

# Exchange Rate Volatility and Macroeconomic War: A Comparative Study of India and Pakistan

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## Abstract

Exchange rate has proved its behavior in determining the country economic position in this age of globalization and trade liberalization. Therefore, this research investigates that the determinants of trade i.e. Import, export, industrial growth, consumption level and oil prices fluctuation brings changes in exchange rate and its influence eventually on balance of payments in comparison of Indian and Pakistani economies. Data of defined variables is collected on annual basis of India and Pakistan for thirty one years. By applying cointegration, it is estimated that there exist a long run relationship in both countries. India and Pakistan has significantly and correctly sign the short run dynamic and some of the factors have not. In Pakistan balance of payment does granger cause exchange rate. For India, exchange rate does not granger cause balance of payment. It is concluded that exchange rate is very important determinant of trading in an open economy. Dealing in foreign exchange market, currency change affects every economy including developed or developing. This occurs because of the market forces of supply and demand, which pushes countries exchange rate as depreciated and appreciated.

**Key Words:** Exchange rate volatility, balance of trade, balance of payment

**JEL:** F33, F30, P31

## 1. INTRODUCTION

Exchange rate tells the value of one currency in terms of other. Generally it is recognized that depreciation in exchange rate be a positive signal for the economy it increases cost of imports that discourages imports and encourages exports and have a positive impact of the balance of trade. As far as appreciation of the currency is concerned it decreases exports and increases imports. This in turn proves that depreciation in exchange rate transfers income from importing

countries to the exporting countries and effects terms of trade. Because of uncertainty of exports revenue people reduces trade and this affects the economic growth of both importing and exporting nations. It is to be noted that for the purpose of adjustment of regime people hold foreign as well as domestic stocks. If exports are more than imports (Trade surplus) then people stated to hold foreign currency. In case of holding demand for the currency decreases and foreign currency will depreciate. If expectations of trade deficit in the future then as imports are more than exports then foreign money holding will be less. In case of that the foreign currency will started to appreciate. If courtiers inject money in the economy then money supply is larger so more consumption and investment in the economy is undertaken. More production will increases demand for goods and prices of goods increases. More money supply means lower interest rate and raise in exchange rate. If prices rises as a result of money supply then domestic interest rate increases (Contraction in monetary policy) then demand for the currency will rises and more capital inflow will have a significant impact on the economy and currency will started to appreciate. Different countries are having fixed as well as floating exchange rates. The goodness of flexible exchange rate is that countries are not dependent on one another in terms of formulating policies like monetary and fiscal policy. But in a fixed exchange rate regime if one country has implemented expansionary monetary policy then other country also has to follow the same policy. exchange rate calculation is one of the essentials for policy formulation for countries, (Qiao, 2007) states that we still are waiting to have comprehensive theory to predict exchange rate depreciation and appreciation on the trade balances, the empirical findings in exchange rate and balance of trade showed the mixed trends (Koray & McMillin, 2006). Exchange rate is a significant factor in international macroeconomics; it affects are witnessed in the recent past on different currency crises in many economies and has attracted focus of policy makers around the globe. Exchange rate has proved its behavior in determining the country economic position in this age of globalization and trade liberalization. Therefore, this research investigates that the determinants of trade i.e. Import, export, industrial growth, consumption level and oil prices fluctuation brings changes in exchange rate and its influence eventually on balance of payments in comparison of Indian and Pakistani economies.

## **2. LITRATURE REVIEW**

Empirical literature on cross-national policy regressions is now disregarded. But it is maybe just to say that the caution against overvaluation remains as tough as ever. In a survey of international growth literature (Easterly, 2005) points that overvaluations create unwanted effects on growth. Summing up, currency overvaluation and undervaluation are creating a challenge for the stable economies to control their stable growth, this need to be catered at very early stage to avoid the disturbance in economic growth and harmful results in long run (Krugman, 1986); (McKenzie, 1999); (Brada, Kutan, & Zhou, 1997); (Hartmann, 1998) and (Hau & Rey, 2006). In review of existing literature so far, it is observed that exchange rate plays critical role in international monetary transactions of an economy. Balance of Payments is a summary statement of these international transactions. In other words, balance of payment is used for the accounting of any specific country's total payments made during the certain period of time along with the receipts collected from any other country from private of government exchange sources. Though, studying the relationship between both is quite significant for

developing mix of trade reforms, formulation of new trade policies, regulation and restriction for uplifting trade balances to improve balance of payments. Hence, making this relationship entirely an empirical issue (Ostry, 1992; Rose, 1989), and recent panel studies of twenty two emerging countries in this area suggest made trade liberalization responsible for disturbance of balance of payment ((Nahuis & Parikh, 2002); (Santos-Paulino, 2002) and Latin American countries study by (Khan & Montiel, 1987) presented similar findings. Moreover, it is also stated that some countries use dual exchange rates systems because of their weak balance of payments situations, rather than devaluation of their currency, this approach sometime proves costly from a political and social point of view. However, if managed properly this dual exchange rate policy can be valuable for improving balance of payments of developing countries. Also, (Obadan, 2002) viewed international trade and foreign exchange markets constancy can be achieved by fixed exchange rates. Similarly, (Cooper, Walde, & Peckarsky, 1990) examines the effect of decrease in imports and increase in exports and eventually balance of payment improvement in long run can be achieved by devaluation. (Kiguel & Ghei, 1993) also highlighted the similar result of devaluation on balance of payments. On the contrary, the opinion is that the just devaluation does not always improve of balance of payments. The devaluation of currencies of different counties as compared to other currencies also helps in raising the positive trade balance. It is analyzed that export surges in the developing countries are connected with the exchange rate devaluation for the achievement of their new exports levels to the new growth destinations (Freund & Pierola, 2008). Oil prices and appreciation in exchange rate are positively correlated with Gross domestic product. A rise in oil prices has affected the global economy positively. The rise in oil prices is due to increase in demand not by supply side effects. Oil prices are more worthwhile than monetary contraction. Federal Reserve's in case of increase in oil prices will increase interest rate to control inflation. Increase in oil prices is affecting the oil producing countries in two contexts. First is positive effect that is income and wealth increases in oil producing countries, because importing countries pay more and if the exporting countries utilize income in home country then investment will be more in countries and increase employment in the society. It increase money supply in the society and currency appreciates in this regard. Second effect is negative because increase in oil prices will decrease demand for oil in oil importing countries and worsens balance of trade position in oil exporting country (Amano & Van Norden, 1998; Brahim Fezzani, 2011), (Aliyu, 2009), (Al-Ezzee, 2011), (Bjørnland, 2009), (Kilian, 2007), (Hamilton, 2009), (Jiménez-Rodríguez\* & Sanchez, 2005). Any changes in the real exchange rates would lead to fluctuations in short term capital flows. It plays an important role in economic activities; therefore the real exchange rate has been one of the most debated issues both in theory and the practice. The effect of real exchange rate on economic growth has been examined, and found that negative relationship between the two variables. Devaluation of a currency leads contraction in aggregate demand and output. Devaluation increases general price level and decrease in real money value increase demand for nominal money and interest rate and have a negative impact on investment and consumption decisions. Government has to pay more money for external debt which is either generated from taxes or by reducing expenditure. If it is by increase in taxes then it will lessen the private sector spending and negatively affects economy. (Munir A. S. Choudhary, 2006). Literature empirically proves that depreciation in exchange rate will make imports expensive that will encourage exports and stronger balance of

trade position and leads to higher economic growth. Despite that, appreciation in exchange rate will make imports cheap and has studied affect the economic growth as well (Aliyu, 2009), ((Tille, 2003), (Hsing, 2005), (Al-Ezzee, 2011). If government increases its spending that will increase consumption decreases balance of trade and depreciation in exchange rate and have a positive impact on Gross domestic product (Kim, 2007). Foreign direct investment is regarded as an important source of capital financing (Globerman & Shapiro, 1999). Government implement different strategies to foster economic growth and regime stability lead to increase in foreign direct investment inward (Ravn, 2012) has suggested that. If foreign direct investment is used in non-tradable sector then it will leads to appreciation of the currency (Hafeez-ur-Rehman, 2010). Different countries have proposed different causes of inflation. Either it is due to the supply of money or due to increase in import prices that causes depreciation of the currency (Ali, 1999).

### **3. METHODOLOGY**

Aim of this research study can be achieved with the help of econometric technique which is used to test the existence of a long run association among the different time series of data for India and Pakistan. In detail review of literature of exchange rate relationship, the trade balance has significant relationship and economic growth i.e. industrial growth ,capital goods and consumption level has strong negative relationship and oil prices has positive/negative relationship with exchange rate as its sign depends upon oil production at national level and its import from other countries.

Time series modeling and forecasting became quite popular following the publication of the text time series analysis forecasting and control (Box). They suggested some properties of time series that would suggest departures from stationary, that is, these would suggest nonstationarity. The two main properties were visual cues. First, if a series does not seem to have a constant mean (part of the definition of stationary) when graphed, that is a visible symptom of nonstationarity. The stationary or otherwise of a series can strongly influence its behavior and properties -e.g. persistence of shocks will be infinite for non-stationary series. If the variables in the regression model are not stationary, then it can be proved that the standard assumptions for asymptotic analysis will not valid. In other words, the usual “t ratios” will not follow a t-distribution, so we cannot validly undertake hypothesis tests about the regression parameters. If a non-stationary series,  $y_t$  must be differenced  $d$  times before it becomes stationary, then it is said to be integrated of order  $d$ . We write  $y_t \sim I(d)$ . So if  $y_t \sim I(d)$  then  $\Delta y_t \sim I(0)$ .

An  $I(1)$  series contains one unit root,

$$\text{e.g. } y_t = y_{t-1} + u_t$$

A series is said to be trend stationary when it is stationary around a trend:

$$y_t = \beta_0 + \beta_1 t + u_t$$

$t$  = trend

Differenced variables are usually thought of as representing the short-run. But if the built model does not belong to above circumstances, so the problem could be referred non stationary. Therefore, before running the model it will undergo stationary check.

If all variables are found to be integrated of the same order, the following process is generally employed. The first step is to estimate whether stable long-run dependencies exist among the

variables, i.e. whether the variables are cointegrated. If the cointegrating relations are identified, the next step is to determine the number of long-run equilibrium relationships or cointegrating vectors among the variables. The two most widely used tests for cointegration are the Engle-Granger two-step estimator maximum likelihood estimator. Since the long-run cointegrating relation is found among the variables, the estimation of cointegrating vectors is executed at the same time (Johansen, 1988; Johansen & Juselius, 1990). If there is evidence of cointegration between two or more variables, then a valid error correction model should also exist between the two variables. The error correction model is then a representation of the short-run dynamic relationship between X and Y, in which the error correction term incorporates the long-run information about X and Y into our model. This implies that the error correction term will be significant, if cointegration exists. In the previous section the cointegrating relationships of the variables are identified, and it will be included explicitly as error-correction terms into a short-run system. The estimated bi-variate ECM for Pakistan and India takes the following form:

$$\Delta EXRate_{it} = \alpha + \sum \beta_1 (\text{Exports}) - \sum \beta_2 (\text{Imp}) - \sum \beta_3 (\text{Capital goods}) - \sum \beta_4 (\text{industrial growth}) - \sum \beta_6 (\text{Consumption level}) + \sum \beta_7 (\text{Oil prices}) + \phi ECT_{it-1} + u_{1it} \dots \dots \dots (1)$$

(i=1...n1) (i=1...n2)

Where  $\Delta$  is the difference operator, are as defined;  $\phi ECT_{it-1}$  is the error correction term derived from the long- run co integrating relationship,  $u_{1t}$  is the white noise error terms  $t$  denotes the years and  $n_1$  is the lag orders of  $\alpha$ 's and  $\beta$ 's respectively. The ECM results distinguish between short-run and long-run Granger causality. The above said methodology is also applied on the second model [12].

$$\text{Balance of payment} = \beta_0 + \beta_1 (\text{exchange rate}) + \epsilon \dots \dots \dots (2)$$

Simple correlation does not necessarily indicate causation. One theoretical implication of cointegration is that if two variables, say, Exchange rate and real oil price or exchange rates, are integrated of order one and cointegrated, there must be a Granger-causality between balance of payment and in at least one direction as one variable can help determine the other. Testing for temporal causality between prices and volumes traded is centered on a bi variant VAR model comprising two stationary series, x and y. The model written as:

$$X_1 = \alpha + \sum_{i=1}^p \beta_i X_{t-1} + \sum_{j=1}^q \gamma_j Y_{t-j} + u_{x,t} \dots \dots \dots (3)$$

$$Y_1 = \delta + \sum_{i=1}^p \theta_i Y_{t-1} + \sum_{j=1}^q \phi_j X_{t-j} + u_{y,t} \dots \dots \dots (4)$$

For example, if x and y are stationary variables and p and q are the lag lengths for x and y respectively (Johansen & Juselius, 1990).

**4. RESULTS**

Table 1 explains the results of ADF test on unit root on level, first and second difference for Pakistan and India. As the null hypotheses time series is non-stationary (unit root). According to the table, For Pakistan, all the variables exchange rate, export, import, industrial growth, capital goods, and consumption level, oil prices and balance of payment are stationary in their first difference I (1). Similarly, for India all the variables are stationary on first difference I (1).

Table 1: ADF Test

	Variables	Types of Test	ADF test Statistics	R2	Stationary	D-W Statistics	Probability
<b>Pakistan</b>	Δ Exchange Rate	0 t 0	-3.670503**	0.36143	1st Diff	1.441286	0.0404
	Δ Import	0 t 0	-5.160417*	0.49657	1st Diff	1.954513	0.0012
	Δ Export	0 t 0	-3.594656**	0.363748	1st Diff	1.447318	0.0473
	Δ Industrial Growth	0 t 0	-3.996052*	0.374135	1st Diff	1.892869	0.0199
	Δ Capital Goods	0 t 0	-3.480554**	0.309715	1st Diff	1.851151	0.0598
	Δ Consumption Level	0 t 0	-5.302373*	0.512556	1st Diff	1.892855	0.0009
	Δ Oil Prices	0 t 0	-4.288914*	0.40954	1st Diff	1.557016	0.0102
	Balance of payment	c 0 0	-3.335468**	0.27727	1st Diff	1.733372	0.0217
<b>India</b>	Variables	Types of Test	ADF test Statistics	R2	Stationary	D-W Statistics	Probability
	Δ Exchange Rate	c 0 0	-6.040215*	0.56579	1st Diff	1.669816	0.000
	ΔΔ Import	c 0 0	-6.426155*	0.60466	1st Diff	2.069498	0.000
	Δ Export	0 t 0	-3.690257**	0.34514	1st Diff	2.052893	0.0387
	Δ Industrial Growth	0 t 2	-3.191716** *	0.31578	1st Diff	2.018238	0.1064
	Δ Capital Goods	0 t 0	-	0.29908	1st Diff	1.76431	0.0761

			3.359962** *			2	
Δ Consumption Level	0 t 0	-	3.224569** *	0.29666	1st Diff	2.22796 7	0.0988
Δ Oil Prices	0 t 0	-4.288914*		0.40954	1st Diff	1.55701 6	0.0102
ΔBalance of Payment	c 0 0	-6.603536*		0.60898	1st Diff	2.08532	0.000

After taking the order of stationary at d time as I (d), the next step is to apply the cointegration. Since before applying the Johansen cointegration test, lag length is selected. Firstly, we estimate vector autoregressive model and determined the optimal number of lags by ER, IM, EX, IG, CG, CL and OP as endogenous variable. So the optimal numbers of lags for Pakistan and India is 1. As the Johansen Cointegration results are shown in table 2.

Table 2: Johansen Cointegration

PAKISTAN							
Unrestricted Cointegration Rank Test (Trace)				Unrestricted Cointegration Rank Test (Maximum Eigenvalue)			
Hypothesized	Trace	0.05		Hypothesized	Max-Eigen	0.05	
No. of CE(s)	Statistic	Critical Value	Prob.*	No. of CE(s)	Statistic	Critical Value	Prob.**
r =0*	256.561 2	134.678	0.000	r =0*	88.2136 1	47.0789 7	0.000
r <1*	168.347 6	103.847 3	0.000	r <1*	62.3637 8	40.9568	0.0001
r <2*	105.983 8	76.9727 7	0.0001	r <2	31.8811 1	34.8058 7	0.1073
r <3*	74.1026 7	54.0790 4	0.0003	r <3*	28.7153 9	28.5880 8	0.0482
r <4*	45.3872 9	35.1927 5	0.0029	r <4*	24.3534 6	22.2996 2	0.0255
r <5*	21.0338	20.2618	0.0391	r <5	15.3926	15.8921	0.0597

	2	4			6		
<b>r &lt;6</b>	5.64115 9	9.16454 6	0.2203	<b>r &lt;6</b>	5.64115 9	9.16454 6	0.2203
<b>INDIA</b>							
<b>Unrestricted Cointegration Rank Test (Trace)</b>				<b>Unrestricted Cointegration Rank Test (Maximum Eigenvalue)</b>			
<b>Hypothesized</b>	<b>Trace</b>	<b>0.05</b>		<b>Hypothesized</b>	<b>Max-Eigen</b>	<b>0.05</b>	
<b>No. of CE(s)</b>	<b>Statistic</b>	<b>Critical Value</b>	<b>Prob.**</b>	<b>No. of CE(s)</b>	<b>Statistic</b>	<b>Critical Value</b>	<b>Prob.*</b>
<b>r =0*</b>	214.9939	134.678	0.000	<b>r =0*</b>	71.63379	47.0789 7	0.000
<b>r &lt;1*</b>	143.3601	103.847 3	0.000	<b>r &lt;1*</b>	46.49103	40.9568	0.0108
<b>r &lt;2*</b>	96.86907	76.9727 7	0.0007	<b>r &lt;2*</b>	35.00604	34.8058 7	0.0473
<b>r &lt;3*</b>	61.86303	54.0790 4	0.0086	<b>r &lt;3</b>	27.67727	28.5880 8	0.065
<b>r &lt;4</b>	34.18576	35.1927 5	0.0639	<b>r &lt;4</b>	21.99475	22.2996 2	0.0551
<b>r &lt;5</b>	12.19101	20.2618 4	0.4319	<b>r &lt;5</b>	8.596063	15.8921	0.4783
<b>r &lt;6</b>	3.594949	9.16454 6	0.4758	<b>r &lt;6</b>	3.594949	9.16454 6	0.4758

As the Johansen Cointegration results are shown in table 1.3. For Pakistan results reports that the trace test indicates 6 cointegration equation(s) at 5% critical value. These statistics indicates that one null hypothesis is rejected. This means that there are six Cointegration equation  $r = 6$  among the seven variables at a significance level of 5 %. Max-Eigen value test indicates 2 cointegration equation(s) at the 5% level. Similarly, India trace test indicates 4 cointegration equation(s) at 5% critical value. These statistics indicates that three null hypothesis are rejected. This means that there are four Cointegration equation  $r = 4$  among the seven variables at a significance level of 5 %. Max-Eigen value test indicates 3 cointegration equation(s) at the 5% level. Results indicates that there is a long-run relationship between the exchange rate,



export, import, industrial growth, capital goods, and consumption level and oil prices in India and Pakistan. From the results generated after the application of test, it is stated that there is a positive and negative relationship of the exchange rate with the import in both countries.

Table 3: Analysis of Exchange Rate and its Determinants of Trade

Variable s	Import	Export	Industrial Growth	Capital Goods	Consumption Level	Oil Prices	Constant
<b>Pakistan</b>	6.187919	- 5.296508	17.01341	-18.61379	-0.057373	0.071004	- 2.374268
	[+8.63580 ]	[ - 7.7075]	[+10.5891 ]	[ -14.141 ]	[ - 0.13594 ]	[+1.27698 ]	[ - 0.2823]
<b>India</b>	1.703966	- 1.29074	-6.420098	0.228034	4.261494	0.524709	- 315.4436
	[+2.39579 ]	[ - 1.6155]	[ - 3.9446]	[+0.22380 ]	[+7.42600 ]	[+2.61482 ]	[ - 7.8663]

Export shows the positive affect in India and Pakistan but the impact of export is higher in Pakistan and on the other side the results are opposite for the imports. Industrial goods has negatively related in Pakistan while it is positive in India. Capital goods has negative coefficient in Pakistan while it is negative in India and consumption level has positive relations in Pakistan and negative in India. Oil price is sensitive in Pakistan and India and has negative relation. Negative relationship with exchange rate shows that direction i.e. as it exports increases then currency appreciated and vice versa if all the variables remain constant then it means equilibrium level has been reached and constant term indicates the long run equilibrium. The intercept value indicates the change in constant change in exchange rate. All the constant term shows significant results. If all the variables remain constant then it means equilibrium level has been reached and constant term indicates the long run equilibrium. The intercept value indicates the change in constant change in exchange rate. All the constant term except Pakistan and India shows significant results.

Table 4: Vector Error Correction Model

	Error Correction:	D(ER)	D(IM)	D(EX)	D(IG)	D(CG)	D(CL)	D(OP)
<b>Pakistan</b>	<b>CointEq1</b>	0.086732	0.032051	0.028477	-0.01168	-0.04075	-0.00813	0.24751
		-0.09427	-0.02521	-0.01505	-0.01273	-0.01011	-0.03704	-0.28969
		[ 0.92006]	[ 1.2758]	[ 1.89186]	[-0.91745]	[-4.03014]	[-0.21956]	[ 0.85439]
	Error Correction:	D(ER)	D(IM)	D(EX)	D(IG)	D(CG)	D(CL)	D(OP)
<b>India</b>	<b>CointEq1</b>	-0.05585	-0.00583	-0.08803	-0.06407	-0.07505	-0.0475	0.18364
		-0.02239	-0.03872	-0.02578	-0.01403	-0.03669	-0.03194	-0.08508
		[-2.49457]	[-0.1561]	[-3.41501]	[-4.56719]	[-2.04524]	[-1.48723]	[ 2.15836]

Table 4 exhibits the short run vector error correction results. In Pakistan, exchange rate, imports industrial growth, consumption level and oil prices variability does not affect the long run relationship significantly in the short run dynamics. While the other, change in export and capital goods are contributing significantly to the long run stability. In India, exchange rate, exports, industrial growth, capital goods and oil prices are affecting long run relationship significantly. Similarly, in china only export shows the significant results.

Table 5: Granger Causality Test

Countries	Null Hypothesis:	Obs	F-Statistic	Probability
<b>Pakistan</b>	ER does not Granger Cause BOP	31	1.38383	0.24935
	BOP does not Granger Cause ER		2.78649	0.10621
<b>India</b>	ER does not Granger Cause BOP	31	6.77262	0.01463
	BOP does not Granger Cause ER		0.46639	0.50027

In table 5, Granger causality checks the bilateral effect as balance of payment on exchange rate and exchange rate on balance of payment. In Pakistan we reject the null hypothesis on 10% significance level in favor of alternate as balance of payment does granger cause exchange rate. For India, we reject null hypotheses as exchange rate does not granger cause balance of payment. Exchange rate is very important determinant of trading in an open economy. Dealing in foreign exchange market, currency change affects every economy including developed or developing. This occurs because of the market forces of supply and demand, which pushes countries exchange rate as depreciated and appreciated.

## 5. CONCLUSION

Exchange rate is very important determinant of trading in an open economy. Dealing in foreign exchange market, currency change affects every economy including developed or developing.

This occurs because of the market forces of supply and demand, which pushes countries exchange rate as depreciated and appreciated. For this research study, we examined that the balance of trade, economic growth factors and oil price brings changes in exchange rate. Furthermore, we found the unilateral or bilateral effect of balance of payment and exchange rate. Consequently, there is an indication in the core findings that the first objective reflects long term relationship between exchange rate and determinants of trade in exchange in exchange rate model. Results of second objective highlight exchange rate granger cause balance of payment at India. On the other hand, in Pakistan balance of payment ganger cause exchange rate significantly in balance of payment model. For fragile economies like Pakistan and India and other developing countries where monetary policy is not actively adjusted expansionary fiscal operation must not be considered as a policy measure. Therefore, the problem of these economies needs to be tackled from two ways; firstly, these countries must use effective long term policies to boost their country supply of tradable goods to the other countries of the world. Secondly, these countries must use the optimal sources and must start to think on alternative resources to curtail unnecessary imports from other countries.

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