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Impact of Exchange Rate on Foreign Trade of Pakistan

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***Abstract*—This research is based on to test the relationship existence between Exchange rate and foreign trade which are imports and exports of Pakistan using annual data from 1993 to 2017. Vector error correction model consisting of three variables imports, exports, and the exchange rate are used. In this study, the dependent variables are imports and exports, whereas the exchange rate is an independent variable. Augmented Dickey-Fuller (ADF) test is conducted to test the stationary of the data; the VAR lag selection model discloses that lag of order 4 is appropriate for this study. Co-integration, Long-run, and short-run relationship test are investigated by Johansen co-integration. Vector Error Correction Model (VECM) is employed on the sample. The results show that the data is stationary and variables are co-integrated having a long-run relationship with each other. The test results of VECM models states that exports of Pakistan are influenced by the exchange rate in the long-term as well as short-term; however, imports are only controlled by the exchange rate in the long-term.**

Keywords—exchange rate, exports, imports, Vector Error Correction Model VECM

I. INTRODUCTION

Foreign Trade is one of the most critical factors in a country's economic development. It is also an essential part of the current account of the Balance of payment BOP. The Debit side of BOP contains imports whereas the credit side contains exports. Almost all of the countries in the world are engaged in trading activities with one, and another and Pakistan is not different from others. Pakistan's exports mainly depend on agricultural products. A country exports those products on which it has a comparative advantage over other countries and which proves to minimize the cost of the product for that specific country.

Dewet [1] proposed that stages of economic development, foreign investment, and technological progress may result in the foreign trade of a country. There are several theories regarding international trade; some of them are the theory of opportunity cost, absolute advantage theory, and comparative advantage theory. The method which is considered to be most effective regarding international trade is comparative theory introduced by Ricardo [2] in which he stated that a country should be engaged in the production of those products or services which proves to have more advantage or less disadvantage as compared to other countries.

The foreign exchange rate between two countries is referred to the rate on which one currency can be purchased in exchange for another currency. Economist state that the depreciation of currency results in an increase in exports and appreciation of currency results in a rise in imports. However, still, there is an ambiguity about the relationship between the exchange rate and international trade of a country. This study's primary objective is to evaluate the effect of exchange rate on the exports and imports of Pakistan by using annual data from 1993 to 2017. This paper is structured into different parts first is Introduction, second is a literature review describing past studies regarding this study, the third section describes the Research Methodology applied to this research, fourth part consists of the discussion of results and last part consist of conclusion.

II. LITERATURE REVIEW

The study of imports, exports and the exchange rate is significant for the economist. The Exchange rate is involved inflow and outflow of goods and services of a country; thus its relationship with imports and exports has been attracting attention for a decade. Many developing countries have adopted the floating from the fixed exchange rate system which resulted in many different studies in this relationship. The research studies regarding this area is still inconclusive; however, there is a general acceptance between the professional of the presence of a connection between the exchange rate and foreign trade.

In this research area, many studies are conducted as Lal [3] found the short run and long run relationship between nominal effective exchange rate and trade balance in South Asian economies Bahmani-Oskooee [4] in their 50% sample countries which have bilateral trade with Pakistan consisting of positive exchange rate and trade balance association. Kemal [5] found a positive relationship between the exchange rate with exports and negative with imports. Aliyu [6] appreciation in exchange rate results in a decrease in exports and expands imports while appreciation of exchange rate increases exports while a decline in imports. Ahmadi [7] studied the impact of

exchange rate on many macroeconomics variables including imports and exports. For his analysis, he used Vector auto aggressive model, Cointegration and impulse responsive function. Zubair [8] also found the effect of instability in the exchange rate of Pakistan on imports, exports GDP, Foreign trade reserves. For his studies, he used yearly data ranging from 1952 to 2010. Mahmood [9] also worked on whether the fluctuation in Exchange rate affects the macro-economic variables of Pakistan. Their study's based on monthly data from 1975 to 2011. Sekmen [10] found that imports and exports have long-run relationship in Turkey but denied the involvement of exchange rate with both of these variables.

Aurangzeb [11] found that the votality of the exchange rate has a depressing effect on the real exchange rate. Shahbaz [12] showed the presence of a long-run association between exchange rate and trade balance upon real changes in both of the variables.

Mahmood [9] found the negative relationship between the vitality of the exchange rate and real exports in Pakistan. Oluyemi [13] examined the effect of exchange rate on exports and imports of Nigeria based on monthly data from 1996 to 2015. He used VAR to check the long-term relationship between the variables, to the check stationarity of data he used ADF test. He concluded that there is the exchange rate has a positive relation with imports but a negative relation with exports. Chaudhary [14] studied the exchange rate, imports and exports of major South Asian and Southeast Asian economies and relationship association of these variables with each other. They used the data from 1979 to 2010. By using Autoregressive Distributed Lag ARDL approach, they concluded that there exists a long-term relationship between exchange rate and exports in more than half of the sample countries, the relationship between imports and exchange is found only in one sample country.

III. Research Methodology

To investigate the relationship of the exchange rate and foreign trade an annual data has been selected ranging from 1993 to 2017 for each variable, i.e., imports, exports, and exchange rate, and this data has been selected from the database of World Bank and State Bank of Pakistan. For foreign trade data we consider the major trading partners of Pakistan which are United states, China, Germany, UK. Saudi Arabia and UAE. The data quoted for exchange rate with considering US$ as the standard currency; whereas, imports and exports data is extracted in billions. Vector Error Correction model (VECM) is used to investigate the long-term and the short-term relationship of all the selected variables.

A. Unit Root Test

The first precaution for any economic analysis of a time series data is to find out the stationary of that data for regular rest it is the priority that data should be stationary. The purpose of running this **Unit root test** is to avoid spurious regression results while analyzing the time series data. As our data is serial correlational and more complex so to get more accurate stationarity results of data in this study we will use **Augmented Dickey-Fuller test.**

Augmented Dicky-Fuller Test (ADF): Dickey and Fuller developed this test to check the stationarity of more complex serial correlation time series data. The lag value is added in the dependent variables to conduct this test. ADF test consist of the following regression:

$$\Delta y = \beta_2 + \beta_{2t} + \delta_{y_{t-1}} + \sum_{j}^{p} \delta_j \Delta y_{t-1} + \mu_t,\ t = 1, 2, 3.....,\mathrm{T} \quad (1)$$

In this equation, y is the dependent variable, whereas $\beta_1, \beta_2, \delta_j$ and δ are the parameters, t denotes a deterministic trend of the variable, T represent the number of variables, Δy_{t-1} represent the empirical number of lagged and μ_t is an noise error term. So the for the above equation if t-statistics is less than the critical value or p value is greater than 5% then the null hypothesis of the unit root test cannot be rejected on the other hand if t-statistics is greater than the critical value or p value is less than 5% then we can reject the null hypothesis. The Null hypothesis for this equation is stated as:

- $H0: \delta = 0$, it indicates that y has a unit root or is non-stationary
- $H1: \delta \neq 0$, this suggests that y does not have a unit root or is stationary

B. Johansen Cointegration Test

Johansen Cointegration Test is a model to test the long run relationship of the variables and to test the cointegration of variables in combined form, which means if their linear combination will be stationary or not. If this test proves that there is a stationary combination of variables, then it implies all of the variables are cointegrated even if they were not stationary individually.

The advantage of using this model is that it always yield valid result about the cointegration regardless the fact that variables are integrated at order one or order zero can also be denoted as I(1) and I(0) respectively or even combination of both. Thus, even though the variables containing I(0) or I(1) this method can help to find the cointegration between the variables.

Johansen Cointegration model representing two variables are as follows

$$\triangle y_t = \sum_{t=1}^{p-1} \Gamma_i \triangle y_{t-1} + \prod y_{t-1} + \beta x_t + \varepsilon_t, t = 1, 2, 3, ..., T \quad (2)$$

In the given equation y_t is the vector of selected endogenous variables β is the constant ε_t is the error term of the equations, T stands for the number of observations, Γ ∏ are the parameters. The information about the long-term relationship in the vector y_t can find out by ∏ matrices. The lag selection for both of the model will be selected based on a lag length which will be the optimal lag for the selected sample size of this study.

C. Vector Error Correction Model (VECM)

Vector Error Correction Model VECM is a fundamental VAR with an error correction term incorporated into the regression model. VECM is the primary model for this study to test the relationship between the selected variables. This model is applicable with cointegrated variables, by implying an appropriate VECM model we can determine the long-term stable causality between the variables. The fundamental reason for the error correction term in this model is to measure movements which positively cause long term stable casualty.

If a set of variables happens to have one or more cointegration with each other, then VECM is a suitable estimating technique which adjusts the changes in the variables and also helps to find a long-run relationship between them.

The General VECM model for tor variables is as follows:

$$\triangle y_t = \beta_0 + \sum_{i=1}^{m} \beta_i \triangle y_{t-i} + \sum_{i=0}^{n} \delta_i \triangle x_{t-i} + \varphi z_{t-1} + \mu_t \quad (3)$$

The error correction term (1.3) is given in (1.4)

$$\triangle z_{t-1} = y_{t-1} - \beta_0 + \beta_1 x_{t-1} \quad (4)$$

In (1.3) and (1.4) $\triangle z_{t-1}$ is the error correction term, whereas $\triangle$ it is the first difference operator, x_t is the independent variable and y_t is the dependent variable. z_{t-1} Is the error term generated by Johansen Cointegration test, β_0, β_i and δ_i are the coefficients and φ is the coefficient of the error term, whereas μ_t is the disturbance term.

D. Research Hypothesis

There will be the following hypothesis on the relationship of our selected variables which are as follows:

i. H_0 = Exchange rate has no significant effect on imports of Pakistan whereas H_1 = Exchange rate has a significant impact on imports of Pakistan.

ii. H_0 = Exchange rate has no significant effect on exports of Pakistan whereas H_1 = Exchange rate has a significant effect on exports of Pakistan.

IV. Results And Discussion

A. Lag Order Selection

The Table I shows that the lag of order 4 is sufficient for this model based on Final predictor error (FPE) and LR test statistics. However, Schwarz information criteria (SIC), Akaike information criterion (AIC) and Hannan-Quinn information criterion (HQ) selected lag of order 5. Table I states the results for Lag order selection by VAR, the Endogenous variables selected are IM, EX and EXR as imports, exports and exchange rate respectively. The sample size is from 1993 to 2017, whereas included observations for this test are 20.

TABLE I. Lag order selection Critera

Lag	Log L	LR	FPE	AIC	SC
0	-198.2759	NA	110659.5	20.12759	20.27695
1	-136.0219	99.60642	547.2779	14.80219	15.39963
2	-125.9958	13.03399	533.0468	14.69958	15.74510
3	-116.5005	9.495289	621.5738	14.65005	16.14365
4	-89.48251	18.9125*	161.8083*	12.84825	14.78993
5	-72.55704	6.770191	207.2128	12.05570*	14.44546*

a. Source: Eviews 10

B. Stationary Test

For stationary test (ADF) test is conducted of each of the variables both the lag of 5 by Schwarz's criterion or lag of 4 by Final prediction error (FPE) can be used. The results show that all of the variables are not stationary at level because their p-value was greater than the critical value of 0.05, so we cannot reject the null hypothesis H_0 at the level. Hence the ADF test is conducted at first difference to make the variables stationary. The p-value at first level was less than the critical value so we can reject the H_0. Results can be seen in Table II which states only Probability values of variables.

C. Johansen Cointegration Test

For this test, we will use the selected optimal lag order of 4. The results of this test are shown in Table III which states that we reject the null hypothesis H_0 for None* and at most one * because the p-values are less than 0.05. On the contrast of this, we accept the null hypothesis H_0 for at most 2 because it's p-value = 0.0682 which is higher than 0.05 which means two co-integration quotations exist in this model. Table III results of Trace test indicates two co-integrating equations at the level 0.05.

From Table IV, we reject the null hypothesis H_0 for None* and at most 1 * because the p-values are less than 0.05. On the contract of this, we accept the null hypothesis H_0 for at most 2 because it's p-value = 0.0682 which is higher than 0.05 which means two cointegration quotation exist in this model. In table IV Max-eigenvalue test indicates two cointegrating equations at level 0.05.

TABLE II. Augmented Dickey-Fuller Test (ADF)

ADF		
Variables	***At level***	***At first difference***
Exchange rate	0.9195	0.0442
Imports	0.9770	0.0004
Exports	0.7457	0.0025

TABLE III. Trace Statistic test

Hypothesis no of CE.	Eigenvalue	Trace Statistics	0.05 critical value	*Prob.***
None*	0.815779	53.44199	29.79707	0.0000
At most 1 *	0.557003	19.60959	15.49471	0.0113
At most 2	0.153197	3.325748	3.841466	0.0682

TABLE IV. MAXIMUM EIGENVALUE TEST

Hypothesis no of CE.	Eigenvalue	Trace Statistics	0.05 critical value	Prob.**
None*	0.815779	33.83240	21.13162	0.0005
At most 1 *	0.557003	16.28384	14.26460	0.0237
At most 2	0.153197	3.325748	3.841466	0.0682

D. Vector Error Correction Model

Now we can future proceed with the VECM for our study's analysis with cointegration of 2 and lag length of 4 (Table I and II) to test whether how much dependent variables can explain the independent variable and also to examine the long run and short run casualty of the variables. In our study, we selected two equations displaying R-squared value and p-value because our research consists of two dependent variables which are imports and exports. Table V states the VECM test results for equations of imports and exchange rate, the results founded that there is a long run relationship between imports and exchange rate of Pakistan as it shows the coefficient of this equation is negative, and p-value is less than 0.05, for long-run relationship coefficient should be negative, and probability should be less than 0.05. Table V states the detailed results of VECM for imports and the exchange rate

Whereas for a short-run relationship for imports and exports Wald test for imports and exchange rate can be seen from Table VI. The results state that there is no short-term relationship between imports and the exchange rate of Pakistan as a probability value is more than 0.05 for F-statistics and Chi-square.

VECM test results for the equation of exports and exchange rate are given in Table VII, which states that there is a long run relationship between exports and exchange rate of Pakistan as it shows the coefficient of this equation is negative, and the p-value is less than 0.05, for long-run relationship coefficient should be negative, and probability should be less than 0.05.Table VII states the detailed results of VECM for exports and exchange rate

Whereas for the short-run relationship between exports and exchange rate Wald test is conducted, results are shown in Table VIII Findings conclude that there is also a short-term relationship between exports and exchange rate of Pakistan as the probability is less than 0.05 for F-statistics and Chi-square.

TABLE V. VECM FOR IMPORTS AND EXCHANGE RATE

	Co efficient	*Std.Error*	*t-statistics*	*Prob.*
C(1)	-0.364221	0.228762	1.592138	0.0458
R-squared	0.778086	Mean depend var		2.169381
Adjusteed R-squared	0.506857	S.D dependent var		4.761779
S.E. regression	3.343918	Akaike info criteria		5.547722
Sum squared resid	100.6361	Schwarz criterion		5.547722
Log likelihood	-46.25109	Hannan-Quinn Critter		5.677258
F-statistic	2.868746	Durbin-Watson stat		1.755292
Prob (F-statistic)	0.042267			

TABLE VI. WALD TEST RESULTS FOR IMPORTS

Wald test			
T-statistics	*Value*	*Df*	*Probability*
F-statistics	0.445310	(2,9)	0.6540
Chi-square	0.890619	2	0.6406

TABLE VII. VECM RESULTS FOR EXPORTS AND EXCHANGE RATE

	Coefficient	Std.Error	t-statistics	Prob.
C(17)	-0.191886	0.075185	2.552194	0.0311
R-squared	0.836260	Mean depend var		0.581143
Adjusteed R-squared	0.636013	S.D dependent var		1.821623
S.E. regression	1.099009	Akaike info criteria		3.322254
Sum squared resid	10.87038	Schwarz criterion		3.919124
Log likehood	-22.8836	Hannan-Quinn Criter		3.451790
F-statistic	4.177006	Durbin-Watson stat		1.424043
Prob (F-statistic)	0.020326			

TABLE VIII. WALD TEST FOR EXPORTS

Wald test			
T-statistics	*Value*	*Df*	*Probability*
F-statistics	5.415860	(3,9)	0.0210
Chi-square	16.24758	3	0.0010

V. CONCLUSION

The conventional perception is that foreign trade contributes to an increase in a country's GDP in both short run and long run through the provision of foreign exchange for developing countries. So, it is concluded even in the previous studies that international trade acts as a growth engine, especially for developing countries. However, most of the developing countries cannot take benefit from international trade because of their volatile exchange rates. As this study has shown that the exchange rate has a relationship with the foreign trade of a country.

So from the results of this study, we reject the null hypothesis for both imports and exports made for this specific research that H_0 which state exchange rate has no significant effect on imports and exports of Pakistan.; whereas, expect the alternative hypothesis H_1 which states exchange rate has a considerable effect on imports and exports of Pakistan.

From the result of this study we can see that there is no short-term relationship between imports and exchange rate. However, this study has concluded the results based on just US dollars currency for exchange rate and taking overall imports and exports of Pakistan not specified to specific countries. So, this study can be further be discussed and worked based on specific countries and on different currencies exchange rate.

If a country adopts effective policies, it can even take benefits from its volatile exchange rate. As this study concluded that there is a long-term relationship between the exchange rate, imports and exports and also short-term relation with export according to lasted updated data of foreign trade and exchange rate of Pakistan. So, if a country takes

precautionary measures, it can also enhance its trade balance by its exchange rate.

In the case of Pakistan by changing its exchange rate, it can decrease or increase its imports in the future and can either result in an increase or decrease in exports. However, as this study did not show how the exchange rate will affect the foreign trade? So even further studies can work to find out the positive and negative relations between these variables. However, policy measure should be taken by the government of Pakistan mainly towards the stability of exchange rates to future avoid a trade deficit.

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