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RELATIONSHIP AMONG EXCHANGE RATE, TRADE, INTEREST RATE AND INFLATION IN PAKISTAN & INDIA: A TIME SERIES MODELING APPROACH

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ABSTRACT

This research work investigates relationship among exchange rate, trade, interest rate and inflation in Pakistan and India, empirically investigated through annual data from 1971 to 2013. An increase in the exchange rate will lead to cost push on imported items than inflation arise in country .High inflation in an economy will lead to higher interest rate. High interest rate will lead to slow down in investment. In this study Autoregressive Distribution Lag (ARDL) model verify the effect of import, export; rate of inflation and interest rate on exchange rate have been found to be significant and insignificant. On primary analysis the variables are tested through ADF unit root test, Autoregressive distributed Lag estimates are determined , long run coefficient using the ARDL approach are calculated ,indicating negative insignificant only by rate of inflation in Pakistan while indicating positive insignificant only by interest rate and rate of inflation in India. Moreover import, export and interest rate are significant variables in case of Pakistan while import and export both variables are significant variables in India. The Coefficient of the ECM term suggests that adjustment process is quiet fast and 25% of the previous year's disequilibrium in exchange rate from its equilibrium path will be corrected in the current year. But in case of India Coefficient of the ECM term suggests that adjustment process is quiet fast and 19% of the previous year's disequilibrium in exchange rate from its equilibrium path will be corrected in the current year. Cumulative Sum of Recursive Residuals and Cumulative Sum of Squares of Recursive Residuals are within the critical bounds of 5% indicating that the model is structurally stable.

Keywords: Exchange rate; trade; interest rate.

1. INTRODUCTION

From the last few years the global economy has faced major challenges like the rapid increase in the inflation, oil prices and food prices, on the other side low interest rate shows the instability of economy. The developing countries could be reduce these turbulences by overvalue the exchange rate. At somehow exchange rate overvaluations differentiate against agriculture and export. Agriculture export has a rapid impact on exchange rate (T.Ademola, 1986). The exchange rate shocks have impact on inflation. The key of secure inflation was exchange rate stability. If the supply and production of food is stabilized then inflation would be controllable (Simwaka, Ligoya, Kabango, & Chikonda, 2011).There are many different factors that affect exchange rate like inflation, interest rate, public debt, current account deficit, terms of trade and political stability. When currency appreciated then import is cheap and export is expansive in foreign countries, when exchange rate appreciated then balance of trade minimized, exchange rate depreciation maximized the balance of trade (Mankiw, 2005). From the economic point of view exchange rate has a significant impact on economy. Exchange rate affects the input, output, investment and labor market. It has direct and indirect impact on international trade (Auboin & Ruta, 2011). Exchange rate, interest rate, inflation and employment have impact on economic growth of country. Asian countries are facing the problem of exchange rate uncertainty, balance of payment and unemployment. But the exchange rate helps to eliminate and control balance of payment and unemployment problem in country. Flexible exchange rate controls the macroeconomic variables and has an impact on domestic and foreign shocks. Exchange rate controls the country trade in financial and international market (Chimnani, Bhutto, Butt, Shaikh, & Devi, 2005).Inflation has direct impact on interest rate when interest rate increases inflation also increases. In business world, interest rate has direct impact on loan because when rate of interest increases then borrowing also increase (Akbari & Rankaduwa, 2005). When interest rate increases, Consumer Price Index (CPI) decrease, economy is not overheating which is the good signal for the economy. When interest rate decrease, consumer price index is decrease then inflation arise (Brzoza-Brzezina, 1999).Globalization in terms of international trade refers to the advancement and enhancement in the

process of broadening international trade relationship, capital and investment flows among the countries. As a result, new advanced and quality based market places will be established for the introduction, innovation and production of new goods and services. Since 1960s, the globalization brings a greater extent of change in the imports, exports, production and employment structure of the countries. For the purpose of the development of the economies, there is a great need to improve the integrated system of international trade of a country (Hufbauer & Burki, 2006) .When firm has no import but have export item in perfectly competition market. When a firm import and export paid in foreign currency than their export earnings will be enhanced in domestic currency and level of exchange rate. When exchange rate changes than output level will not change if the trade is encouraging and discouraging. Risk level in organization should be eliminated when marginal revenue is more than marginal cost. So in this condition, the profitability of firm depends upon the exchange rate and exchange rate variation (B.Clark, 1973). The exchange rate volatility had negative impact on intentional trade. Since the past few years many developing countries facing the exchange rate volatility phenomenon. Exchange rate volatility accumulates due to unpredictable relative prices in countries. Exchange rate stability will be enhancing the growth, investment and price stability (Auboin & Ruta, 2011).

2. OBJECTIVES OF STUDY

The purpose of this research is to study the relationship among the exchange rate, import, export and inflation in Pakistan and India. Specific objectives of this research are:

1. To find the possible existence of causality running among import, export, interest rate and inflation to exchange rate.
2. To analyze the long run relationship among different macroeconomic variables.
3. To analyze the short run relationship among concerned variable of the study.
4. To compare the results of these variables for Pakistan and India.

3. LITERATURE REVIEW

A literature review comprises of past empirical studies, theories and models related to the research topic. This section will help to understand the previous work done on the research topic. Literature review formulates the foundation of previous developed theories. While analyzing the literature on exchange rate,interest rate,trade and inflation I consulted articles from Pakistan and abroad to see various viewpoints in this regard. Most of the contributors to the topic emphasis the importance and relationship between inflation,exchange rate,trade and interest rate . I have selected different articles pertinent to this topic, which are reviewed in the thesis to see the current work on the topic. In conclusion of literature it shows that exchange rate ,trade,interest rate and inflation have either positive or negative relationship. Exchange rate affect the import and export particularly across the many regions, then significance level is different. Due to import and export volume the variation in exchange rate acured ,particularly in industrial countries.Exchange rate had negative and stable impact on trade. In long run and short run export volume and exchange rate both have significant relationship. Monetray policy adjusts itself according to exchange rate and interst rate. In long run inflation influences the currency devaluation and exchange rate. Demand and supply prices influences the world inflation move upward it has effect on inflation in long run. In developing countries inflation arte volatility has showed minor impact on interest rate. Demeza and Ustaoglub (2012) studied the " exchange rate volatility impact on Turkey's export" using data for top five importer countries over the period 1992 to 2010. Emperical results showed that in long run exchange rate had negative significant impact on export while short run exchange rate not influence the export.

Abdullah and Kalim (2012) pointed out that food price inflation rises globally and in developing countries like Pakistan. In this study Johansen's co-integration technique used to determined the existence of causal relatioship among per capita GDP, money supply,food import and export, support price and inflation ,over the period of 1972-2008 . Empirical results showed that food price was insignificantly positively correlated with money supply. It conclude that demand and supply side predicted the food price inflation .Gregorio (2012) investigated the impact of monetary policy and commodity price inflation using annual data over the period 1980-2007. In this study regression results showed that oil price and food had significant impact on inflation.Tang (2011) studied the relationship between exchange rate and trade by using single data set and panel data procedure of Association of Southeast Asian Nations (ASEAN) and other countries over the period 1980-2009. While in panel data procedure, short run unidirectional causality running from exchange rate to equipment and intermediate goods trade and long bidirectional causality between exchange rate and trade was also found. Empirical results showed that inters South Asia exchange rate had significant impact on inter South Asia trade. Auboin and Ruta (2011) investigated relationship between exchange rate and trade . Objective of this study was to determine impact of exchange rate on international trade, impact of currency appreciation and depreciation on trade. Results of this study showed that exchange rate volitality had negative impact on import and export flows. While in short run production network and

pricing strategy effect on international trade and exchnage rate. Alam (2010) investigated impact of exchange rate volitality on aggregate demand of export by using quarterly data over the period 1979-2005. In this study cointegintegration coefficient results showed that export were integrated with foreign economic activity, real exchange rate and exchange rate volatility. It found that economic activity had significant positive impact on export. In long run when competition increased then export would not increase. Prasertnukul, Kim and Kakinaka (2010) studied the relationship among exchange rates, price level and targeting inflation by using time series data from 1990 -2007 for the panel of Asian countries. Emperical results showed that due to increased in inflation rate then exchange rate would be depreciated in Philippines, Indonesia, Thailand and South Korea . They found that ,when inflation accured in selected countries than inflation and exchange rate was stabilized.

4. DATA SOURCES AND METHODOLOGY

This empirical study uses the time series data of exchange rate, imports, exports, interest rate and consumer price index for the period 1971 – 2013 for Pakistan and India. Data is obtained from World Development Indicator, International Monetary Fund (IMF) and Bureau of Statistics of respective countries.In this study money exchange rate is expressed in term national currency per US dollar (Rs/US). Imports and exports are expressed in US millions Dollars. Consumer price index is used as a proxy of inflation rate. CPI is chosen as it is a broad base measure to calculate average change in price of goods and services during a specific period. The time series econometric procedures are used in order to determine the relationship among exchange rate (EXRT), imports (IMPT), exports (EXPT), interest rate (INTR) and inflation (CPI). The functional form of variables are

$$INRT = \gamma_0 + \varepsilon_1 IMPT + \varepsilon_2 EXPT + \varepsilon_3 EXRT + \varepsilon_4 CPI + \varepsilon_5 \ldots \quad (A)$$

$$EXPT = \gamma_0 + \zeta_1 IMPT + \zeta_2 EXRT + \zeta_3 INTR + \zeta_4 CPI + \varepsilon_5 \quad (B)$$

$$EXRT = \gamma_0 + \gamma_1 IMPT + \gamma_2 EXPT + \gamma_3 INTR + \gamma_4 CPI + \varepsilon_5 \quad (C)$$

$$CPI = \beta_0 + \beta_1 EXRT + \beta_2 IMPT + \beta_3 EPXPT + \beta_4 INTR + \varepsilon_5 \quad (D)$$

$$IMPT = \alpha_0 + \alpha_1 EXRT + \alpha_2 EXPT + \alpha_3 INTR + \alpha_4 CPI + \varepsilon_5 \quad (E)$$

4.1 UNIT ROOT TESTS

Unit root test is used to check the stationary (non-stationary) of time series data because a non-stationary regressor gives many invalid standard empirical results and therefore require special treatment. Unit root test has become widely popular over the last several years in time series analysis to test the stationary of variable using an autoregressive model (Cheung & S.Lai, 1995). The unit root test is very important before apply and estimating the ARDL model. In this study Phillips-Perron(PP) and Augmented Dickey-Fuller(ADF) tests are being used. A Dickey-Fuller (DF) test is an econometric test to find out whether a time series data has an autoregressive unit root. Unit root test has become a standard feature in applied econometric research, with the Dickey-Fuller (1979) test generally employed. DF test is generally applied in its augmented version, because it is not valid in the presence of serial correlation.

4.2 AUTO-REGRESSIVE DISTRIBUTED LAG (ARDL) APPROACH TO CO- INTEGRATION

There are several methods for conducting the co-integration test. The most commonly used methods include the residual based Engle-Granger (1987) test, and the maximum likelihood based Johansen and Juselius (1990) tests. Due to the low power and other problems associated with these test methods, the OLS based Auto-Regressive Distributed Lag (ARDL) approach to co-integration has become popular in recent years .The Autoregressive Lag Distributed (ARDL) basically used to apply the co-integration. The main advantages of co-integrtaion is to applied in any case of checking stationary in sample of variables. The important feature of ARDL modeling is that it apply on those variables which have different order of integration.The error correction model (ECM) and cointegration is directly related with each other. Autoregressive distributed lag (ARDL) derived to Error Correction Model (ECM) .Geometric lag model and finite lag model are strongly describe that lagged response had some restriction which affect the dependent variable to change the independent variable. The autoregressive lag distributed model is

$$Y_t = \mu + \sum_{i=1}^{p} \gamma i\, y_{t-1} + \sum_{j=0}^{r} \beta_j x_{t-j} + \delta w_t + e_t$$

In the above equation term e_t showed homoscedastic and serially uncorrelated. ARDL(p,r) model form describe the order of only two polynomials in L. The partial adjustment model showed that p =1 and r =0. When stochastic

variables accumulate then classical disturbance showed that ARDL is a linear model. The lagged dependent variable not violation of any assumption because ordinary least square is a good estimator.

4.3 EMPIRICAL RESULTS AND THEIR INTERPRETATION

In order to investigate the relationship between EXRT,IMPT,EXPT,INTR and INF the ARDL affroach to cointegration was used. In this section results of unit unit root tests and ARDL approach to co-integration are being used.

Table1. Unit Root Tests Results of Pakistan by Augmented Dickey –Fuller Test(ADF) and Phillips-Perron Test(PP)

Variables	ADF		PP	
	Intercept	P-value	Intercept	P-value
EXRT	-5.161904	0.0001	-5.183854	0.0001
IMPT	-6.483827	0.0000	-6.049312	0.0000
EXPT	-8.128861	0.000	-4.648626	0.0005
INTR	-7.191069	0.0000	-3.325678	0.0202
CPI	-3.587374	0.0110	-8.349346	0.0000

Table shows the results for the ADF and PP unit root test for EXRT, IMPT,EXPT, INTR and CPI of Pakistan. In this test, we take intercept because it is more suitable with economic practice (Vogelvang, 2005) .

Table 2.Order of Integration

Unit Root Tests	ADF Test With Trend		PP Test With Trend	
Variables	I(0)	I(1)	I(0)	I(1)
EXRT		I(1)		I(1)
IMPT		I(1)		I(1)
EXPT		I(1)		I(1)
INTR		I(1)		I(1)
CPI	I(0)		I(0)	

The order of integration of EXRT is of I(1) according to ADF and PP unit root tests while IMPT is I(1) according to ADF and PP unit root tests. The order of integration of EXPT, INTR are of I(1) according to ADF and PP unit root tests. The order of integration of CPI is of I(0) according to ADF and PP unit root tests. The results of Pakistan ADF and PP test indicate that variable rate of inflation was stationary at level. However, variables exchange rate, import, export and interest rate were stationary at first difference 5% significant level (Ng & Stevanovic, 2012).

4.4 CO-INTEGRATION ANALYSIS

If all variables are non-stationary at level but stationary not even at their 1st difference , simply speaking are having random walk, allows us to proceed further for implementation of Pesaran and Shin(1995) ARDL cointegration test depending upon the power of the unit root tests, moreover there is no need to classify variables into 1(0) or I(1). According to Autoregressive distributed lag estimates determined based on Schwarz Bayesian Criterion , most of variables are co-integrated with exchange rate to determine the predictability and performance measurement in Pakistan .

$$\Delta EXRT = a_{0EXRT} + \sum_{i=0}^{n} b_{iEXRT}\ \Delta EXRT_{t-I} + \sum_{i=0}^{n} c_{iEXRT}\ \Delta IMPT_{t-I} + \sum_{i=0}^{n} d_{iEXRT}\ \Delta EXPT_{t-I} + \sum_{i=0}^{n} e_{iEXRT}\ \Delta INTR_{t-i} + \sum_{i=0}^{n} f_{iEXRT}\ \Delta CPI_{t-i} + \delta_{1EXRT} EXRT_{t-1} + \delta_{2EXRT} IMPT_{t-1} + \delta_{3EXRT} EXPT_{t-1} + \delta_{4EXRT} INTR_{1t-1} + \delta_{5EXRT} CPI_{1t-1} \quad (1)$$

$$\Delta IMPT = a_{0IMPT} + \sum_{i=0}^{n} b_{iIMPT}\ \Delta EXRT_{t-I} + \sum_{i=0}^{n} c_{iIMPT}\ \Delta IMPT_{t-I} + \sum_{i=0}^{n} d_{iIMPT}\ \Delta EXPT_{t-I} + \sum_{i=0}^{n} e_{iIMPT}\ \Delta INTR_{t-i} + \sum_{i=0}^{n} f_{iIMPT}\ \Delta CPI_{t-i} + \delta_{1IMPT} EXRT_{t-1} + \delta_{2IMPT} IMPT_{t-1} + \delta_{3IMPT} EXPT_{t-1} + \delta_{4IMPT} INTR_{1t-1} + \delta_{5IMPT} CPI_{1t-1} \quad (2)$$

$$\Delta EXPT = a_{0EXPT} + \sum_{i=0}^{n} b_{iEXPT}\ \Delta EXRT_{t-I} + \sum_{i=0}^{n} c_{iEXPT}\ \Delta IMPT_{t-I} + \sum_{i=0}^{n} d_{iEXPT}\ \Delta EXPT_{t-I} + \sum_{i=0}^{n} e_{iEXPT}\ \Delta INTR_{t-i} + \sum_{i=0}^{n} f_{iEXPT}\ \Delta CPI_{t-i} + \delta_{1EXPT} EXRT_{t-1} + \delta_{2EXPT} IMPT_{t-1} + \delta_{3EXPT} EXPT_{t-1} + \delta_{4EXPT} INTR_{1t-1} + \delta_{5EXPT} CPI_{1t-1} \quad (3)$$

$$\Delta INTR = a_{0INTR} + \sum_{i=0}^{n} b_{iINTR}\ \Delta EXRT_{t-I} + \sum_{i=0}^{n} c_{iINTR}\ \Delta IMPT_{t-I} + \sum_{i=0}^{n} d_{iINTR}\ \Delta EXPT_{t-I} + \sum_{i=0}^{n} e_{iINTR}\ \Delta INTR_{t-i} + \sum_{i=0}^{n} f_{iINTR}\ \Delta CPI_{t-i} + \delta_{1INTR} EXRT_{t-1} + \delta_{2INTR} IMPT_{t-1} + \delta_{3INTR} EXPT_{t-1} + \delta_{4INTR} INTR_{1t-1} + \delta_{5INTR} CPI_{1t-1} \quad (4)$$

$$\Delta CPI = a_{0CPI} + \sum_{i=0}^{n} b_{iCPI}\ \Delta EXRT_{t-I} + \sum_{i=0}^{n} c_{iCPI}\ \Delta IMPT_{t-I} + \sum_{i=0}^{n} d_{iCPI}\ \Delta EXPT_{t-I} + \sum_{i=0}^{n} e_{iCPI}\ \Delta INTR_{t-i} + \sum_{i=0}^{n} f_{iCPI}\ \Delta CPI_{t-i} + \delta_{1CPI} EXRT_{t-1} + \delta_{2CPI} IMPT_{t-1} + \delta_{3CPI} EXPT_{t-1} + \delta_{4CPI} INTR_{1t-1} + \delta_{5CPI} CPI_{1t-1} \quad (5)$$

Table 3. Autoregressive Distributed Lag Estimates, ARDL(3,5,4,5,0) selected based on Schwarz Bayesian Criterion

Regressor	Model ARDL(1,0,3,4)	
	Coefficient	T-Ratio[Prob]
EXRT(-1)	.35877	2.0424[.060]
EXRT1(-2)	.42895	2.4209[.030]
EXRT1(-3)	.47210	1.9308[.074]
IMPT	.35373	3.9267[.002]
IMPT(-1)	.20676	1.1417[.273]
IMPT(-2)	-.21202	-1.5067[.154]
IMPT(-3)	.542110	3.3397[.005]
IMPT(-4)	-.556810	-2.9751[.010]
IMPT(-5)	.440734	3.4490[.004]
EXPT	-.61486	-3.4325[.004]
EXPT(-1)	-.33324	-.96235[.352]
EXPT(-2)	.35782	1.2646[.227]
EXPT(-3)	-.96172	-3.4931[.004]
EXPT(-4)	.53343	1.7930[.095]
INTR	.10323	.69213[.500]
INTR(-1)	-.53373	-2.8850[.012]
INTR(-2)	-.51167	-2.3719[.033]
INTR(-3)	-.20509	-.94683[.360]
INTR(-4)	-.78247	-3.5713[.003]
INTR(-5)	.33518	1.6461[.122]
CPI	.0054100	.082012[.936]
Constant	8.9777	4.8951[.000]
Notes: R-Squared =.99792 , R-Bar-Squared = .99479 ,S.E. of Regression = 1.1618 F-stat.F(21, 14) 319.4894[.000], Mean of Dependent Variable = 28.7846, S.D. of Dependent Variable = 16.1025 ,Residual Sum of Squares = 18.8973, Equation Log-likelihood = -39.4808 ,Akaike Info. Criterion = 61.4808 , Schwarz Bayesian Criterion -78.8995 , DW-statistic = 1.9337		

The ARDL estimated approach is applied to examine the cointegration through conducting F-statistic. The results of cointegration are presented in Table. The results of F-Statistic in table show that there exist cointegration between EXRT,IMPT,EXPT,INRT and CPI .The coefficient of EXRT(-2),IMPT,IMPT(-3),IMPT(-4),EXPT, EXPT(-3),INTR(-1), INTR(-2) and CPI looked significant and explain the relation with exchange rate.

The graphs of CUSUM and CUSUM Squares tests used to check the stability of model. The Figure 1 and 2 showed that model is stable because the calculated values are lies within the critical bounds. The 5% significance level showed that model is statistically stable if the calculated values are lies cross the critical bounds then model is unstable. This model cab be used for prediction or forecasting and for policy making.

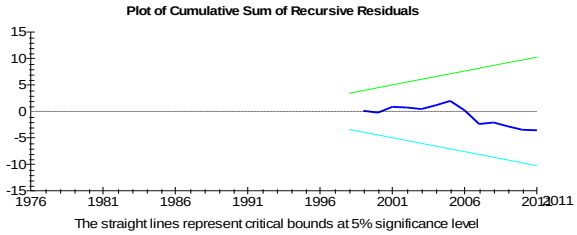

Fig. 1 *.Plot of Cumulative Sum of Recursive Residuals*

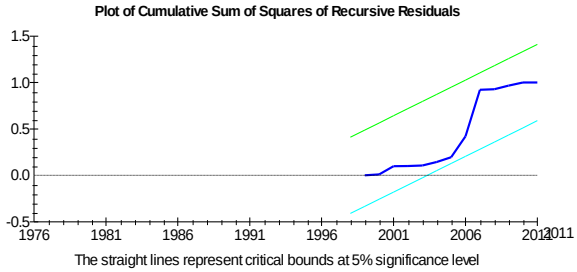

Fig.2*.Plot of Cumulative Sum of Squares Recursive Residuals*

4.5 GRANGER CAUSALITY TEST

As granger causality test is used to analyze whether the causality relationship exists between variables or not. Criteria to examine causality is that if P value is less than 5% null hypothesis is rejected; null hypothesis is that there is no causality between variables.

Pair wise Granger Causality Tests
Lags: 6

Null Hypothesis:	Obs	F-Statistic	Prob.
IMPT does not Granger Cause EXRT	35	4.11200	0.0064
EXRT does not Granger Cause IMPT		7.00892	0.0003
EXPT does not Granger Cause EXRT	35	1.06641	0.4119
EXRT does not Granger Cause EXPT		1.03301	0.4307
INTR does not Granger Cause EXRT	35	0.86173	0.5378
EXRT does not Granger Cause INTR		0.67116	0.6740
CPI does not Granger Cause EXRT	35	0.62611	0.7077
EXRT does not Granger Cause CPI		1.25796	0.3164
EXPT does not Granger Cause IMPT	35	2.08397	0.0967
IMPT does not Granger Cause EXPT		0.19676	0.9743
INTR does not Granger Cause IMPT	35	3.06818	0.0245
IMPT does not Granger Cause INTR		0.25911	0.9501
CPI does not Granger Cause IMPT	35	0.65270	0.6877
IMPT does not Granger Cause CPI		1.02855	0.4333
INTR does not Granger Cause EXPT	35	1.01716	0.4399
EXPT does not Granger Cause INTR		0.51857	0.7879
CPI does not Granger Cause EXPT	35	1.04185	0.4257
EXPT does not Granger Cause CPI		1.20962	0.3385
CPI does not Granger Cause INTR	35	0.29680	0.9319
INTR does not Granger Cause CPI		2.11299	0.0927

Here in the case of Pakistan the null hypothesis that import(IMPT) does not granger exchange rate (EXRT) is not rejected as the P value (0.0064) is greater than 5% but on the other side , but the null hypothesis is rejected in the case of causality from exchange rate (EXRT) to import (IMPT) as P value (0.0003) is less than 5%.Here in the case of Pakistan the null hypothesis that export(EXPT) does not granger exchange rate (EXRT) is not rejected as the P value (0.4119) is greater than 5%, same is the case from EXRT to EXPT .Here in the case of Pakistan the null hypothesis that interest rate (INTR) does not granger exchange rate (EXRT) is not rejected as the P value (0.5378) is greater than 5%, same is the case from EXRT to INTR. Null hypothesis is rejected for the causality from interest rate (INTR) to import (IMPT) because P value (0.0245) is less than 5%. But null hypothesis is not rejected for the causality from IMPT to INTR as the P value (0.3538) is more than 5%.

4.6 EMPIRICAL RESULTS AND THEIR INTERPRETATION

In order to investigate the relationship between EXRT,IMPT,EXPT,INTR and INF the ARDL affroach to cointegration was used. In this section results of unit unit root tests and ARDL approach to co-integration are being used.

Table.4. Unit Root Tests Results of India by Augmented Dickey –Fuller Test(ADF) and Phillips-Perron Test(PP)

Variables	ADF		PP	
	Intercept	P-value	Intercept	P-value
EXRT	-11.13857	0.0000	-7.183854	0.0000
IMPT	-5.37187	0.0001	-4.749312	0.0005
EXPT	-5.18768	0.0001	-3.248626	0.0002
INTR	-8.191069	0.0000	-8.325678	0.0000
CPI	-4.787374	0.0004	-4.749346	0.0005

Table shows the results for the ADF and PP unit root test for EXRT, IMPT,EXPT,INTR and CPI of India. In this test, we take intercept because it is more suitable with economic practice (Vogelvang, 2005) .

Table 5. Order Of Integration

Unit Root Tests	ADF Test With Trend		PP Test With Trend	
Variables	I(0)	I(1)	I(0)	I(1)
EXRT		I(1)		I(1)
IMPT		I(1)		I(1)
EXPT		I(1)		I(1)
INTR		I(1)		I(1)
CPI	I(0)		I(0)	

The order of integration of EXRT is of I(1) according to ADF and PP unit root tests while IMPT is I(1) according to ADF and PP unit root tests. The order of integration of EXPT, INTR are of I(1) according to ADF and PP unit root tests. The order of integration of CPI is of I(0) according to ADF and PP unit root tests. The results of Pakistan ADF and PP test indicate that variable rate of inflation was stationary at level. However, variables exchange rate, import, export and interest rate were stationary at first difference 5% significant level (Ng & Stevanovic, 2012).

Table 6. Estimated Long Run Coefficients using the ARDL Approach ,ARDL(3,5,4,5,0) selected based on Schwarz Bayesian Criterion

Regressor	ARDL(3,5,4,5,0)	
	Coefficient	T-Ratio (P-value)
IMPT	-.0029803	-3.4960 [.004]
EXPT	.003900	5.4428[.000]
INTR	6.1372	2.1497[.050]
CPI	-0.020822	-.0832288[.935]
Constant	-34.5540	-1.7853[.096]

According to analysis rate of inflation carries negative but insignificant relationship for long run money exchange rate performance, rate of interest is having positive and significant relationship with exchange rate in long run, import having negative and significant impact on exchange rate expect exports which is having significant positive relationship in exchange rate. The analysis reveals that exports (EXPT) and interest rate (INTR) is the only variables which showed a significant relationship in long run for the money exchange rate. This implies that an increase in exports and interest rate lead to higher money exchange rate in long run. Whereas, import(IMPT) having negative significant impact on money exchange rate (EXRT) in Pakistan. The coefficient of imports is negative and significant , means that lesser amount of imports leads to more money exchange rate and vice versa.

Table.7 Error Correction Representation for the Selected ARDL Model, ARDL(3,5,4,5,0) selected based on Schwarz Bayesian Criterion

ARDL(3,5,4,5,0)		
Regressor	Coefficient	T-Ratio[Prob]
dEXRT11	-.90105	-3.6308[.002]
dEXRT12	-.47210	-1.9308[.070]
dIMPT2	.35373	3.9267[.001]
dIMPT21	-.21403	-1.4938[.154]
dIMPT22	-.42603	-3.0533[.007]
dIMPT23	.11613	.85734[.403]
dIMPT24	-.44073	-3.4490[.003]
dEXPT3	-.61483	-3.4325[.003]
dEXPT31	.70504	.23840[.814]
dEXPT32	.42833	1.4425[.167]
dEXPT33	-.53343	-1.7930[.091]
dINTR4	.10323	.69213[.498]
dINTR41	1.1641	3.9595[.001]
dINTR42	.65239	2.5808[.019]
dINTR43	.44730	1.8930[.076]
dINTR44	-.33518	-1.6461[.118]
dCPI5	.0054100	.082012[.936]
DConstant	8.9777	4.8951[.000]
ecm(-1)	.25982	2.0173[.030]
ECM = X1 + .0029803*X2 -.0039200*X3 -6.1372*X4 + .020822*X5 + 34.5540*INPT		

R-Squared = .93622 , R-Bar-Squared = .84054 , F-stat.F(18, 17) 11.4162[.000] , DW-statistic = 1.9337

The one period lag Error Correction term (ECM (-1)) captures the adjustment towards the long-run equilibrium. ECM (-1) coefficient specified the speed of adjustment back to long-run equilibrium after a short-run shock. ECM (-1) is highly significant with negative sign, indicating the establishment of cointegration and long-run causality among money exchange rate ,imports, exports, interest rate and rate of inflation.
In short run imports having positive significant impact on money exchange rate. Whereas, exports having significant negative impact on money exchange rate. In short run rate of interest and rate of inflation having insignificant positive impact on money exchange rate.

4.7 CO-INTEGRATION ANALYSIS

If all variables are non-stationary at level but stationary not even at their 1st difference , simply speaking are having random walk, allows us to proceed further for implementation of Pesaran and Shin(1995) ARDL cointegration test depending upon the power of the unit root tests, moreover there is no need to classify variables into 1(0) or I(1). According to Autoregressive distributed lag estimates determined base on Schwarz Bayesian Criterion , most of variables are not co-integrated with exchange rate to determine the predictability and performance measurement in India expect interest rate which shows a negatively significant relationship for the exchange rate performance determination.

Table. 8 Autoregressive Distributed Lag Estimates by ARDL(2,3,0,1,0) selected based on Schwarz Bayesian Criterion

Regressor	Coefficient	T-Ratio
EXRT(-1)	.66099	3.4215[.002]
EXRT(-2)	.53446	2.6207[.014]
IMPT	.2938	3.7026[.001]
IMPT(-1)	.1585	.70277[.488]
IMPT(-2)	-.9389	5.4739[.000]
IMPT(-3)	.14583	5.4277[.000]
EXPT	-.53513	-4.0540[.000]
INTR	.045570	.22247[.826]
INTR(-1)	-.80830	4.1933[.000]
CPI	.039124	.55255[.585]
Constant	3.8017	2.5648[.016]
RNote: R-Squared = .99164 , R-Bar-Squared = .98854, S.E. of Regression= 1.7466, F-stat.F(10, 27) 320.2373[.000], Mean of Dependent Variable= 27.7193 , S.D. of Dependent Variable = 16.3176, Residual Sum of Squares = 82.3680, Equation Log-likelihood = -68.6183, Akaike Info. Criterion = -79.6183 , Schwarz Bayesian Criterion = -88.6250		

The ARDL estimated approach is applied to examine the cointegration through conducting F-statistic. The results of cointegration are presented in Table . The results of F-Statistic in table show that there exist cointegration between EXRT, IMPT, EXPT, INRT and CPI.

4.8 LONG RUN ESTIMATION

In the first stage, we test for co-integration using the T-Ratio with new critical values. According to Bahmain-Oskooee and Brooks(2003), the lag length is important for the results of each differenced variables. Only appropriate lag length selection criterion could be able to identify the true dynamics of the model. We employ on Schwarz Bayesian Criterion in selecting the lag length on each differenced variables where the recommended lag length for ARDL estimation was show in table. The analysis reveals that exports (EXPT) and import (IMPT) is the only variable which showed a significant relationship in long run for the money exchange rate ,whereas, rate of inflation (CPI) and interest rate are not having significant impact on exchange rate in India. According to analysis inflation carries negative but insignificant relationship for long run exchange rate performance, rate of interest is having positive and insignificant relationship with exchange rate in long run, import having negative and significant impact on exchange rate and an export which is having significant positive relationship in exchange rate. The relationship is depicted from the p-value presented in table.

Table. 9 Estimated Long Run Coefficients using the ARDL Approach by ARDL(2,3,0,1,0) selected based on Schwarz Bayesian Criterion

Regressor	Coefficient	T-Ratio[Prob]
IMPT	-.0018501	-6.9089[.000]
EXPT	.0027379	7.2318[.000]
INTR	3.9025	2.9515[.006]
CPI	-.20018	-.55655[.582]
Constant	-19.4515	-1.8535[.075]

4.9 SHORT RUN DYNAMICS

Estimation of a cointegrion vector from ARDL specification is equivalent to that from an error –correction (EC) model which is used for the short run forecasting and predictability. For this reason, the error correction version of the autoregressive distributed lag procedure (ARDL) is then employed to specify the short term relationship with

exchange rate. According to ECM value of (-1) in our analysis all independent variables are having significance in the prediction of exchange rate.

Table.10 Error Correction Representation for the Selected ARDL Model by ARDL(2,3,0,1,0) selected based on Schwarz Bayesian Criterion

Regressor	Coefficient	T-Ratio[Prob]
dEXRT11	-.53446	-2.6207[.014]
dIMPT2	.29383	3.7026[.001]
dIMPT21	-.51964	-2.0052[.054]
dEXPT22	-.14583	-5.4277[.000]
dEXPT23	-.53513	-4.0540[.000]
dINTR	.045570	.22247[.826]
dCPI	.039124	.55255[.585]
dConstant	3.8017	2.5648[.016]
ecm(-1)	.19545	3.6539[.001]

The empirical investigation for the short run dynamics of the impact of macroeconomic variables on exchange rate showed that imports and exports does show a significant relation in short run. Import having significant positive relationship with exchange rate. Exchange rate has positive insignificant impact on Interest rate and inflation. According to the empirical findings of the researcher the rate of interest is having a mixed behavior in relation to exchange rate as positive in short run and tends to be negative in long run. As inflation is also found to have an insignificant and positive relationship with exchange rate.

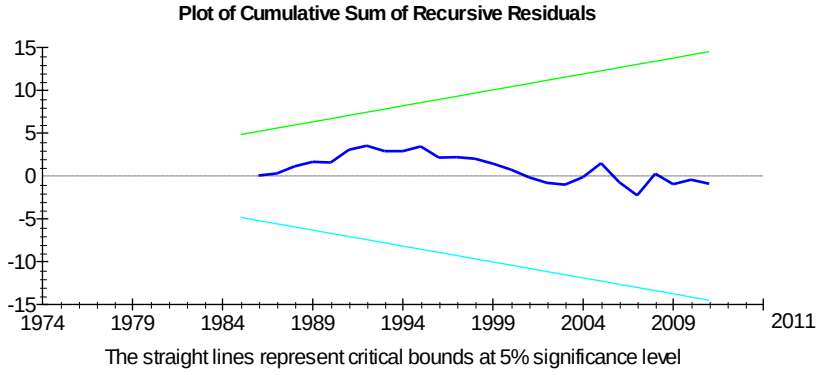

Fig. 11 .*Plot of Cumulative Sum of Recursive Residuals*

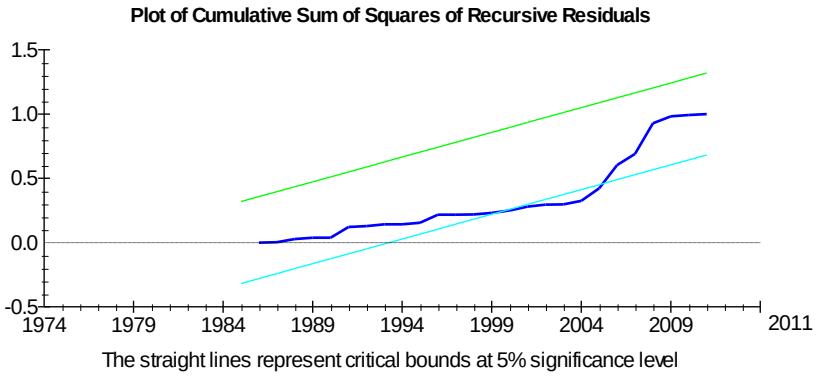

Fig.12*.Plot of Cumulative Sum of Squares Recursive Residuals*

4.10 GRANGER CAUSALITY TESTS OF INDIA

Pairwise Granger Causality Tests
Lags: 6

Null Hypothesis:	Obs	F-Statistic	Prob.
IMPT does not Granger Cause EXRT	35	1.64274	0.1827
EXRT does not Granger Cause IMPT		5.92712	0.0008
EXPT does not Granger Cause EXRT	35	0.94952	0.4808
EXRT does not Granger Cause EXPT		4.05092	0.0069
INTR does not Granger Cause EXRT	35	3.69675	0.0108
EXRT does not Granger Cause INTR		2.99581	0.0271
CPI does not Granger Cause EXRT	35	0.45489	0.8337
EXRT does not Granger Cause CPI		0.97900	0.4627
EXPT does not Granger Cause IMPT	35	1.47806	0.2315
IMPT does not Granger Cause EXPT		4.16148	0.0061
INTR does not Granger Cause IMPT	35	0.83244	0.5577
IMPT does not Granger Cause INTR		1.59069	0.1969
CPI does not Granger Cause IMPT	35	0.40875	0.8652
IMPT does not Granger Cause CPI		0.83576	0.5555
INTR does not Granger Cause EXPT	35	1.99738	0.1095
EXPT does not Granger Cause INTR		1.71324	0.1650

CPI does not Granger Cause EXPT	35	0.40195	0.8697
EXPT does not Granger Cause CPI		1.64411	0.1823
CPI does not Granger Cause INTR	35	0.96874	0.4689
INTR does not Granger Cause CPI		2.91991	0.0300

Here in the case of India the null hypothesis that import(IMPT) does not granger exchange rate (EXRT) is not rejected as the P value (0.1827) is greater than 5% , but the null hypothesis is rejected in the case of causality from exchange rate (EXRT) to import (IMPT) as P value (0.0008) is less than 5%. the null hypothesis that export(EXPT) does not granger exchange rate (EXRT) is not rejected as the P value (0.4808) is greater than 5% , but the null hypothesis is rejected in the case of causality from exchange rate (EXRT) to export (EXPT) as P value (0.0069) is less than 5%.the null hypothesis that interest rate (INTR) does not granger exchange rate (EXRT) is not rejected as the P value (0.108) is greater than 5% , but the null hypothesis is rejected in the case of causality from exchange rate (EXRT) to interest rate (INTR) as P value (0.0271) is less than 5%. The causality from import to export as P value (0.0061) is less than 5 %. the null hypothesis that rate of inflation (CPI) does not granger interest rate (INTR) is not rejected as the P value (0.4689) is greater than 5% , but the null hypothesis is rejected in the case of causality from interest rate (INTR) to rate of inflation (CPI) as P value (0.0300) is less than 5%.

5. CONCLUSION

This study investigate the causal relationship between Exchange rate and other macroeconomic variables such as imports ,exports ,interest rate and rate of inflation by applying Granger causality test in Pakistan and India over the period 1971-2013. Understanding the nexus between EXRT and respective independent variables such as IMPT,EXPT,INTR and CPI is very important .Autoregressive distributed lag approach has been applied to explore the long run as well as short run relationship and estimates the long run coefficient that are asymptotically normal irrespective of whether the underlying regressors are I(0) ,I(1) or I(2). Data has been tested by unit root ADF and PP test. Unit root test clearly indicates that the index series are not stationary at level but the first difference and second difference of the series are stationary. According to the ARDL and ECM models used to estimate the significance of macroeconomic variables and its impact on exchange rate over both long term and short term basis indicates that import ,export ,interest rate and rate of inflation selected macroeconomic indicators of Pakistan does show significant relationship with stock exchange in both short run and long run. According to long run coefficient using ARDL approach import, export and interest rate were cointergrated variables in Pakistan. Moreover, import is only variable having negative significant long run relationship and it is cointegrated with exchange rate. According to long run coefficient using ARDL approach import and export were cointegrated variables in India. Moreover, interest rate and rate of inflation having positive and insignificant relationship with exchange rate in India.

According to ECM used for the short run forecasting and predictability interest rate and rate of inflation are having positive and insignificant relationship with exchange rate in short run whereas, imports and exports are having positive relationship with exchange rate in Pakistan and Pakistan according to the error correction representation for the ARDL model where the lag length is selected based on Schwarz Bayesian Criterion . In case of Pakistan the error correction variables ECM(-1) has been found negative and statistically significant . The Coefficient of the ECM term suggests that adjustment process is quiet fast and 25% of the previous year's disequilibrium in exchange rate from its equilibrium path will be corrected in the current year. But in case of India Coefficient of the ECM term suggests that adjustment process is quiet fast and 19% of the previous year's disequilibrium in exchange rate from its equilibrium path will be corrected in the current year.

The results vary in India and Pakistan. The empirical results confirmed the presence of Short run and long run causality among variables in the case of Pakistan and India. The results have shown the bidirectional Granger causality between import and exchange rate in case of Pakistan. At the same time import and exchange rate reflect each other. A result implies that increase in import will lead to increase in exchange rate and as a result it will decrease the exchange rate and vice versa. But in case of India, causality is found between exchange rate and import, it implies that increase in exchange rate leads to increase in import.

The results reveal that there is evidence of unidirectional causality between exchange rate and exports, export and interest rate, import and export, interest rate and rate of inflation in case of India. Results imply that increase in exchange rate leads to increase in exports and as a result, it will decrease the export and vice versa. The exchange rate and interest rate are key macroeconomic variables of the Indian economy. India import and export suffer if the exchange rate is changed.

Instability of exchange rate hampers the economy in the long term by affecting the volume of exports and imports, allocation of investment and balance of payment. In short term run local consumer and trader are affected. Instability is caused by an appreciation of exchange rate, as in case of Pakistan it causes a decrease in exports and an increase in import as the export become expensive and import become cheaper. One factor in the appreciation of exchange rate could be the constantly increasing inflation.

Developing country like Pakistan facing the problem of inflation, this is majorly due to exchange rate. Due to the sky rocking inflation, the interest rate increase overall demand in economy decrease. Similarly, due to a spike in inflation, the demand for export is negatively affected as they become uncompetitive in the world market. . If the economy is highly dependent on imports, then a decrease in demand for export and the exchange rate depreciates. Hence, when the overall demand in the economy is depressed, with decrease in consumer demand and a decrease in investment due to the high interest rates, the growth halts.

This study tries to identify the short and long run relationship among variables of exchange rate, trade, interest rate and inflation. Change in exchange rate will stimulate the export and significant impact on investors. When exchange rate is depreciated it means economy spends more what it earns .in this way export will decrease and indirectly it will affect the economy of country. When exchange rate is depreciated it means economy spends more what it earns. In this way export will decrease and indirectly it will affect the economy of country. The performance of Pakistan economy is in a state of constant decline. This decline manifested itself in dwindling export as increasing imports trade gap low growth rate of GDP, balance of Payment problem and highly inflationary pressure etc. Inconsistencies of economic policies have resulted in economic stagnation. An increase in the exchange rate will lead to cost push on imported items which will lead to inflation in the country .High inflation in an economy will lead to higher interest rate. High interest rate will lead to slow down in investment. This will push the cost upward then ultimately inflation arises

6. RECOMMENDATIONS

We should try to increase our exports for the betterment of our economy, by doing this the interest rate become higher which will result in higher foreign exchange rate this will enhanced remittances. As a result suggests that imports have negative impact on economy so, we should try to minimized as much as possible since this will be beneficial for the money exchange rate of country in long run. Pakistan should have the ability to face the demand of export by managing their exchange rate, when external competition increases demand of export becomes higher.
In developing country like Pakistan where money demand has been ignored, so we should try to increase money demand by increase our export and minimized imports.

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Statement:

We hereby confirm that this research paper is our own original work and we have cited all sources that were used.