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Exchange Rate Volatility in Pakistan and Its Impact on Selected Macro Economic Variables (1980-2014)

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Abstract

Among the developing countries, Pakistan experienced a unique downward trend in rupee value and frequent transitions in the exchange rate systems. These distinctive features make Pakistan economy an interesting case study for the empirical examination of the rupee exchange rate and its role in the monetary policy and macroeconomic performance. The purpose of the present study is to find out which of the macroeconomic indicators has led the Pak-rupee exchange rate volatility during the study period. Furthermore, the effect of the exchange rate volatility on foreign exchange reserves and selected macroeconomic variables has also been studied in the framework of a regression approach. Time series annual data covering the period of 1980 to 2014 has been used for the empirical analysis. Augmented Dickey Fuller test has been used for checking the unit root in the data. Ordinary Least Squares method is used for the estimation of regression equations. For avoiding the problems of spurious relationship between the variables and series implications for the standard errors, various diagnostic tests have been applied. Initially study has taken exchange rate as dependent variable and some selected macroeconomic variables as independent variables. The result show that exchange rate has negative relationship with the variables such as inflation (*INF*), foreign direct investment (*FDI*), imports (*IMP*) and positive with *GDP* per capita (*PCGDP*) and exports (X), which is also supported by the theory and results. As there is two-way relationship between exchange rate and several macroeconomic variables, some selected macroeconomic variables are taken as dependent variables and exchange rate as independent variable. The results show that exchange rate volatility has negative impact on foreign exchange reserves (*FOREX*), and imports (*IMP*) and positive on *GDP* per capita (*PCGDP*) and exports (*X*). On the basis of the findings, it has been recommended that foreign factors in addition to the domestic

factors should also be taken into account for the stability of exchange rate. Moreover, instead of targeting the monetary aggregates, the State Bank of Pakistan should follow a rule based monetary policy where exchange rate fluctuations should also be taken into account. Moreover, instead of devaluations of rupee for increasing exports, the government is required to follow import substitution policies. Furthermore, to increase the inflow of foreign exchange reserves in the country, the development of export sector of the country can play an important role.

Keywords

Exchange Rate, Volatility, Inflation, *FDI*, Import, Export

1. Introduction

Exchange rate is the rate at which one currency is exchanged for an alternate. In other words the cost of a nation's currency in terms to an alternate nation is exchange rate. It is additionally viewed as the valuation of one nation's currency in terms of an alternate currency, and the measure of units of currency that can buy measure of units of another currency. The Nominal exchange rate is a rate at which the relative prices of the two moneys or currencies are measured, e.g. Rupee in relation to US Dollar. Hence nominal exchange rate is a monetary concept, while Real exchange rate is undoubtedly observed as real concept. Through real exchange rate the comparative price of two tradable goods (exports and imports) with regards to non-tradable goods (goods and services produced and consumed locally) is measured. The fact that relationship between two goods could be such that changes in nominal exchange rate leads to cause short-run changes in real exchange rate [1]. This study will take into account the nominal exchange rate for the period of 1980 to 2014.

Exchange rates float widely against each other, which mean that they are simply in frequent fluctuations. Money or specifically currency appraisals are dependent on the moves of currency in and outside a country. A higher demand for a specific currency results in that the worthiness of a currency increases and vice versa. In short, a market-based exchange rate changes whenever the values of currencies change. Whenever demand for a currency is higher than the available supply, it will have a tendency to become more valuable. It will become less valuable whenever demand is significantly less than available resource as people may like holding their prosperity in other styles or perhaps another currency. From this apart, exchange rate fluctuations are triggered by changes in a great many other macroeconomic factors also. For instance, in the long-run, changes in the supply and demand of a currency rely upon changes in the value of imports and exports. In the same way exchange rate is damaged by the known level of inflation in the economy, prevailing interest, money supply and other variables. Exchange rate adjustments in several countries have the largest effect on the worthiness of currencies

because traders usually look for safe investments with the best possible yields. In the same way if imports surpass exports, changes in balance of trade arise, the desire to have foreign currency goes up and therefore, exchange rate for such country depreciates. If the gross domestic product enhances it reduce the true home currency depreciation. Therefore the gross domestic product influences the exchange rate fluctuation so do the other variables. Furthermore changes in exchange rate also have some significant repercussions for different macroeconomic parameters [1].

Exchange rate takes on an important role within the age of globalization as well as financial liberalization. Because movements in exchange rates impact the success of multinationals as well as increase exchange connection with enterprises and fund companies. If exchange rate is steady it can benefit enterprise and financing institutions in analyzing the performance of purchases, funding and evading thus minimizing their comprehensive risks and dangers. Macroeconomic variables for example interest rate, wages, unemployment, and the quality of output could be affected by fluctuations in the exchange rate possibly. This may finally end up with a macroeconomic disequilibrium that may lead to devaluation of exchange rate to improve the external instability in the economy [2].

In Pakistan, monetary policy has passed through different stages. First, the State Bank of Pakistan followed a fixed exchange rate system from 1973 to 7th January 1982 and the rupee exchange rate was kept at 9.9 per US dollar. On 8th January 1982, the State Bank of Pakistan adopted a managed float exchange rate system but the rupee kept its downward trend. During the period 1982-1999 it further depreciated from 12.71 to 51.77 per US dollars. After that the State Bank of Pakistan introduced a full float market based system on 19th May 1999, determined by the demand and supply side factors in foreign exchange market. But the value of rupee declined further and it depreciated from 58.03 to 62.55 per US dollar during the period 2000-2008 (State Bank of Pakistan, 2005). Looking at the growth performance, the GDP growth rate was 6.80% during 1973 which reduced to 1.70% in 1997 and again rose to 4.10% during 2008. Similarly inflation in the country was at its highest, 26.71% during 1975 reduced to 3.59% in 1987 and again raised to 12% during the period 2008. The trade balance of the country remained surplus with an amount of 153 million rupees only in the year 1973. After that it showed a downward trend and reached to a deficit of 51,799 million rupees in 1985 and this condition deteriorated further as the deficit reached to 1,315,454 million rupees during 2008. The foreign exchange reserves although showed an increasing pattern but with a slow growth rate. During 1973 it was 3920.4 million rupees that rose to 78,386 million rupees in 1994 and again rose to 592,723.8 million rupees in 2008 [3] [4].

2. Literature Review

A comprehensive description of the previous theoretical as well as empirical discussions highly relevant to the objectives of the study has been highlighted in this

chapter. Literature review is crucial part of any good research. The literature reviewed for this study has been organized in the following way.

Reference [5] used annual data from 1980 to 1998 to examine the relationship between exchange rate systems and price levels for more than 100 international locations. The study concluded that for developing countries, using fixed exchange rate technique, the inflation rate seemed to be 20 percent higher in comparison to those countries which had flexible exchange rate systems. The study also found the same but a comparatively weaker relationship for industrial countries.

Reference [6] empirically analysed the role of exchange rate in price distortion in Nigeria by utilizing annual data for the period 1970-2003. The study used price level, money supply, nominal GDP and exchange rate. Both Vector Error correction (VEC) and Slope-dummy methodology were adopted for that economic and statistical significance of exchange rate variation created by government in determination connected with inflation. The impulse response function showed that depreciation of Naira raised inflation and also reduced output level. The error variance decomposition concluded that changes in both exchange rate and money supply strongly influenced inflation within Nigeria. The slope-dummy results also verified the aforementioned results. Overall, the results showed that in Nigeria exchange rate variability played a vital role in the determination of inflation rate in the United Kingdom (UK).

Reference [7] examined the demand for foreign exchange reserves under fixed and also floating exchange rate regimes for three developing nations namely Mexico, Kenya and Philippines by using quarterly data within the period 1986: QI-2000: QIV. It had been estimated that average propensity to import, variability of reserves and volume of imports were the main determinants of foreign exchange reserves in these countries for the full sample period. Nevertheless, the sub-sample results of the study showed that the behaviour of foreign exchange reserves remained the same under both the regimes periods.

Reference [8] studied the relationship between exchange rate and foreign exchange reserves in Turkey through the use of monthly data for the time period 1982: M1 to 2005: M11. Using Unit root and Co integration tests, the study figured there was a relationship between exchange rate and foreign exchange reserves. The study additionally mentioned that for nominal effective exchange rate, the causality runs simply for foreign exchange reserves both in short and long run. Nevertheless, about the relationship involving nominal exchange rate and foreign exchange reserves, the study concluded that ultimately nominal exchange rate affected foreign exchange reserves. In the flexible exchange rate system, foreign exchange reserves holdings became abridged. The study suggested that to stop any possibility of financial crisis in future, foreign exchange reserves could be used as an important tool to cut back the negative effects involving exchange rate volatility. Reference [9] has concluded that exchange rate fluctuation as well as changes in inflation is generally interrelated. They said that macro-economic factors affect the daily volatility of the exchange rate against the US Dollar. Analysing an international panel of 43 stock markets in 1990-2001 we know that the flexibility on the

exchange rate regime, central bank's intervention and also the uncertainty of the particular domestic economy increase exchange rate volatility, while the country's economic wealth decreases volatility. Restrictions on capital flows tend not to affect exchange rate volatility.

Reference [10] undertook a threshold Co-integration analysis to examine the relationship between exchange rate and foreign reserves in some African countries through the use of quarterly data over the time 1980: QI to 2004: QIV. It had been concluded that some sort of relationship existed between the exchange rate and foreign exchange reserves in many countries. It was also determined that foreign exchange reserve holdings in these countries were higher in the floating regime as compared to peg regime period.

Reference [11] looked into the impact of interest rate differentials on the exchange rate of Indonesia in opposition to four industrialist countries specifically Japan, Singapore, UK and USA from the framework of an International Fisher Effect approach. The research showed that interest rate differentials had an important but negative impact on the Indonesian exchange rate in opposition to Japan. However, for the opposite three countries *i.e.* Singapore, UK and USA, the relationship between the interest rate differentials and exchange rate were found to be positive but insignificant.

Reference [12] used monthly data for the period 1993 to 2007 intended for examining the role involving mercantilist and precautionary measures in the foreign exchange reserves demand of India. They incorporated imports, foreign institutional expenditure, opportunity cost measure and also nominal exchange rate as the determinants. The Co-integration results showed a long run relationship between the foreign exchange reserves and its factors in the event where nominal exchange rate is utilized as a proxy for the mercantilist motive. It was also found that each variable play an important role in the holdings of *FOREX* in India. Nevertheless, the measures of the particular mercantilist approach were found to be more significant comparatively.

To summarize it, there is strong correlation between exchange rate and certain other macroeconomic variables like inflation, devaluation of currency, output level and foreign exchange reserve etc. In case of developing countries using fixed exchange rate technique, the inflation rate seemed to be higher in comparison to those countries which had flexible exchange rate systems. Also depreciation of currency raised inflation and also reduced output level. Exchange rate variability played a vital role in the determination of inflation rate. From existing literature it can be concluded that to stop any possibility of financial crisis in future, foreign exchange reserves could be used as an important tool to cut back the negative effects involving exchange rate volatility.

3. Objectives

The study has the following main objectives:

1) To find out the impact of selected macroeconomic variables on exchange rate

volatility from the year 1980 to 2014.

2) To examine the impact of exchange rate volatility on selected macroeconomic variables for the period 1980-2014.

3) To provide useful suggestions for tackling the problems associated with exchange rate volatility in Pakistan, in the light of findings of the study from 1980-2014.

4. Research Methodology

The two step analysis was carried out to explain the methodological framework of this study. As a catastrophe step, variables were tested regard unit root to examine stationarity and the order of integration. And in second point econometric techniques are put on to test hypotheses with the study. A comprehensive explanation is given in the following paragraphs.

4.1. Secondary Data

For the present study, time series data from the year 1980 to 2014 was used. The data extracted for the selected variables. The data extracted majorly from State Bank of Pakistan (SBP), World Bank Development Indicator, Asian Development Bank and Economic Surveys, covering a time span of 1980-2014. While some of the findings and information is also gathered from previous reports, research papers, academic journals and official websites.

4.2. Data Analysis

E-Views (Version 07), statistical and econometric application software were used for the empirical analyzation of the data and hypothesis testing.

4.2.1. Analytical Techniques

With a view to accomplish the pre-determined set of objectives of the research, different sets of techniques and tests have been taken on. Different econometric techniques were applied to accomplish the predefined objectives of the study. These techniques are discussed as below.

4.2.2. Stationarity Checks

A time series data is made stationary to avoid bogus regression and conclude results that are significant in real world and which also make some sense in conditions of economic theory. Stationarity of time series is required not only to draw some meaningful inferences of the results obtained but also to obtain a reliable base for economic forecasting. An information/data series is stationary if their mean and variance remain frequent over an identified time period and the covariance between the two time periods will not rely upon the actual time at which it is figured out but depends only on lag between the two time periods where the relationship between a series and its lagged values is assumed to depend only on the length of the lag and not on when the series started [13]. A time series following this property is considered stationary and assumed to have no unit root. To

inquire for unit root in the time series variables considered, this study employs Augmented Dickey Fuller (ADF) unit root test. Unit root test is utilized to check the stationary (non-stationary) of time series data as a non-stationary regressor gives many invalid standard empirical results and therefore require special treatment. Unit root test is now widely popular over the last a long period in time series analysis to test the stationary of variable using an autoregressive model. A Dickey Fuller (DF) test is an econometric test to determine 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. In the augmented version DF test is generally functional, because in the occurrence of serial correlation it is not valid.

Generally ADF test involves the estimation of one of the following three equations respectively [14].

$$\Delta Xt = \beta Xt - 1 + \sum_{J=1}^{p} \delta j \Delta Xt - j + €t \quad (1)$$

$$\Delta Xt = \alpha 0 + \beta Xt - 1 + \sum_{J=1}^{p} \delta j \Delta Xt - j + €t \quad (2)$$

$$\Delta Xt = \alpha 0 + \alpha 1t + \beta Xt - 1 + \sum_{J=1}^{p} \delta j \Delta Xt - j + €t \quad (3)$$

The additional lagged terms are included to ensure that the errors are uncorrelated. The maximum lag length begins with 4 lags and proceeds down to the appropriate lag by examining the Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC). The null hypothesis is that the variable Xt is a non-stationary series ($H0$: $\beta = 0$) and is rejected when β is significantly negative (Ha: $\beta < 0$). If the calculated ADF statistic is higher than McKinnon's critical values, then the null hypothesis ($H0$) is rejected and the series is stationary. Alternatively, non-rejection of the null hypothesis indicates non Stationarity leading to the conduct of the test on the difference of the series till stationarity is obtained and the null hypothesis is rejected.

4.2.3. Inferential Statistics Technique

To investigate the data and make useful judgments on the basis of such evaluation, inferential statistics procedures are applied where inferences are made on the basis of sample data to conclude valid judgments about the population structured on such samples. Inferential statistics procedures are ways of analyzing data in such a way that they provide useful guidelines to the researcher in drawing findings about whether or not a hypothesis was sustained by the results. Right now many ways are used to inference the results. Since the key purpose of this study is to discover the impact of independent specifics on dependent variables, therefore, the study has used regression analysis. Regression evaluation (t-ratios, f-statistics, p-ideals, r-squared) allows to create a conclusion related to the speculation made under this study.

4.3. Model Specification

To perform the analysis, five econometric models are built. The first one estimates the impact of major macroeconomic factors on exchange rate, while the other models depict the impact of exchange rate on selected macroeconomic variables *i.e. FOREX*, *PCGDP*, *EXP*, *IMP* related to period 1980 to 2014.

4.3.1. Model 1

The central regression equation that will explain the impact of macroeconomic variables on exchange rate will be constructed from the following functional form.

$$EXR = f\left(FDI, PCGDP, INF, IMP, EXP\right) \tag{4}$$

$$EXRt = f\left(FDIt, PCGDPt, INFt, IMPt, EXPt\right)$$

Expression for log-log (or double log or simply log) model is thus given as,

$$LEXRt = \beta 0 + \beta 1LFDIt + \beta 2LPCGDPt + \beta 3LINFt + \beta 4LIMPt + \beta 5LEXPt + \mu i \tag{5}$$

where,

L denotes log and t denotes time period,

EXR = Exchange Rate,

FDI = Foreign Direct Investment Net Inflows Growth Rate,

PCGDP = GDP per Capita,

INF = Inflation,

IMP = Imports,

EXP = Exports,

μi = Error Term.

4.3.2. Model 2

To specify the impact of exchange rate fluctuations on selected macroeconomic variables four regression models are derived in the following functional form.

$$FOREX = f\left(AID, FREM, MS, IR, EXR\right) \tag{6}$$

The number of the determinants of *FOREX* can be very large but exchange rate is one its vital determinants. Similarly as interest rate is also of central importance in affecting foreign exchange reserves.

The functional form of the regression model is given as,

$$FOREXt = f\left(AIDt, FREMt, MSt, IRt, EXRt\right)$$

where the log-log model is as,

$$LFOREXt = \beta 0 + \beta 1LAIDt + \beta 2LFREMt + \beta 3LMSt + \beta 4LIRt + \beta 5LEXRt + \mu i \tag{7}$$

where,

L denotes log and t denotes time period,

FOREX = Foreign Exchange Reserves (excluding Gold reserves),

AID = Net Official Development Assistance and Official Aid Received,

FREM = Foreign Remittances,

MS = Money Supply (Money and Quasi Money (M2)),
IR = Interest Rate,
EXR = Exchange Rate,
μi = Error Term.

4.3.3. Model 3

To identify the impact of exchange rate fluctuations on GDP per capita the regression model is derived in the following functional form

$$PCGDP = f\left(EXR, INF, FDI\right) \tag{8}$$

The functional form of the regression model is given as,

$$PCGDPt = f\left(EXRt, INFt, FDIt\right)$$

where the log-log model is as,

$$LPCGDPt = \beta 0 + \beta 1EXRt + \beta 2INFt + \beta 3FDIt + \mu i \tag{9}$$

where,

L denotes log and t denotes time period,
$PCGDP$ = GDP per Capita,
EXR = Exchange Rate,
INF = Inflation,
FDI = Foreign Direct Investment Net Inflows Growth Rate,
μi = Error Term.

4.3.4. Model 4

The impact of exchange rate fluctuations on exports is depicted in the following regression model.

$$EXP = f\left(EXR, INF, IR\right) \tag{10}$$

$$EXPt = f\left(EXRt, INFt, IRt\right)$$

where the log-log model is as,

$$LEXPt = \beta 0 + \beta 1EXRt + \beta 2INFt + \beta 3IRt + \mu i \tag{11}$$

where,

L denotes log and t denotes time period,
EXP = Exports,
EXR = Exchange Rate,
INF = Inflation,
IR = Interest Rate,
μi = Error Term.

4.3.5. Model 5

The impact of exchange rate fluctuations on imports is depicted in the following regression model

$$IMP = f\left(EXR, PCGDP, INF\right) \tag{12}$$

where the log-log model is as,

$$LIMPt = \beta 0 + \beta 1EXRt + \beta 2PCGDPt + \beta 3INFt + \mu i \quad (13)$$

where,

L denotes log and t denotes time period,

IMP = Imports,

EXR = Exchange Rate,

$PCGDP$ = GDP per Capita,

INF = Inflation,

μi = Error Term.

5. Results and Discussions

5.1. Empirical Results of Model-1

The regression model explaining the impact of selected macroeconomic variables on exchange rate growth is based on the functional form given as,

$$EXRt = f\left(FDIt, IMPt, EXPt, PCGDPt, INFt\right)$$

where t represents the time trend and,

EXR = Growth in Exchange Rate,

FDI = Growth in Foreign Direct Investment,

IMP = Growth in Imports,

EXP = Growth in Exports,

$PCGDP$ = Growth in per Capita GDP,

INF = Growth in Inflation.

5.1.1. Stationarity Check

The data series has been examined for the stationarity through the standard procedure of unit root testing. For this by employing the Augmented Dickey Fuller (ADF) test (Table 1).

From figure above it can be seen that variables such as and INF is non-stationary at level with intercept, trend & intercept and without both (none) but becomes stationary at first difference with intercept, trend & intercept and at none. The variables such as *IMPORTS*, *EXPORTS*, *FDI* and *PCGDP* are found stationary at level with intercept, trend & intercept and at none.

5.1.2. Regression Analysis

After running the regression the following results (Table 2) are generated. In this coefficients of all variables along with their t-statistics and p-values are observed. Also R-Squared and Durbin Watson statistics is calculated. R-Squared is also known as the coefficient of determination, which is calculated to obtain the number of times actual and estimated values are same. Durbin Watson (DW) test is carried out to check for auto-correlation in the model. Literally the range for DW is 1.7 to 2.3. If the value of DW is in this range it shows that there is no-auto correlation in the model and this data can be utilized for further analysis. Various diagnostic checks have also been carried out for the model to confirm its stability which is provided in the proceeding paragraphs.

Table 1. Unit root estimation by augmented-dicky fuller test.

Variables	p-Values at Level			p-Values at First Difference			Decision Remarks
Intercept	Trends &	None	Intercept	Trends &	None	Intercept	Intercept
IMP	0.0002	0.0007	0.0001	-	-	-	I(0)*
EXP	0	0.0002	0.0001	-	-	-	I(0)*
FDI	0.0005	0.0032	0.0001	-	-	-	I(0)*
PCGDP	0.0029	0.016	0.0074	-	-	-	I(0)*
INF	0.0799	0.1666	0.2364	0	0	0.0001	I(1)*
EXR	0	0.0786	0.0132	-	-	-	I(0)*

*indicates significance level of 5%.

Table 2. Regression results model-1.

Dependent Variable: EXR

Method: Least Squares

Sample (Adjusted): 1981 2014

Included Observations: 34 after Adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.99692	2.399497	5.833273	0
FDI	−0.09461	0.03384	−2.79578	0.0098
IMP	−0.09443	0.119038	−0.79327	0.0435
EXP	0.760515	0.173555	4.381977	0.0002
PCGDP	0.579484	1.044935	0.554564	0.5841
INF*	−0.01982	0.481512	−0.04116	0.9675
R-squared 0.644073		Mean dependent var		7.730467
Adj R-squared	0.582888	S.D. dependent var		10.78322
S.E. of regression	7.976026	Akaike info criterion		7.162743
Sum squared resid	1590.425	Schwarz criterion		7.440289
Log likelihood	105.0225	Hannan-Quinn criter.		7.253216
F-statistic	5.966678	Durbin-Watson stat		2.281711
Prob (F-statistic)	0.000918			

*Indicates variable is stationary at first difference.

The table above represents the results of the regression model.

Multiple R-Squared and Adjusted R-Squared values both are measures of model performance. Their possible values range from 0.0 to 1.0. Because of model complexity, the value of Adjusted R-Squared is always a bit lower than the value of Multiple R-Squared and accordingly model performance is more effectively accessed by this. The R-squared of 0.644 shows that 64.4 percent of the variation in dependent variable (*EXR*) is discussed by Growth in imports, exports, foreign direct investment, per capita *GDP* and inflation. Moreover, the F-statistics with prob-

ability of 0.000918 confirms the overall significance of the model and approves that the model is jointly significant, showing that all the explanatory variables have a significant joint impact over the dependent variable. Moreover it is evident from the result that the model is not a spurious one and can be used for economic analysis (value of R-squared is less than value of D-statistics, *i.e.* 0.64 < 2.28 and the residuals are stationary when tested for unit root).

In the table the value of Durbin-Watson (DW) test is 2.28 and lies in the range of 1.7 and 2.3 confirming no autocorrelation in the model. The values of the standard errors are too small and there are three out of five explanatory variables which are individually statistically significant provide quite enough evidence that there is no multicollinearity in the explanatory variables.

The power and kind of relationship that every explanatory variable bears for the dependent variable are shown by their coefficients. A positive coefficient indicates a positive relationship of an explanatory variable with the dependent variable while a negative coefficient represents negative one. Holding all other variables constant, the coefficient reveals the projected change in the dependent variable for every one unit change in the associated regressor.

The values of coefficient for each series have been given in Table 2. The t-statistics for each series are also given in Table 2 to assess the individual statistical significance of each explanatory variable. The table shows that the coefficients for exports (*EXP*), and per capita *GDP* (*PCGDP*) are positive, while the coefficients for imports, foreign direct investment and inflation are negative. It is also evident from the table that imports, exports and foreign direct investment are individually statistically significant whereas exports and per capita *GDP* are individually statistically insignificant. In general the coefficient signs associated to almost all the variables are according to theoretical predictions. Thus the results indicate that the model is correct and best fitted.

The expression for the estimated model-1 is given as under.

$$EXR = 13.9969 - 0.0946FDIt - 0.0944IMPt + 0.7605EXPt + 0.57941PCGDPt - 0.0198INFt$$

Interpretation of the results is given step by step.

Results of Growth in foreign direct investment (*FDI*) suggests that there exists a negative relationship between *EXR* and *FDI*, where it is seen that keeping all other variables constant, a one unit rise in *FDI* will cause 0.094 unit fall in dependent variable *EXR*. The result in terms of economic theory can be justified in the sense that as exchange rate falls an increase in *FDI* may be observed and such increase in *FDI* may raise aggregate demand for certain goods and service. Such rise in demand may therefore, result in increase in prices of those goods and services and may directly affect inflation leading to fall in the domestic currency price of foreign currency that is to a fall in exchange rate.

The relationship between growth in imports and the dependent variable *EXR* is found to be negative and shows that one unit increase in imports growth will cause 0.094 units fall in *EXR* keeping all the other variables as constant. This means

that an increase in imports will cause an increase in value of foreign currency in relation to domestic currency. As more and more imports are furnished, more and more domestic currency will be needed to have one unit of foreign currency. The relationship is statistically significant which confirms the fact that imports undermines the economic stimulus that will support stronger home currency. Increase in imports deepens growth in international payments and increases the value of foreign currency comparative to the domestic one.

Exports (*EXP*) being a source of foreign exchange has a significant positive impact on *EXR*, since positive growth in exports earnings always play a supportive role in strengthening domestic currency against foreign currency. The above results strengthen the theory and show that every time growth in exports increases by 1 unit *EXR* will raise by 0.76 units. The result confirms that an upward trend will be observed in *EXR* whenever exports in the economy rise. It is so because positive growth in exports results in positive foreign exchange earnings which slowdowns domestic inflation and consequently results in rise in exchange rate.

Per capita *GDP* (*PCGDP*) shows a positive but insignificant impact on the dependent variable EXR. The results show that keeping all the other variables as constant a one unit increase in *PCGDP* may result in 0.57 units increase in the dependent variable; however, this impact is not significant enough in the time period taken under this study as evident from the results presented in Table 2.

Growth in inflation (*INF*) has a negative but insignificant impact on the dependent variable *EXR*. Keeping all the other variables as constant a one unit increase in inflation growth will lead to 0.01 unit fall in the dependent variable *EXR* however, this impact is not significant enough as obvious from the results given Table 2. Generally, a high level of inflation adversely affect import-oriented sector of the economy while export-oriented sector may benefit from it and this might be the reason that inflation has not been one of the significant determinants of EXR.

5.2. Empirical Results of Model-2

The functional form of the regression model is given as,

$$FOREX = f\left(AIDt, FREMt, MSt, IRt, EXRt\right)$$

Where, t denotes time trend and,
FOREX = Growth in Foreign Exchange Reserves,
AID = Growth in Foreign Aid,
FREM = Growth in Foreign Remittances,
MS = Growth in Money Supply,
IR = Growth in Interest Rate,
EXR = Growth in Exchange Rate.

5.2.1. Stationarity Check

The Augmented Dickey Fuller (ADF) test is employed to check for stationarity of the data series, which has been investigated by the standard procedure of unit

root testing.

The results are presented in Table 3 below.

From the table above it can be observed that variable such as IR is non-stationary at level with intercept, trend & intercept and at none but becomes stationary at first difference with intercept, trend & intercept and at none. The variables such as *AID, FREM, MS*, *FOREX* and *EXR* are found stationary at level with intercept, trend & intercept and at none as obvious from the above table.

5.2.2. Regression Analysis

After applying the regression model the following results (Table 4) are generated.

The table below indicates the results of the regression model.

The R-squared of 0.653 shows that 65.3 percent of the variation in dependent variable (*FOREX*) is explained by Growth in foreign aid, remittances, money supply, interest rate and exchange rate. Furthermore, the F-statistics with probability of 0.003283 approves the overall significance of the model and accepts that the model is jointly significant. It is further evident from the result that the model is not as spurious.

In the table the value of Durbin-Watson (DW) test is 1.92 which lies in the range of 1.7 and 2.3 confirming no autocorrelation in the model. The values of the standard errors are too small and there are three out of five explanatory variables which are individually statistically significant provides quite enough evidence that there is no multicollinearity in the explanatory variables.

The values of coefficient for each series have been given in Table 4. To assess the individual statistical significance of each explanatory variable the t-statistics for each series are also given in the same table. The table shows that the coefficients for foreign aid (*AID*), foreign remittances (*FREM*), money supply (*MS*) are positive while the coefficients for interest rate (*IR*) and exchange rate (*EXR*) are negative. It is also evident from the table that foreign aid (*AID*), foreign remittances (*FREM*), money supply (*MS*) are individually statistically significant whereas interest rate (*IR*) and exchange rate (*EXR*) are individually statistically insignificant.

The model can now be represented in the following econometric form,

$$FOREX = -22.052 + 0.465AIDt + 0.881FREMt + 0.759MSt - 0.980IRt - 0.341835EXRt$$

$$0.0284 \quad 0.0060 \quad 0.0507 \quad 0.7161 \quad 0.6831$$

The results confirm that growth in foreign aid has a significant positive impact on foreign exchange reserves in Pakistan from 1980-2014 and show that one percent increase in foreign aid will cause foreign exchange reserves to grow by 0.46 percent.

Since the contribution of foreign assistance towards the development of Pakistan is considerable. Foreign aid has played a supporting role in helping the

Table 3. Unit root estimation by augmented-dicky fuller test.

Variables	p-Values at Level			p-Values at First Difference			Decision Remarks
Intercept	Trends &	None	Intercept	Trends &	None	Intercept	Intercept
AID	0	0	0	-	-	-	I(0)*
FREM	0.0006	0.0017	0.0001	-	-	-	I(0)*
MS	0.0012	0.0069	0.018	-	-	-	I(0)*
IR	0.6308	0.917	0.382	0.0192	0.0144	0.0238	I(1)*
EXR	0	0.0786	0.0132	-	-	-	I(0)*
FOREX	0.003	0.0007	0.0016	-	-	-	I(0)*

*indicates significance level of 5%.

Table 4. Regression results model-2.

Dependent Variable: FOREX

Method: Least Squares

Sample (Adjusted): 1981 2014

Included Observations: 34 after Adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	−22.0526	24.17226	−0.91231	0.3694
AID	0.465133	0.201269	2.311001	0.0284
FREM	0.881485	0.296468	2.973293	0.006
MS	0.759885	0.569962	1.333216	0.0507
IR*	−0.98079	1.942167	−0.505	0.7161
EXR	−0.34184	0.828764	−0.41246	0.6831
R-squared	0.653209	Mean dependent var		28.96843
Adj R-squared	0.545568	S.D. dependent var		58.36839
S.E. of regression	46.85613	Akaike info criterion		10.69083
Sum squared resid	61473.91	Schwarz criterion		10.96018
Log likelihood	175.7440	Hannan-Quinn criter.		10.78268
F-statistic	4.641572	Durbin-Watson stat		1.921515
Prob (F-statistic)	0.003283			

*indicates the variable is stationary at first difference.

country to grow its international reserves. Countries like Pakistan usually face the problem of shortage of resources. There is a gap between savings and investment. With help of international assistance or foreign aid, a country can import more than what it is with the capacity backing by its exports. Thus, the resource restriction which stands in the way of development can greatly be solved through foreign aid or assistance.

It is apparent from the result that overseas remittances has a confident significant effect on the development of forex reserves showing that a one percent in-

crease in growth in foreign remittances will lead to 0.29 percent growth in foreign exchange reserves. The positive relationship can be justified in the sense that workers' remittances play vital role in provision of foreign exchange earnings and thus lead to a rise in the volume of foreign exchange reserves.

Foreign Exchange Reserves are foreign money held by international banks for use in international trade and in an effort to diversify their holdings and hedge against the inflation of their own currency.

This has to be considered into account here that a higher area of the worker's remittances is private and is channelled through the black market in and outside country, private foreign exchange shops and so on. In the case of Pakistan which if included in the official number would further augment the significance of remittances in growth of foreign reserves.

Foreign Exchange Reserves are overseas money kept by international bankers for use in international trade and in order to diversify their holdings and evade up against the inflation of their own money.

Besides qualitative evidence the statistical results here also indicate a positive significant relationship between the money supply and foreign reserves. The table shows that a one percent increase in money supply may lead to 0.75 percent increase in foreign exchange reserves.

The result of interest rate with foreign exchange reserves shows a negative and insignificant relationship where a one percent rise in interest rate may cause a −0.98 percent decline in foreign exchange reserves. A rise in interest rate may raise the cost of capital accumulation and also discourage foreign investors. This will lead to lower productivity and adversely affect export oriented sector and may therefore negatively affect projected foreign exchange reserves.

It is a common phenomenon that a rise in exchange rate fluctuation will cause a fall in the volume of foreign exchange reserves and which is also confirmed by the results here that exchange rate has a negative impact on the accumulation of international reserves. The same result that nominal effective exchange rate has a negative effect on the foreign exchange reserves is shown reference [8] [10] [15].

5.3. Empirical Results of Model-3

Regression Analysis

After application of regression model the following results (**Table 5**) are generated.

The table below represents the results of the regression model.

The model can now be represented in the following econometric form,

$$PCGDP = 2.119153 + 0.027609EXRt - 0.084616INFt + 0.015096FDI$$

INF is non-stationary at level with intercept, trend & intercept and without both (none) but becomes stationary at first difference with intercept, trend & intercept and at none.

As observed from the above table *PCGDP* is a function of *EXR*, *INF* and *FDI*. Out of three, two variables *i.e. EXR* and *FDI* are individually statistically signify

Table 5. Regression results model-3.

Dependent Variable: PCGDP				
Method: Least Squares				
Sample (Adjusted): 1981 2014				
Included Observations: 34 after Adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.119153	0.427819	4.953384	0
EXR	0.027609	0.030529	−0.90434	0.03738
INF*	−0.08462	0.091649	−0.92327	0.36402
FDI	0.015096	0.006183	2.441647	0.00215
R-squared	0.659753	Mean dependent var		2.233926
Adjusted R-squared	0.677503	S.D. dependent var		1.812402
S.E. of regression	1.643697	Akaike info criterion		3.951687
Sum squared resid	72.94695	Schwarz criterion		4.136717
Log likelihood	−57.2512	Hannan-Quinn criter.		4.012002
F-statistic	3.158104	Durbin-Watson stat		1.765244
Prob (F-statistic)	0.000838			

*indicates the variable is stationary at first difference.

cant and INF is individually statistically in significant. R-squared 0.659753 is less than adjusted R-squared. The R-squared of 0.659 shows that 65 percent of the variation in dependent variable (*PCGDP*) is discussed by Growth in exchange rate, inflation and foreign direct investment.

5.4. Empirical Results of Model-4

Regression Analysis

After applying the regression model the following results (Table 6) are generated.

The table below represents the results of the regression model.

Dependent variable exports have positive relation with *EXR* and inflation and negative relation with IR. Durbin Watson stat 1.78 lies in the range hence there is no auto correlation. Out of three, two variables *i.e. EXR* and *INF* are individually statistically significant and *IR* is individually statistically in significant.

The model can now be represented in the following econometric form,

$$EXP = 12.17131 + 0.516262EXRt + 0.108745INFt - 0.302822IRt$$

5.5. Empirical Results of Model-5

Regression Analysis

After running the regression model the following results (Table 7) are generated.

The table below represents the results of the regression model.

Import has negative relation with EXR. However positive with *PCGDP* and INF. Durbin Watson stat 2.23 lies in the range hence there is no auto correlation.

Table 6. Regression results model-4.

Dependent Variable: EXPORTS				
Method: Least Squares				
Sample (Adjusted): 1981 2014				
Included Observations: 34 after Adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.119153	0.427819	4.953384	0
EXR	0.027609	0.030529	−0.90434	0.03738
INF*	−0.08462	0.091649	−0.92327	0.36402
FDI	0.015096	0.006183	2.441647	0.00215
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.17131	1.812491	6.715239	0
EXR	0.516262	0.143894	−3.5878	0.0013
INF*	0.108745	0.481089	0.226039	0.0029
IR*	−0.302822	0.527613	−0.573947	0.5708
R-squared	0.590577	Mean dependent var		8.164466
Adjusted R-squared	0.622863	S.D. dependent var		9.717479
S.E. of regression	7.996349	Akaike info criterion		7.115761
Sum squared resid	1726.423	Schwarz criterion		7.300792
Log likelihood	−106.2943	Hannan-Quinn criter.		7.176077
F-statistic	5.76807	Durbin-Watson stat		1.783316
Prob (F-statistic)	0.003495			

*indicates the variable is stationary at first difference.

Out of three, two variables *i.e. EXR* and *PCGDP* are individually statistically significant and *INF* is individually statistically in significant.

The model can now be represented in the following econometric form,

$$IMP = 0.744131 - 0.063368EXRt + 3.227751PCGDPt + 1.350255INFt$$

6. Conclusions

Instability of exchange rate hampers the economy in the long run by affecting the volume of exports and imports, and, eventually leads to hampering of economic growth and development. In short term local consumer and trader are affected. Instability is caused by an appreciation of exchange rate, as it causes a decrease in exports and an increase in import as the exports become expensive and imports become cheaper. One factor in the appreciation of exchange rate could be the constantly increasing inflation. The study confirms that exchange rate has an essential position in financial market of Pakistan and fluctuation in exchange rate will lead to fluctuation in various macro-economic variables and will eventually lead to slower economic growth and country's development. Study showed that

Table 7. Regression results model-5.

Dependent Variable: IMPORTS

Method: Least Squares

Sample (Adjusted): 1981 2014

Included Observations: 34 after Adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.744131	4.77096	0.155971	0.8772
EXR	−0.06337	0.243121	−0.26064	0.0063
PCGDP	3.227751	1.406978	2.294102	0.0098
INF*	1.350255	0.730917	1.847345	0.0757
R-squared	0.272335	Mean dependent var		7.463889
Adjusted R-squared	0.191483	S.D. dependent var		14.7662
S.E. of regression	13.27741	Akaike info criterion		8.12992
Sum squared resid	4759.822	Schwarz criterion		8.31495
Log likelihood	−122.014	Hannan-Quinn criter.		8.190235
F-statistic	3.368321	Durbin-Watson stat		2.236069
Prob (F-statistic)	0.033015			

*indicates the variable is stationary at first difference.

exchange rate has negative relationship with the variables such as inflation (*INF*), foreign direct investment (*FDI*), imports (*IMP*) and positive with GDP per capita (*PCGDP*) and exports (*X*), which is also supported by the theory and results. Results show that there is negative relationship between foreign exchange reserves and exchange rate. This is also true considering the fact that greater exchange rate fluctuation will cause fall in the capacity of foreign exchange reserves and results here confirm that exchange rate has a negative effect on the accumulation of foreign reserves. The results confirm that stabilized exchange rate plays a central role in the economy. Furthermore any depreciation of exchange rate will lead to weakening the strength of Pakistan's rupee. Our results strongly support our null Hypotheses. The study finds out that certain major macroeconomic variables such as foreign aid (*AID*) and foreign remittances (*FREM*) and money supply (*MS)* affect foreign exchange reserves (*FOREX*) in a positive way and hence should be taken into account to ensure lesser budget deficit. The study concludes that interest rate is that stabilized monetary policy variable that helps to strengthen the economy. This is also depicted from the results in case of Pakistan from the year 1980-2014 that there is negative relationship between forex reserves (*FOREX*) and interest rate (*IR*). A solid economy would assist in increasing international reserves and foreign direct investment (*FDI*). Pakistan is an impoverished and underdeveloped country which has experienced years of internal political disputes and low degrees of foreign investment. Change in foreign investment is associated with these financial factors. When there is more foreign investment and investors spend money

on State Bank of Pakistan's securities, they have to sell their own currencies (like US dollar, United kingdom's pound, Euro, etc.) to be able to buy Pakistan's rupee. An increased exchange rate makes the international goods valuable in Pakistan which results in upsurge in imports and reduces exports. Several key findings emerge from the study such as: to maintain a minimal rate of inflation has remained an upmost priority of the State bank of Pakistan (*SBP*), but the monetary policy also aims to support the national objectives of monetary diversification and competitiveness. In order to keep the exchange rate of the Pakistan's rupee stable, the authorities try to avoid deterioration in external competitiveness.

State bank of Pakistan use to take the following measures under the foreign exchange regulation act, 1947 from time to time in order to keep exchange rate of Pakistani rupee stable:

1) Lowering discount rate.

2) Lower yield on T. bills of different tenors. This raised pressure on the government to reduce its borrowing cost through rationalization of interest rates on national savings schemes.

3) Restrictions on dealing foreign exchange.

4) Restriction on payments like:

a) Any payment to or for the credit of any person resident outside Pakistan.

b) draw, issue or negotiate any bill of exchange or promissory note or acknowledge any debt, so that a right (whether actual or contingent) to receive a payment is created or transferred in favour of any person resident outside Pakistan.

c) Make any payment to or for the credit of any person by order or on behalf of any person resident outside Pakistan.

d) Place any sum to the credit of any person resident outside Pakistan.

e) Make any payment to or for the credit of any person as consideration for or in association with the receipt by any person of a payment or the acquisition by any person of property outside Pakistan and the creation or transfer in favour of any person of a right whether actual or contingent to receive a payment or acquire property outside Pakistan.

f) Draw, issue or negotiate any bill of exchange or promissory note, transfer any security or acknowledge any debt, so that a right (whether actual or contingent) to receive a payment is created or transferred in favor of any person as consideration for or in association.

5) Restrictions on import and export of certain currency and bullion.

6) Power to regulate the uses, etc., of imported gold and silver.

7) Regulation of export and transfer of securities.

8) Custody of securities.

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