. Dev.	1.06E+09	9886.670
Observations	18442	18442

According to the above table, the Jarque-Bera probability value is fewer than our significance level. As per the lower probability we reject the null hypothesis. Consequently, it is enough indication to infer that the regression residual is normal.

The Breusch-Godfrey Serial Correlation LM test

Result of Breusch-Godfrey test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	328.3192	Prob. F(4,18413)	0.0000
Obs*R-squared	1226.777	Prob. Chi-Square(4)	0.0000

H_o=There is a serial correlation among the residuals.

H_a=There is no serial correlation among the residuals.

As per the above table, the probability of the Chi-square value is lower than our significance level; the Breusch-Godfrey LM test rejects the null hypothesis.

The Breusch-Pagan LM test (Heteroscedasticity)

H_o= The variance of the residual is not constant.

H_a= The variance of the residual is constant.

Result of Breusch-PaganGodfrey test

Heteroscedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	10.08590	Prob. F(10,18416)	0.0000
Obs*R-squared	100.3695	Prob. Chi-Square(10)	0.0000
Scaled explained SS	209821.9	Prob. Chi-Square(10)	0.0000

According to the above table, the chi-square probability value is fewer than our significance level. Therefore, there is enough evidence to reject the null hypothesis and infer that there is no evidence related to heteroscedasticity regarding the variance.

Autocorrelation (Durbin-Watson test)

H_o= There is no autocorrelation among the residuals.

H_a= There is autocorrelation are among the residuals.

Result of Durbin-Watson test

R-squared	0.492006	Mean dependent var	0.000000
Adjusted R-squared	0.491868	S.D. dependent var	1.032051
S.E. of regression	0.735681	Akaike info criterion	2.224286
Sum of squared residuals.	9974.271	Schwarz criterion	2.226832
Log-likelihood	-20496.35	Hannan-Quinn criterion.	2.225122
F-statistic	3569.793	Durbin-Watson stat	2.006517
Prob(F-statistic)	0.000000		

According to the above table, there is enough indication to infer that there is no autocorrelation amongst the residuals.

Stability diagnostic test (Quandt-Andrews Break Point test)

According to the following figure, we can conclude that there is no structural break in the selected sample. The test reveals that the parameters are stable since the blue line is lies within the red lien.

This blue line within two red lines. It can be concluded that the model is constant, in other words, our dependent variable stock price has stability.

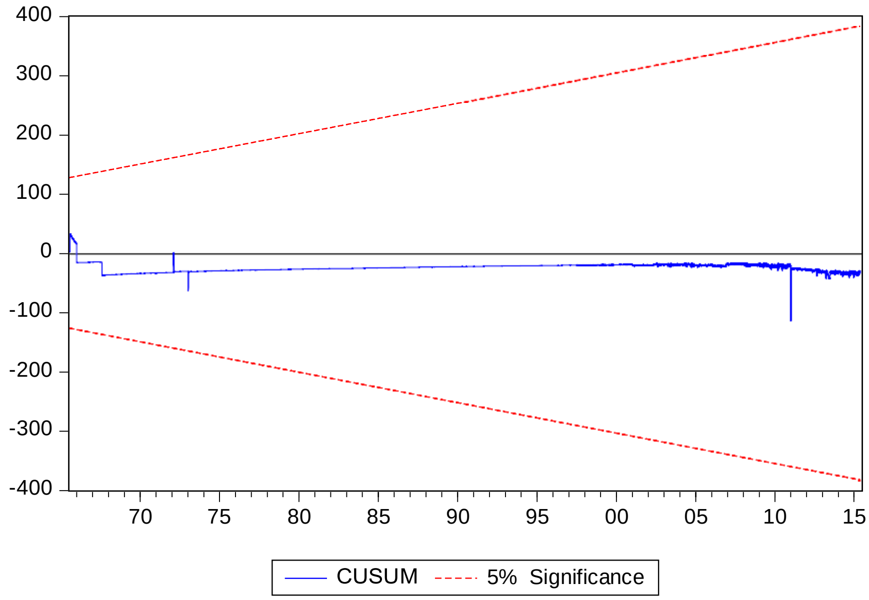

Figure of Stability diagnostic test

V. ANALYSIS

The summary of the data is presented in Table 01

Table: 01 Descriptive Statistics

	DSTOCK_PRICE	DEXCHANGE_RATE
Mean	2.280906	0.005655
Median	12.00100	100.4500
Maximum	8945.000	52.50029
Minimum	24175.54	47.30000
Std. Dev.	240.3114	0.732205
Skewness	-55.15923	-12.88979
Kurtosis	5925.626	3382.296
Jarque-Bera	2.70E+10	8.78E+09
Probability	0.000000	0.000000
Sum	42064.46	104.2903
Sum Sq. Dev.	1.06E+09	9886.670
Observations	18442	18442

Table 01 shows the descriptive statistics of the study. Three are two variables namely stock price and exchange rate, USD/PKR. Three are eighteen thousand four hundred and forty-four observations which are covered from the period of 1965 to 2015. In the above table mean value of the stock price is 2.2809 and the exchange rate is 0.0056. Variation is very high in the stock price as compared to the exchange rate. The USD/PKR mean is 0.0056, the maximum value is 100.45 and the lowest value is 47.3 and the variation is very small throughout the sample. But on the other hand, the stock price means the value is 2.25, the maximum value is 8945 and the lowest value is 24175.5, variation is very high for this variable.

5.2 Unit Root Test Result

Stationary properties are very important in time series. There are numerous approaches available to check the stationary behavior of data by graph and econometrics test. There are many methods in econometrics to check stationarity, but in this research two methods are used namely the augmented Dickey-Fuller test and Phillips- Perron test.

To determine the stationarity of the selected variable, time-series observations are plotted individually without taking the first difference.

5.3 Graphical Analysis

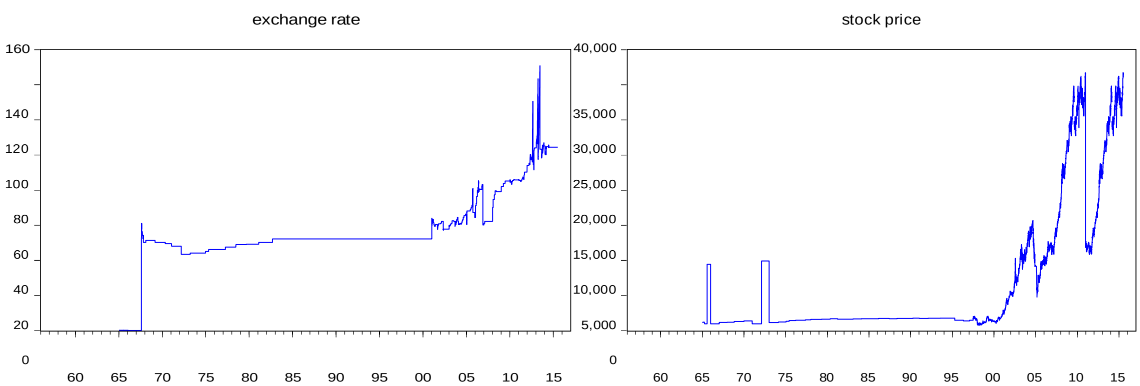

Figure 01: Time series graphs of stock price and exchange rate without the first difference.

According to the above graph, the exchange rate and stock costs have some trend in the series; it means that the data is not stationary. However, non-stationary data in a time series is a problem, for this problem the first difference and econometric test are used in this study.

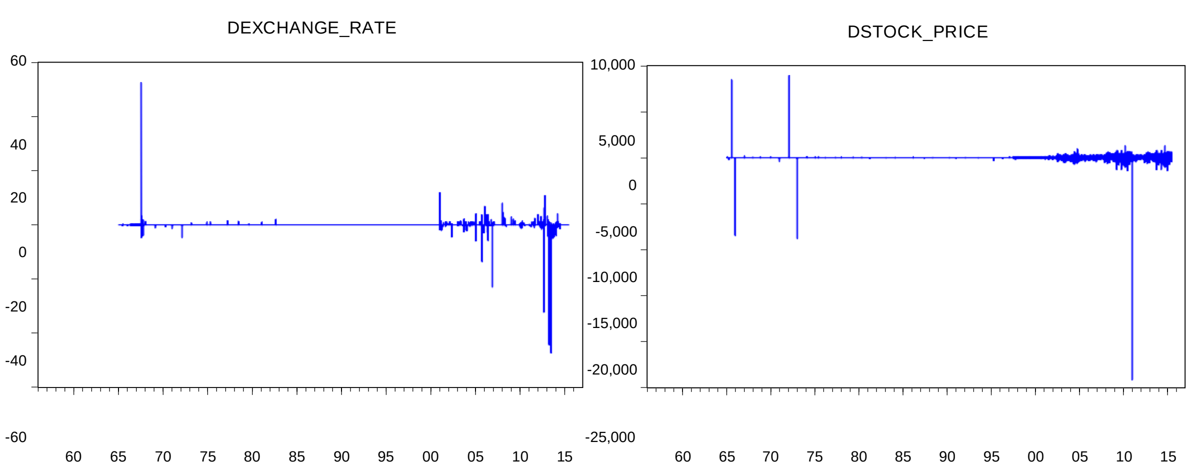

Figure 02: Time series graphs of the stock price and exchange rate with the first difference.

According to the above graph, after taking the first difference of the exchange rate and the stock price, both time series are stationary at the first difference. There is no trend in the series.

5.4 Augmented Dickey-Fuller (ADF) and Phillips-Perron(pp) test Result

It is essential to determine the stationarity of the variable using a co-integration test and establish a long-period association amid the variables. For this purpose, there are two tests are used in this research. This test reveals that all variables are non-stationary at level, but after taking the first alteration all variables are stationary. The outcome of these two tests are shown in Table 01

Table 02: Augmented Dickey-Fuller (ADF) and Phillips-Perron (pp) Result

	ADF				PP				
	Variable at level		First difference		Variable at level		First difference		
	Test statistics	P-value	Test statistics	P-value	Test statistics	P-value	Test statistics	P-value	
exchange	-2.5820	0.0967	-134.8555	0.0001	-2.4158	0.1373	-135.45	0.0001	
stock	0.0318	0.9603	-132.362	0.0001	0.0795	0.9642	-132.41	0.0001	

5.5 Lag length Criteria by using Vector Autoregressive

Lag length criteria are based on Akaike information criteria and Final Prediction error criteria, because AIC showing the smallest lags length which is two for the selected variable.

Table03: VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-147592.8	NA	30978.49	16.01680	16.01765*	16.01708*
1	-147586.4	12.93269*	30970.19	16.01653	16.01908	16.01737
2	-147582.1	8.541001	30969.28*	16.01651*	16.02075	16.01790
3	-147581.7	0.823700	30981.34	16.01689	16.02284	16.01885
4	-147580.8	1.856198	30991.67	16.01723	16.02487	16.01974

5.6 Johansen Co-integration test result

All variables are stationary at first alteration; therefore, the Johansen co-integration approach was used to determine any long-period link amongst the designated variables. Johansen tests are based on dual statistics, namely, trace statistics and maximum eigenvalue test. The outcomes of the Johansen technique are presented in table 3.

H_o= There is no co-integration amongst the variables at a significant level.

H_1= There is co-integration amongst the variables at a significant level.

The outcomes for together trace statistic and maximal eigenvalue statistic are stated in Table 4 and Table 5 separately. Together tests revealed that there are two co-integration amid the variables.

Table4: Unrestricted Johansen Co-integration Rank Test (Trace Statistics)

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.162925	6522.704	15.49471	0.0000
At most 1 *	0.161494	3245.608	3.841466	0.0000
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table5: Unrestricted Johansen Co-integration Rank Test (Maximum Eigenvalue)

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.162925	3277.096	14.26460	0.0000
At most 1 *	0.161494	3245.608	3.841466	0.0000
Max-eigenvalue test indicates 2 co-integrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

5.7 Short-run Causality association in VECM

To determine the short-run dynamic association among the variable, a vector error correction approach was employed. The result of the Vector error correction approach is shown in table 6. In this model, D (stock price) is applied as a dependent variable, and the exchange rate is applied as an independent variable. Wald test is also used to determine short association direction among the variable.

The long-run causality association amongst the variable is determined by C (1). When C (1) is negate, it means that there is a long-run connotation among the variables, significance also determines by probability value, when a probability is less than the significance level, it means that it is important. C (1) exhibits the speed of adjustment from disequilibrium in the model, in this research. C (1) is -0.9641and the probability value is less than our significance value. The speed of adjustment here is 96.41%. Nearly one year is required to achieve equilibrium in the long-run.

The majority of the probability values are less than our significance level and the F-statistic value is 3569.79 which are very high and significant.

The R-square value in this model is 0.492006. It means 49 % can be explained in stock price by exchange rate. There 51 % variation is unexplained. Unexplained variation belongs to some other variables which are not included in this research.

Table 6: Result of Vector Error Correction Model

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.964122	0.012555	-76.79433	0.0000
C(2)	-0.020249	0.010339	-1.958502	0.0502
C(3)	-0.002030	0.007370	-0.275496	0.7829
C(4)	0.000334	1.91E-05	17.49194	0.0000
C(5)	0.000158	1.87E-05	8.418438	0.0000
C(6)	2.46E-05	0.005418	0.004533	0.9964
R-squared	0.492006	Mean dependent var		0.000000
Adjusted R-squared	0.491868	S.D. dependent var		1.032051
S.E. of regression	0.735681	Akaike info criterion		2.224286
Sum squared resid	9974.271	Schwarz criterion		2.226832
Log-likelihood	-20496.35	Hannan-Quinn criteria.		2.225122
F-statistic	3569.793	Durbin-Watson stat		2.006517
Prob(F-statistic)	0.000000			

5.8 Granger Causality/Block Exogeneity Wald Test

The Granger tests are used to determine any causal association among the selected variables. Based on the p-value, one variable significantly contributes to forecasting the other variable, it can be infer that stock costs grange source with the exchange rate. Table 7 provides results regarding the Wald test, according to the probability values, all values are less than our significance level and the chi-square value is 306.188 with 2 degrees of freedom, which means that we reject the null hypothesis and conclude from the Block Exogeneity Wald test that there is a bi-directional causality association among the stock price and exchange rate.

Table 7: Granger Causality/Block Exogeneity Wald Test

VEC Granger Causality/Block Exogeneity Wald Tests			
Included observations: 18433			
Dependent variable: D(DEXCHANGE_RATE)			
Excluded	Chi-sq	df	Prob.
D(DSTOCK_PRICE)	306.1880	2	0.0000
All	306.1880	2	0.0000
Dependent variable: D(DSTOCK_PRICE)			
Excluded	Chi-sq	df	Prob.
D(DEXCHANGE_RATE)	86.76234	2	0.0000
All	86.76234	2	0.0000

II. CONCLUSIONS

This research investigated the long and short-run connotation amid the stock price and exchange rate. There are two variables, both of which are non-stationary at level, but after taking the first alteration all variables convert stationary. The Johansen co-integration approach reveals that two co-integration factors exist among the series. So, in each passé in the period stock costs and exchange rate change together and achieve durable equilibrium. Granger technique revealed that there is a bi-directional causality association among the variables in the short run as well as the long-run. VECM model revealed that a negative association exists among the stock costs and exchange rate. Any adjustment near the equilibrium in the long-period will take approximately one year. This research result revealed that if any variation arises in the stock price it will directly impact the exchange rate and vice versa.

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