Pak. J. Commer. Soc. Sci.
2012 Vol. 6 (1), 83-96

Effectiveness of Exchange Rate in Pakistan: Causality Analysis

Rana Ejaz Ali Khan (Corresponding Author)
Associate Professor, Department of Management Sciences,
COMSATS Institute of Information Technology, Sahiwal. Pakistan.
E-mail: ranaejazalikhan@yahoo.com

Rashid Sattar
Department of Economics, The Islamia University of Bahawalpur. Pakistan
E-mail: rashid.sattar@iub.edu.pk

Hafeez ur Rehman
Department of Economics, The Islamia University of Bahawalpur. Pakistan
E-mail: hafeez.rehman@iub.edu.pk

Abstract

The study analyzed the effectiveness of exchange rate on macroeconomic variables of Pakistan. The precise objective of the study is to examine the causality between exchange rate, trade, inflation, FDI and GDP through a series of models. On the annual time series data for the years 1980-2009 unit root test for stationarity, Johansen's cointegration test for long-run equilibrium relationship between the variables for each model and Granger Causality test to check the causality between the variables is applied. The main findings are as: there is no long-run equilibrium relationship between exchange rate and inflation, but there exists long-run equilibrium relationship between exchange rate and trade. There is also long-run equilibrium relationship between exchange rate and FDI and causality runs in both directions, i.e. exchange rate to FDI and FDI to exchange rate. Finally, there is long-run equilibrium relationship between exchange rate and GDP but causality does not run in either direction.

Keywords: **Exchange rate, Pakistan, Inflation, FDI, GDP**.

1. Introduction

Exchange rate is one of the most important policy variables in an open economy as it affects the macroeconomic variables like, trade, capital flows, FDI, inflation, international reserve, GDP and remittances, etc. The economists and policy makers believe that increasing the exchange rate brings about competitive advantage in international trade. When a country increases exchange rate, domestic export goods becomes cheaper relative to its trading partners resulting into an increase in international demand of exports and a decrease in imports. It also affects the FDI and remittances. All of these ultimately affect the level of GDP. Due to the change in the prices of imports and exports, there emerged the possibility of change in inflation in the economy.

For an economy like Pakistan exchange rate plays an important role in international trade along with FDI and ultimately the GDP. The impact of exchange rate volatility on macroeconomic variables particularly the international trade has been studied intensively since the late 1970's when the exchange rate moved from fixed to flexible system. The theory explains that higher exchange rate volatility reduces trade by creating uncertainty about future profits from export trade. By using the forward markets and managing the timings of payments and receipts the exports can reduce the uncertainties in the short-run. In the long-run, exchange rate volatility may affect trade indirectly by influencing firms' investment decisions. Real exchange rate is crucial to determine foreign direct investment. Goldberg and Klein (1997) opined that foreign direct investment in less developed countries is significantly affected by bilateral real exchange rate.

Less restrictive models of the equilibrium exchange rate, such as the traditional Mundell-Fleming model (Mundell, 1963) or generalized portfolio balance (Branson and Buiter, 1983) assume that output is not fixed at the level of full employment, and postulate that the current account balance determines the equilibrium exchange rate. In other words, the real exchange rate, rather than assumed to be constant, is related to the relative output levels. The empirical implication of this hypothesis is that the real exchange rate should be co-integrated with the relative levels of domestic and foreign output.

The change in exchange rate can affect domestic prices through direct and indirect channels. Under the direct channel, a fall in exchange rate may trigger increase in the prices of imports of finished goods and inputs in local currency. Under the indirect channel, depreciation of the exchange rate makes domestic products relatively cheaper for foreign buyers, demand for exports rise and induce an increase in the domestic price level subject to limited surplus for exports. Since nominal wage contracts are fixed in the short-run, so real wages decline. However, when real wages approach to their original level over time, the production cost increases and the overall price level moves up.

For the reasons, exchange rate is the most watched analyzed and manipulated economic measures by governments. However, the empirical evidences of such types of relationships are mixed for different economies possibly due to the economic level, structure and international trade policies. The objective of our study is to empirically see the effectiveness of exchange rate for adjusting trade, inflation, FDI and GDP in Pakistan.

2. Review of Literature

There is a variety of literature on exchange rate implications for different economies. It ranges from causality analysis to effectiveness of exchange rate policies. Similarly, a good range of techniques exists in the literature. For instance, Rittenberg (1993) employed the granger causality tests to examine the relationship between change in exchange rate and price level in Turkey. Since causality tests were sensitive to lag selection, therefore the researcher employed three different methods for optimal lag selection. In all cases it was found that causality runs from price level change to exchange rate change but there was no feedback causality from change in exchange rate to change in price level.

The simultaneous determination of nominal exchange rate and domestic price level in Pakistan has been analyzed by (Ahmad and Ali, 1999). The study concluded that the relationship between price level and exchange rate was bi-directional. So managing the exchange rate was not proposed in the presence of inflation. Bhatti (2001) using the quarterly data of 1982-2004 and applying Johansen multivariate maximum likelihood technique of cointegration concluded that there exists a long-run relationship between exchange rate and relative prices, income and interest rate.

Aftab and Aurangzeb (2002) investigated the long-run and short-run impact of exchange rate devaluation on Pakistan's trade performance. They used the Johansen's co-integration technique to investigate the long-run trade elasticities and the presence of Marshall-Lerner (ML) condition. They also investigated the short-run exchange rate dynamics by constructing an error-correction model to trace the J-curve. For the quarterly data for time period 1998-2000, the study reaffirmed the satisfaction of the ML condition in the long-run for Pakistan. The results showed that there was the existence of j-curve phenomenon in the country. The results indicated that the real depreciation of Pak-rupee may be used as a policy tool to improve the trade balance.

The effect of exchange rate volatility on export growth has been investigated by Mustafa and (Nishat, 2004). They used quarterly data for the years 1991-2004 and applied cointegration and error-correction technique. The study concluded with mixed results of export growth in Pakistan for different economies. The volatility of exchange rate has negative and significant effect in the long-run and short-run for Australia, New Zealand, UK and US. However for the countries like Bangladesh and Malaysia no empirical relationship observed. Azid et al. (2005) have probed whether excessive volatility or shifting of exchange rate regimes have pronounced effects on manufacturing sector of Pakistan. The results obtained by impulse response endorsed that exchange rate volatility has no significant effect on manufacturing production. It raised a serious concern to policy makers about the cost of adopting flexible exchange rate system.

The empirical evidence on interaction between exchange rate and FDI are based on the fact the there is a keen competition for FDI among countries. The exchange rate policy could explicitly or implicitly serve as an instrument to reinforce a country’s FDI competitiveness. Xing (2006b) examined the FDI-exchange rate nexus in the context of one FDI source and two host countries. It focused on the effect of exchange rates on relative FDI inflows between the two host countries. The theoretical analysis shows explicitly that relative FDI inflows are a function of relative real exchange rates. In particular, if one host country devalues its currency against that of the source country more than the other does, FDI into the former country will be expected to increase relative to the other country. This theoretically inference is examined by the study, with Japanese FDI in manufacturing industries of China and ASEAN-4 (Indonesia, Malaysia, Philippines and Thailand). The results support the theoretical conclusion suggesting that real devaluation of the Chinese Yuan undercut FDI into ASEAN-4. The theoretical and empirical results also suggested that the relation between exchange rates and FDI is multidimensional. The exchange rate policy of one FDI host country influences not only its own FDI inflows but also substantially affects FDI into other countries competing for FDI from the same source.

Examining the competition between China and ASEAN-4 for FDI from Japan, Xing and Wan (2006) empirically show that the Chinese Yuan’s cumulative devaluation was one of the reasons causing shifting of Japanese FDI from ASEAN-4 to China. Based on analysis of Japanese FDI in China’s manufacturing, Xing (2006a) argued that the cumulative devaluation of the Chinese Yuan significantly enhanced Japanese direct investment into China.

The relationship between exchange rate volatility and economic growth for Pakistan had been empirical investigated by Javed and Farooq (2009) employing Error Correction techniques along with Auto Regressive Distributed Lag (ARDL) Model. They concluded that exchange rate volatility, reserve money and exports have long-run positive relationship with economic growth. Alam and Ahmed (2010) have investigated the impact of exchange rate volatility on Pakistan's aggregate export demand. The study concluded that real effective exchange rate has not increased the level of exports in the long-run. The study further concluded that volatility of real depreciation has not decreased import demand in Pakistan, i.e. import demand is insensitive or inelastic to real depreciation and its volatility

3. Data and Model Specifications

The main objective of this study is to explore the links between exchange rate, and trade, inflation, FDI and GDP in Pakistan. We used the annual time series data for the years 1980-2009. The data has been taken from Economic Survey of Pakistan, Federal Bureau of Statistics and World Bank. Most of the economic variables exhibit a non stationary trend.

We checked the stationarity of data, otherwise ordinary least square may generate spurious results. We used the Augmented Dickey-Fuller (ADF) test developed by Dickey and Fuller (1981) to find the unit root problem in data, which is indication for non-stationarity of data. ADF test is based on the following equation:

$$(1\text{-}L)Y_{t=\alpha} + \mu Y_{t-1} + \sum_{i=1}^{k} \beta_i \, (1\text{-}L)\, Y_{t-i} + ut \text{ ……..… (i)}$$

Where, L is a lag operator, t denotes time trend, and u_t is a white noise error term. Y_t denotes the variables for which study is testing unit root problem. Y_{t-i} are the lagged values of variables of our study. β_i are the coefficients of lagged values of Y_{t-i} to capture the optimum lag length (k), k ensures that there is no correlation between error term and regressors of this equation. Lag length is selected by AIC criterion. The equation is only with constant α and includes also time trend γt afterward along with constant. ADF test checks the statistical significance of μ, if μ has statistically zero value then Y_t has unit root problem and is non-stationary. If μ is not statistically zero then there is not a problem of unit root and Y_t is stationary.

A series of the models have been used to see the effectiveness of exchange rate (EXR = Rs/Dollar) on macroeconomic variables like inflation (INF = Consumer Price Index), foreign direct investment (FDI = FDI as a percentage of GDP), international trade (TR = Volume of Trade as percentage of GDP), and gross domestic product (GDP = GDP growth rate).

We hypothesized that exchange rate is conintegrated with inflation, trade, FDI and GDP.

Cointegration, a multivariate technique, occurs between two or more time series variables, if one or more linear combinations of different nonstationary time series produce stationary time series (Engle and Granger, 1987). The linear combination produces the long run relationship between different time series because it is a description of the lasting effects shared by the different time series (Johansen, 1995). The long run relationship, as a statistical point of view, means the variables move together over time so that short term disturbances from the long term trend will be corrected. A lack of cointegration suggests that such variable have no long run equilibrium relationship and in principle, they can wander arbitrarily far away from each other (Dickey et al., 1991).

The Johansen (1991) maximum likelihood test is used to test the cointegration between EXR, INF, FDI, TR and GDP. That means it examines, whether the series are driven by common trends (Stock and Watson, 1988) or, equivalently, whether they are cointegrated (Engle and Granger, 1987). The test statistic is used as follows;

$$X_t = \delta_1 X_{t-1} + \delta_2 X_{t-2} + \ldots + \delta_k X_{t-k} + \zeta_t \qquad \text{(ii)}$$

Where X_t is the vector of non-stationary I (1) variables; δ_1, δ_2, .. δ_k are the parameters; ζ_t is the vector of random errors which is distributed with zero mean and Ω variance matrix.

The model can be further rewrites as:

$$\Delta X_t = \theta X_{t-1} + \sum_{i=1}^{p-1} \lambda_i \Delta X_{t-i} + \varepsilon_t \ \ldots\ldots \text{(iii)}$$

Where $$\theta = \sum_{i=1}^{p} \lambda_i \partial_i - I_i \quad \ldots\ldots\ldots\ldots\ldots \text{(iv)}$$

and $$\lambda_i = -\sum_{j=1}^{p} \lambda_i \partial_j \quad \ldots\ldots,\ldots \text{(v)}$$

The Granger representation theorem asserts that if the coefficient matrix θ has reduced rank r < x, there exists x X r matrix ω and Ω each with rank r such that $\theta = \omega\Omega'$ and $\Omega' X_t$ is stationary. R is the number of cointegrating relations (the cointegration rank) and each column of Ω is the cointegrating vector. The elements of ω are known as the adjustment parameters in the vector error correction model. Johansen's method is to estimate θ matrix is an unrestricted form, the test whether we can reject the restrictions implied by the reduced rank of θ.

We use Granger Causality Test to analyze the causality between variables for each model. If both variables are integrated of order one, 1(1), and there is cointegration between them. Granger causality test is a technique for determining whether one time series is useful in forecasting other one.

4. Results and Discussion

Before conducting tests for cointegration and causality, the stationarity properties of the variables have been checked by using Augmented Dickey-Fuller (ADF) unit root test. To determine the order of integration of time series, unit root test has been applied on level as well as first difference. The table-1 shows the results of ADF unit root test. Stationarity of all variables has been tested with intercept and trend. Results indicate the acceptance of the unit root hypothesis in the level, then time series become stationary in first difference, in other words all the variables are integrated of order one, I(1).

Table 1: Results of ADF Unit Root Test

Variables	Level		First Difference	
	t-statics	critical value at 1%	t-statics	critical value at 1%
Exchange Rate	-1.653	-4.416	-5.611	-4.416
Trade	-4.953	-4.309	-5.262	-4.356
Inflation	-3.393	-4.394	-6.186	-4.323
FDI	-4.372	-4.440	-4.080	-3.644
GDP	-3.750	-4.309	-3.583	-3.261

4.1 Exchange Rate and Inflation

In the literature, there are various trends associated with the use of fixed exchange rate to reduce inflation. These trends include an appreciation of the real exchange rate, strong growth of output and aggregate demand and a widening of trade and current account deficit. Two broad approaches exist to explain these developments. One approach focuses on explaining the stylized facts of exchange rate based stabilization, in an equilibrium framework, assuming that prices clear the goods market at each moment in time (see Rebelo and Vegh, 1995 for overview of equilibrium theories). In this equilibrium approach the disinflation associated with exchange rate based stabilization is shown to raise aggregate demand, thereby boosting output, raising prices of non-tradable goods appreciating the real exchange rate and widening the trade deficit. The second broad approach towards understanding the effects of exchange rate based stabilization stresses the persistence of inflation in a framework in which goods and/or labor markets temporarily may be out of equilibrium. It might be termed as “intertial inflation” approach, immediately following the implementation of a fixed exchange rate regime, inflation is posited to be slow to decline to international levels as a result of over-lapping contracts, imperfect credibility, or backward-looking expectations (Dornbusch and Werner, 1994). The presence of intertial inflation explains both the real appreciation of the exchange rate and determination of trade performance observed during exchange rate based stabilization program.

The theoretical model relating the Exchange Rate Pass Through (ERPT) to a lower inflation environment is provided by Tylor (2000). This is explained through a model of firm behavior based on staggered price setting and monopolistic competition. As firms set prices for several periods in advance, they are more responsive to cost increase due to exchange rate movement if cost changes are perceived to be persistent. The regimes with higher inflation tend to lead to persistent cost changes. Taylor argued that a high inflation environment would thus tend to increase ERPT. In other words, ERPT would be endogeneous to a country’s inflation performance. Devereux and Yetman (2010) developed a related argument. In their model with sticky prices, they allowed for the frequency price changes to be chosen by firm. For a given menu cost of changing prices, their model shows that firm will choose a higher frequency of price adjustment, the higher is the average rate of inflation and the volatility of the nominal exchange rate. The higher in the frequency of price changes, the greater is ERPT. Campa and Goldberg (2005) argued that an important implication of Taylor’s argument is that there is a virtuous circle where low inflation leads to reduce ERPT which makes it easier to keep inflation low, thereby keeping ERPT low. Choudhri and Hakura (2006) found strong evidence of a positive correlation between ERPT and the average inflation for a large sample of developed and emerging market economies.

For Pakistan, there are empirical evidences of increase in exchange rate to boost inflation (see Ahmed and Ali, 1999). We will check cointegration between exchange rate and inflation which explores the long-run equilibrium relationship between them. Akaike Information Criterion (AIC) is used to determine the optimal lag length selection.

Table 2: Results for Lag Length Selection

Lag Length	AIC
0	14.594
1	10.484
2	10.452
3	10.403*
4	10.584

AIC denotes Akaike Information Criterion
* indicates optimal lag length selected by AIC

The AIC has been again used to determine the most appropriate model specification for Johansen cointegration test.

Table 3: Optimal Model Specification Selected by the AIC

Number of cointegration equations	Model 1	Model 2	Model 3	Model 4	Model 5
0	10.914	10.914	10.790	10.790	10.785
1	10.786	10.787	10.689	10.651*	10.652
2	10.989	10.892	10.892	10.747	10.747

*indicates optimal model specification selected by the AIC

Results of the cointegration test are reported in tables-3. Both the Trace Eigenvalue test and Maximum Eigenvalue test indicate no-cointegratin, which shows that there is no long-run relationship between exchange rate and inflation.

Table4: Johansen Cointegration Test (Trace Eigen value Statistics)

Number of cointegrating equations	Eigenvalue	Trace statics	5% critical value
None*	.407	21.127	25.872
At most 1	.251	7.515	12.517

Table 5: Results of Johansen Cointegration Test (Maximum Eigen value Statistics)

Number of cointegrating equations	Eigenvalue	Max statics	5% critical value
None*	.407	13.612	19.387
At most 1	.251	7.515	12.517

We have calculated the Wald test statics for causality between exchange rate and inflation (see table-6). The Wald static shows no causality in either direction. The evidence of long-run cointegration does not exist between exchange rate and inflation.

Table 6: Causality Results Based on Wald Test Statistics

Hypothesis	Wald test-statics	Prob
Exchange Rate does not cause Inflation	3.80	0.149
Inflation does not cause Exchange rate	2.89	0.235

4.2 Exchange rate and Trade

Theoretically there exists a correlation between exchange rate and international trade. A depreciation in currency makes the exports cheaper and imports costly. In this way the effect of depreciation on international trade may be positive or negative. If the exports are more price sensitive to the imports and the country is having surplus items of exports then total volume of the trade will be increased. On the other hand if imports are more price sensitive as compared to the exports and the country is having deficit balance of payments then there may be possibility of decreased trade volume of the country. Ahmed, et. al. (2006) supported the conventional positive responsiveness of net exports due to real exchange rate depreciation but largely driven by falling imports rather than rising exports.

Similarly the volume of trade along with its composition, i.e. volume of imports and exports also affects the exchange rate. For a country having higher bulk of the trade, if the ratio of exports to imports is higher, then there may be a possibility of decrease in exchange rate. Although Ahmed et al. (2006) empirically evidenced that terms of trade shocks have very little effect on Pakistan's real exchange rate.

For empirical investigation we have checked the cointegration between exchange rate and trade to explore the long-run equilibrium relationship between exchange rate and trade. The results of Akaike Information Criterion (AIC) to determine the optimal lag length selection has been shown in table-7.

Table 7: Results of Lag Length Selection

Lag Length	AIC
0	15.301
1	11.000*
2	11.235
3	11.461

AIC denotes Akaike Information Criterion

* indicates optimal lag length selected by AIC

The AIC has been used to determine the most appropriate model specification for Johansen cointegration test. The results are shown in table-8.

Table 8: Optimal Model Specification Selected by the AIC

Number of cointegration equations	Model 1	Model 2	Model 3	Model 4	Model 5
0	11.659	11.659	11.512	11.512	11.592
1	11.473	11.329	11.144	11.090*	11.100
2	11.602	11.402	11.402	11.263	11.263

*indicates optimal model specification selected by the AIC

Results of the Johansen cointegration test are reported in tables-9 and 10. Both the Trace Eigenvalue test and Maximum Eigenvalue test indicate cointegration expressing long-run relationship between exchange rate and trade.

Table 9: Results of Johansen Cointegration Test (Trace Eigenvalue Statistics)

Number of cointegrating equations	Eigenvalue	Trace statics	5% critical value
None*	.540	26.958	25.872
At most 1	.168	5.155	12.517

*indicates significance at 5% level

Table 10: Results of Johansen Cointegration Test (Maximum Eigenvalue Statistics)

Number of cointegrating equations	Eigenvalue	Max statics	5% critical value
None*	.540	21.802	19.387
At most 1	.168	5.155	12.517

*indicates significance at 5% level

The Wald-static for exchange rate and trade are shown in table-11, which shows no causality in either direction. The evidence of long-run cointegration between exchange rate and trade is existed. The results may be explained as the imports of the country are inelastic to prices so an increased exchange rate has no effect on the imports. On the other hand, for exports we have no surplus of exports mainly due to compressed agricultural production. So exports remained unaffected to change in exchange rate. Furthermore, in the global market demand for agricultural products is inelastic to price.

Table 11: Causality Results Based on Wald Test Statics (Model 2)

Hypothesis	Wald test-statics	Prob
Exchange Rate does not cause Trade	1.878	0.391
Trade does not cause Exchange rate	1.089	0.580

Theoretical studies on the nexus of FDI and exchange rate explained that a devaluation of the host country' (of FDI) currency against that of a source country enhance inflows of FDI through both the production cost and relative wealth channels. Exchange rate not only influence FDI flows between source and host countries, but also the distribution of FDI among host countries competing for FDI from the same source country. Given other factors determining FDI, such as market size, growth, labor skill, political and economic stability and the regulatory framework constant, if a host country devaluates its currency against that of the FDI source country by more than its rival countries, the devaluation will reduce its local production cost in terms of foreign currency more, thus making it more attractive for foreign investment. In other words, from the point of view of foreign investors, the wealth and production cost effects associated with devaluation should be greater in the country which devalues its currency more, therefore strengthening its competitiveness for FDI and leading to a higher level of FDI inflows.

In our study for the third model of exchange rate and FDI, the results of Akaike Information Criterion (AIC) to determine the optimal lag length selection are shown in table-12.

Table 12: Results for Lag Length Selection

Lag Length	AIC
0	11.296
1	6.667
2	6.002*
3	6.198

AIC denotes Akaike Information Criterion
* indicates optimal lag length selected by AIC

The AIC results to determine the most appropriate model specification for Johansen cointegration test are shown in table-13.

Table 13: Optimal Model Specification Selected by the AIC

Number of cointegration equations	Model 1	Model 2	Model 3	Model 4	Model 5
0	6.622	6.622	6.455	6.455	6.528
1	6.415	6.471	6.231*	6.305	6.306
2	6.491	6.494	6.494	6.420	6.420

*indicates optimal model specification selected by the AIC

Results of the cointegration test are reported in the tables-14 and 15. Both the Trace Eigenvalue test and Maximum Eigenvalue test indicate one cointegrating equation, which shows that there exists long-run relationship between exchange rate and FDI.

Table 14: Johansen Cointegration Test (Trace Eigenvalue Statistics)

Number of cointegrating equations	Eigenvalue	Trace statics	10% critical value
None*	.405	14.928	13.428
At most 1	.032	.887	2.705

*indicates significance at 10% level

Table 15: Johansen Cointegration Test (Maximum Eigenvalue Statistics)

Number of cointegrating equations	Eigenvalue	Max statics	10% critical value
None*	.405	14.040	12.296
At most 1	.032	.887	2.705

*indicates significance at 10% level

The results of Wald test statics for causality between exchange rate and FDI are shown in table-16. The Wald-static shows the causality in both directions.

Table 16: Causality Results Based on Wald test statics

Hypothesis	Wald test-statics	Prob
Exchange Rate does not cause FDI	5.750	.056
FDI does not cause Exchange rate	22.067	.0000

The bi-directional positive relationship between FDI and exchange rate[1] may be explained as an increase in exchange rate enhances the value of foreign currency making the decrease in cost of production in host currency. It attracts the foreign investment. On

[11] Bayoumi and Lipworth (1998) emphasized that for Southeast Asian economies the bilateral real exchange rate was one of the FDI determinants for these countries.

the other hand, the increase in FDI results into increased exports as in Pakistan, foreign direct investment is mainly concerned with export industry. The phenomenon contributes to variability in exchange rate.

4.3 Exchange Rate and GDP

For the model of long-run equilibrium relationship between exchange rate and GDP, the Akaike Information Criterion (AIC) results to determine the optimal lag length selection are shown in table-17.

Table 17: Results of Lag Length Selection

Lag Length	AIC
0	13.125
1	9.260*
2	9.353
3	9.520

AIC denotes Akaike Information Criterion

* indicates optimal lag length selected by AIC

The AIC is again used to determine the most appropriate model specification for Johansen cointegration test.

Table 18: Optimal Model Specification Selected by the AIC

Number of cointegration equations	Model 1	Model 2	Model 3	Model 4	Model 5
0	9.769	9.769	9.621	9.621	9.675
1	9.732	9.513	9.349	9.343	9.332*
2	9.888	9.602	9.602	9.508	9.508

*indicates optimal model specification selected by the AIC

Results of the cointegration test are reported in tables-19 and 20. Both the Trace Eigenvalue test and Maximum Eigenvalue test indicate one cointegrating equation, which shows that there is long-run relationship between exchange rate and GDP.

Table 19: Johansen Cointegration Test (Trace Eigenvalue Statistics)

Number of cointegrating equations	Eigenvalue	Trace statics	5% critical value	10% critical value
None*	.466	20.692	18.397	16.106
At most 1	.104	3.091	3.841	2.705

*indicates significance at 5% and 10% level

Table 20: Johansen Cointegration Test (Maximum Eigenvalue Statistics)

Number of cointegrating equations	Eigenvalue	Max statics	5% critical value	10% critical value
None*	.466	17.600	17.147	15.001
At most 1	.104	3.091	3.841	2.705

*indicates significance at 5% and 10% level

The Wald-static shows no causality in either direction (see table-21). There is evidence of long-run cointegration between exchange rate and GDP.

Theoretically there exists a positive correlation between high exchange rate and economic growth of a country. The depreciation stimulates economic growth, if the imports are price elastic and comprised of consumer items or the exports are price elastic. It may be particular case for developing economies.

On the other hand, due to economic development there would be efficient use of resources, adaptation of technology and refined human capital resulting into better quality output in a bigger volume for exports. Consequently prices of exports are decreased and the relative prices of imports are increased. In the case of Pakistan, the scenario is different. The major imports are comprised of raw material like machinery, petroleum, oil and lubricants and chemicals. On the other hand major exports are consisted of agricultural products. It explains the results of current study, i.e. no causality between the exchange rate and GDP.

Table 21: Causality Results Based on Wald test statics

Hypothesis	Wald test-statics	Prob
Exchange Rate does not cause GDP	2.857	0.239
GDP does not cause Exchange rate	2.502	.286

5. Conclusion

We analyzed the effectiveness of exchange rate on inflation, trade, GDP and FDI for Pakistan. The major findings of the study are as follows:

- Exchange rate and inflation are not cointegrated with each other. So there is no causality in either direction.
- Exchange rate and trade are cointegrated with each other, so there is long-run equilibrium relationship between exchange rate and trade, but no causality found in either direction.
- Exchange rate and FDI are cointegrated with each other, so there is long-run equilibrium relationship between exchange rate and FDI and causality found in both directions.
- Exchange rate and GDP are also cointegrated with each other but there is no causality in either direction.

It may be concluded that exchange rate policy is not effective to have the desired results for macroeconomic variables. Only foreign direct investment is the area for which exchange rate may contribute.

REFERENCES

Aftab, Z. and Aurangzeb (2002). The Long-Run and Short-Run Impact of Exchange Rate Devaluation on Pakistan's Trade Performance. *The Pakistan Development Review*, 41(3), 277-286.

Ahmad, E. and Ali, A.S. (1999). Exchange Rate and Inflation Dynamics. *The Pakistan Development Review*, 38(3), 235-251.

Ahmed, S., Ara, I. and Hyder. K. (2006). How External Shocks and Exchange Rate Depreciation Affects Pakistan's Implication for Choice of an Exchange Rate Regime. *SBP Research Bulletin*, 1(2), 61-88.

Alam, S. and Ahmed, Q.M. (2010). Exchange Rate Volatility and Pakistan's Import Demand: An Application of Autoregressive Distributed Lag Model. *International Research Journal of Finance and Economics*, Issue 48, 7-22.

Azid, T., Jamil, M. and Kausar, A. (2005). Impact of Exchange Rate Volatility on Growth and Economic Performance: A Case Study of Pakistan (1973-2003). *Pakistan Development Review,* 44, 479-775.

Bayoumi, T. and Lipworth, G. (1998). Japanese Foreign Direct Investment and Regional Trade. *Journal of Asian Economics*, 9(4), 581-607.

Bhatti, R.H. (2001). Determining Pak Rupee Exchange Rate vis-à-vis Six Currencies of the Industrial World: Some Evidence Based on National Flow Model. *Pakistan Development Review,* 40, 885-897.

Branson, W.H. and Buiter, W.H. (1983). Monetary and Fiscal Policy with Flexible Exchange Rate, In J. S. Bhandri and B. H. Putnam (eds.) Economic Independence and Flexible Exchange Rate. MIT Press, Cambridge.

Caballew, R. and Corbo, V. (1988) Real Exchange Rate Uncertainty and Exports: Multi-country Empirical Evidence. [Discussion Paper] No.12/1988. Department of Economics, Columbia University.

Campa, J. and Goldberg, L. (2005). Exchange Rate Pass-through into Imports Prices. *The Review of Economic and Statistics*, 87, 679-690.

Choudhri, E. and Hakura, D. (2006). Exchange Rate Pass-through to Domestic Prices: Does the Inflationary Environment Matter? *Journal of International Money and Finance*, 25, 614-639.

Devereux, M.B. and Yetman, J. (2010). Price Adjustment and Exchange Rate Pass-through. *Journal of International Money and Finance*. 29(1), 181-200.

Dickey, D.A. and Fuller, W.A. (1981). The likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica*, 49, 1057-1072.

Dickey, D.A., Jansen, D.W. and Fuller, W.A. (1991). A Primer on Cointegration with an Application to Money and Income. *Review Federal Reserve Bank of St. Louis*, 73, 58-78.

Dornbusch, R. and Werner, A. (1994). Mexico: Stablization, Reforms, and No-Growth. [Brookings Papers on Economic Activity], 1:253-315.

Engle, R.F. and Granger, C.W.J. (1987). Cointegration and Error Correction: Representation, Estimation and Testing. *Econometrica*, 55, 251-276.

Goldberg, L.S. and Klein, M.W. (1997). Foreign Direct Investment, Trade and Real Exchange Rate, Linkage in Developing Countries. NBER [Working Paper] No.6344.

Javed, Z.H. and Farooq, M. (2009) Economic Growth and Exchange Rate Volatility in Case of Pakistan. *Pakistan Journal of Life and Social Sciences*, 7(2): 112-118.

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica*, 59, 1551-1580.

Johansen, S. (1995). Likelihood-based Inference in Cointegrated Vector Autoregressive Models. Oxford University Press, New York.

Mundell, R. (1963). Capital Mobility and Stablization Under Fixed and Flexible Exchange Rate. *Canadian Journal of Economics and Political Science*, 29, 475-485.

Mustafa, K. and Nishat, M. (2004). Volatility of Exchange Rate and Export Growth in Pakistan: Structure and Interdependence in Regional Markets. *Pakistan Development Review*, 43,813-828.

Rebelo, S. and Vegh, C.A. (1995). Real Effects of Exchange Rate Based Stablization: An Analysis of Competing Theories. NBER Macro Annual. National Bureau of Economic Research (NBER). Cambridge, M.A.

Stock, J. and Watson, M. (1988). Testing for Common Trends. *Journal of American Statistical Association*. 83, 1097-1107.

Taylor, J. (2000). Low Inflation, Pass-through and the Perceiving Power of Firm. *European Economic Review*, 44, 1389-1408.

Xing, Y. (2006a). Why is China so Attractive for FDI: The Role of Exchange Rate. *China Economic Review*, 17(2), 198-209.

Xing, Y. (2006b). Exchange Rate Policy and the Relative Distribution of FDI among Host Countries. BOFIT [Discussion Paper] No.15/2006. Bank of Finland (BOFIT).

Xing, Y. and Wan, G. (2006). Exchange Rate and Competition for FDI in Asia. *The World Economy*, 29(4), 419-434.