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Factors Affecting the Nominal Exchange Rate of Pakistan: An Econometric Investigation (1982-2008)

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Abstract

Which macroeconomic factors determine the nominal exchange rate of Pak-rupee against US dollar during the period 1982-2008? This issue has been investigated in this paper by using Ordinary Least Squares and Johansen's Cointegration techniques. The results show that both monetary and real factors i.e. money supply, trade balance, foreign exchange reserves, inflation and interest rate have long run relationship with the exchange rate of Pak-rupee. However, the granger causality test results show that the relationship between most of the macroeconomic variables and nominal exchange rate bi-directional.

Keywords: Nominal Exchange Rate, Co integration, Granger Causality test

Introduction

Nominal exchange rate measures the value of one country currency in terms of other currencies. Under a fixed exchange rate system, this value is set by the monetary authorities. Whereas, during a floating exchange rate system the relative demand and supply of goods between the countries determine it. A stable exchange rate is one of the central policy objectives almost in all the countries particularly in developing countries. It plays a key role in the inflow of foreign investment, exports of goods and restoration of trade balance and finally put the economy on the path of sustainable development (Edwards, 1989; Berka and Devereux, 2010). In contrast, instability in exchange rate results in misrepresentation of trade opportunities, misallocate the resources, reduces investment, rises inflation rates and deteriorates the trade balance (Xiaopu, 2002; Eichengreen, 2008).

However, which factors determine affect the one currency value against the other, it is still an unsolved issue in the literature. The purchasing power and interest parity theories refer that it is the inflation differential and interest differential between the countries determine their currencies exchange rates. In contrast, the absorption approach considered the trade balance and the monetary approach favors the money supply as the main drivers of exchange rate (Abbas, *et al* 2011).

The above facts show that there is still confusion amongst the economists in deciding the factors of nominal exchange rate. The present study has been carried out to cover this gap for a developing economy, Pakistan. An empirical analysis of exploring the factors determining the nominal exchange rate of rupee can be beneficial for a country like Pakistan, which has a unique exchange rate systems and economic history.

Literature Review

The present section show a detail review of some of the relevant research work so for carried out for exploring the determinants of exchange rate for different countries.

Dornbusch (1976) in his monetary approach mentioned that approach, PPP holds only in the long run, and there are "jump variables" (i.e., exchange rates and interest rates) that compensate for stickiness in prices and account for the fact that exchange rates can overshoot in the long run.

Stockman (1980) mentioned that the causes of

variation of real exchange rate can be attributed to real shocks after the breakdown of Britton Woods system of fixed exchange rate.

Edwards (1989) studied the factors of exchange rate in a theoretical model of real exchange for a panel of developing countries. According to the study results terms of trade, the level and the composition of public spending, capital movements, the control of exchange and the movements of goods, technical progress, and capital accumulation were the main factors brought variability in exchange rate of the sample countries.

Lastrapes (1992) found that movements in the real exchange rate were because of the real shocks to an economy. The study concluded that knowing the factors of exchange rate movements might help the policy makers in the adoption of appropriate policies regarding the exchange rate.

Clarida and Gali (1994) investigated the sources of fluctuations in the exchange rate. The study used a VAR model. The main variables of the study were relative output, relative prices and real exchange rate. The study found that real demand shocks are the main causes of the variation in real exchange rate both in short and long run period of time. However, the study suggested that supply shocks not play any role in the variability of exchange rate.

Enders and Lee (1997) studied the causes of fluctuation in both nominal and real exchange rate. The study found that the variations in real exchange rate mainly occurred because of the real shocks.

Carstensen and Hansen (1997) studied the real exchange rate of German mark and US dollar. The study concluded that monetary shocks were the main factors caused fluctuations in the real exchange rate between the two countries' currencies.

Basurto and Gosh (2000) for Indonesia, Korea and Thailand found little evidence of the fact that higher real interest rates result in a higher risk premium, whilst they appear to be associated with an appreciation of the currency.

Frenkel (1999) studied the exchange rates fluctuations between US dollar and Pound Sterling (GBP), Deutsche Mark (DEM) and French Franc (FFR). The study concluded that changes in exchange rate were mostly occurred because of the unanticipated movements in it and information about its value. For US dollar the study also found a positive impact of interest on exchange rate. As macroeconomic theory shows a negative impact of interest rate on exchange rate, the study claimed a positive impact of interest rate on US exchange rate for the sample data Frenkel presented a model for showing the impact of information/news on exchange rate. The study included spot exchange rate, forward exchange rate, interest rate in the home currency and interest rate in the foreign currency as main variables in the model. By applying separate regressions on all the three pairs of currencies separately, the relationship between news and exchange rates turned positive.

Obstfeld and Rogoff (2000) have noted, there is generally a very weak relationship between the exchange rate and virtually any macroeconomic variable a situation they term the "exchange rate disconnect puzzle."

Lyons (2001) concludes that the short run behavior of exchange rate cannot be determined by macroeconomic fundamentals. The study mentioned that the movements in exchange rate in the short run are mainly caused by inventory management and information of the foreign the dealers in the foreign exchange market aggregation by foreign exchange dealers.

Tanner (2001) conducted a study for finding the relationship between the exchange rate and monetary policy in Brazil, Chile, Mexico, Indonesia, Korea and Thailand. By using a Vector Auto Regressive model for the period 1990-1998, the study concluded that a tight monetary policy helps leads to the appreciation of currency. Aleisa and Dibooglu (2002) examined the role of both nominal and real shocks in the variability of real exchange rate of Saudi Arabia. By using a VAR model the study concluded that variation in real exchange rate was mainly determined by real shocks. The study further mentioned that real production shocks of oil were more dominant in comparison to oil prices in Saudi Arabia. The study recommended that if Saudi Arabia wanted to stabilize the value of its currency it should focus on the production of oil.

Hau (2002) studied the impact of trade openness on the movements of the real exchange rate. The study claimed that there is

an inverse relationship between the trade integration and real exchange rate. By using a model the study divided the economy into tradable and non tradable sectors. The model showed that a more open economy, the more flexible will be the price level in that country which will not only help in reduction of unanticipated money supply shocks but will also results in lower volatility of exchange rate. However, the study indicated that this relationship between the price level and real exchange rate is more robust for tradable as comparing to non-tradable goods.

Xiaopu (2002) concluded that terms of trade, the openness degree of the economy, and capital flows were the main long-run determinants of the real exchange rate. MacDonald and Ricci (2003) also reached to the similar conclusion.

Galati and Ho (2003) for the investigation of the impact of news on the euro and dollar exchange rate. This study also found a significant relationship between the news and exchange rate of Euro and US dollar and concluded that good news leads to the appreciation of currency and vice versa. Similarly, Sanchez-Fung (2003) studied the relationship between news and exchange rate volatility and concluded that the volatility of exchange rate is higher in response depreciations than for appreciations.

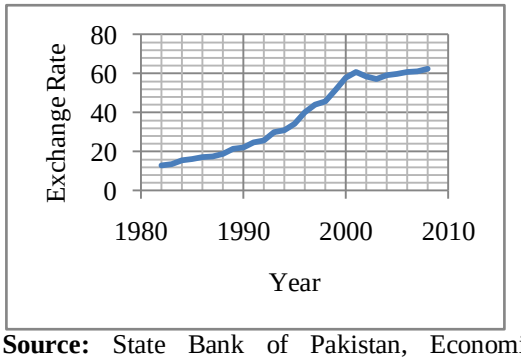
Drine and Christophe (2005) used a congregation technique and a sample of 45 countries divided into three groups according to geographical regions, Africa, Latin America and Latin America found that the degrees of development and openness of the economy strongly influence the real exchange rate.

Pakistan Macroeconomic Performance (1982-2008)

Over the years Pak-rupee tumbled against dollar. Even the assistance of IMF, shifts in regimes and export based policies could not provide a solid base for the stabilization of the domestic currency.

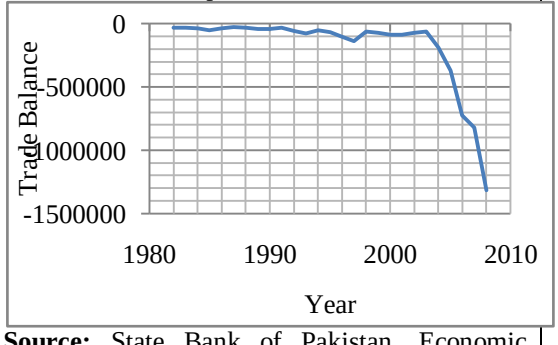
Figure. 1 presents a historical review of the exchange rate of rupee against US dollar. In 1982 the State Bank of Pakistan decided to delink the rupee from the US dollar and shifted from a fixed a exchange rate system towards a managed float exchange rate system. This dropped down the rupee value to 12.84 against the dollar from a fixed exchange rate of 9.9 which has been maintained from the post Bretton Woods period of 1973 to 1981. After that the rupee continued its downward trend and reached to 59.12 in 2004 (Zakaria, *et al* 2007). This rate further dropped to 62.13 in 2008.

Figure-1: Pak-Rupee Exchange Rate against US dollar



Source: State Bank of Pakistan, Economic Surveys of Pakistan

Figure-2: Trade Balance of Pakistan in millions of Pak-Rupees



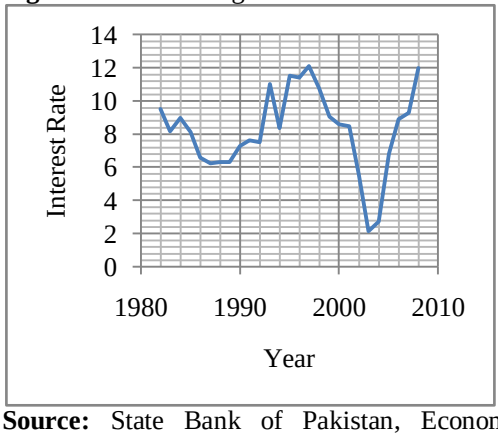
Source: State Bank of Pakistan, Economic Surveys of Pakistan

One of the reasons for this downward trend of the rupee against the dollar was the huge trade deficit in the trade balance of Pakistan. Figure. 2 shows the trade balance of Pakistan during the study period which is given as under.

The above figure shows that the trade balance of Pakistan showed a continues downward tendency during 192-2008 The trade deficit of the country during 1983 was 29205.8 million

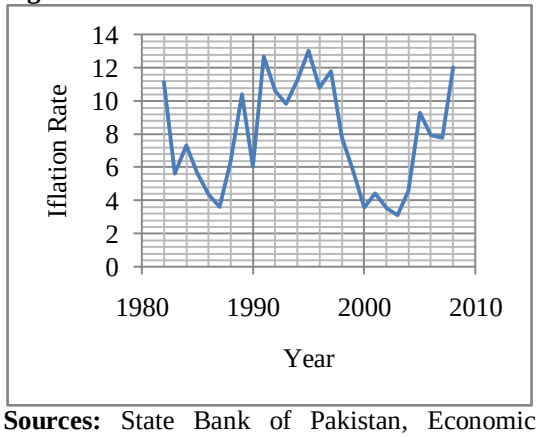
rupees, which increased to 46426.46 million rupees during the year 1988. The trade deficit further worsened to 59760.72 million rupees during the year 1993, 93237.8 million rupees in 1998, and 57811.98 million rupees in 2003, 459950 million rupees during 2008 respectively. The main reason for the worse trade balance of the country was the poor base of exports of the country. Also like other developing countries Pakistan imports most of technological equipments from foreign countries which are very expensive. One reason for this dependency on the foreign imports is the low production level of the country. The GDP growth rate of the country remained very slow over the years which is given in figure. 3.3.

Figure-3: Real GDP growth Rate of Pakistan



Source: State Bank of Pakistan, Economic surveys of Pakistan

Figure-4: Inflation Rate of Pakistan



Sources: State Bank of Pakistan, Economic surveys of Pakistan

Figure 3 depicts the GDP growth rate of Pakistan during the period 1980-2008. The GDP growth rate was 7.3% in 1980, 4.6% in 1990, 3.9% in 2000 and 4.1% in 2008.

Similarly, the high inflation rate is also remained a common characteristic of Pakistan economy since independence. Figure. 4 shows the inflation rate of Pakistan during the period 1982-2008.The figure shows that after touching the highest rates of i.e. 30% & 26% during 1970s it dropped down to 10.70% in 1980 and reached to the lowest rate of 3.58% in 2000. However, it again reached to the double digit figure of around 12% in 2008.

Methodology

Time series annual data over the period 1982-2008 has been used for the analysis. The data has been collected from different sources i.e. Federal Bureau of Statistics (FBS), Government of Pakistan. Economic Survey of Pakistan, various issues, Fifty Years Statistics of State Bank of Pakistan. For the investigation of the factors causing fluctuations in the nominal exchange rate of Pakistan the following model has been used.

Model

$$EXR = \mu 0 + \mu 1RGDPG + \mu 2INT + \mu 3INF + \mu 4FR + \mu 5MS + \mu 6TB + Ui$$

The above equation shows the regression model designed for the empirical testing of the relationship between the study variables. In the model the dependent variable is EXR which shows the nominal exchange rate of Pak-rupee against one unit of dollar. Whereas, the independent variables are RGDP stands for the real Gross Domestic Product, INT is the nominal interest rate (i.e. money call rate), INF is the inflation rate (i.e. percentage change in CPI), FR is the real foreign exchange reserves, MS is the real money supply (i.e. M2) and TB shows the real trade balance of Pakistan. The coefficients μ1, μ2, μ3, μ4, μ5, μ6 are the

related parameters. The μ0 is the intercept term in the model. Whereas, Ui is the error term. Statistical Package Eviews. 6 has been used for the computation of all the results.

Results and Discussion

Least Squares regression method is used for getting the estimates of independent variables affecting exchange rate of Pakistan. After the application of Least Squares method the following results has been obtained.

Table-1: Regression Results, Nominal Exchange Rate as Dependent Variable

Independent Variables	Coefficient	Std.Error	t-Statistic	P-value
RDGP	-48.294	7.258	-6.653	0.000
INT	-0.946	0.262	-3.609	0.001
INF	0.750	0.170	4.409	0.001
FR	0.426	0.859	0.495	0.625
MS	31.422	7.221	4.351	0.0000
TB	-0.017	0.007	-2.244	0.036
C	0.078050	0.113785	0.685942	1.2019
R^2	0.89			
Adj R^2	0.86			
Durbin Watson Statistic	2.08			
F-statistic	197.48			
Prob(F-statistic)	0.00000			

A rise in nominal exchange rate shows devaluation/depreciation of Pak-Rupee against per unit of US dollar.

The above results show that the variables RGDP, INT, INF, MS and TB turned out to be significant. However, only one variable FR remained insignificant. It has been found out that RGDP became significant with a negative sign showing that an increase in the countries RGDP helps in the stabilization of currency value and finally results in its appreciation. Similarly, the INT sign is also negative. This negative sign of the INT shows that when there is an increase in the interest rate of country, this will attract the foreign investment in the country which will finally helps in the appreciation of rupee exchange rate against the dollar. Likewise, the INF also remained significant however, with a positive sign. This result shows that when there is an increase in the inflation rate of a country, this will result in the overvaluation of rupee against dollar. Hence the demand for the country exports will be decreased which will ultimately results in the depreciation of rupee. In the same way the MS sign is also positive showing that when an increase in the money supply occurs this will increase the inflation rate in the country and will finally results in the depreciation of rupee exchange rate against dollar. Finally, the variable TB also turned significant with a negative sign. This negative sign of the trade balance shows that with an improvement of the trade balance of the country the demand for its exports will increase, which will in turn raise demand for its currency and will ultimately results in the appreciation of the currency.

The R^2 value is 0.89 showing that the explanatory variables explained most of the variations in the dependent variable. Also the Durbin Statistic shows that there is no problem of autocorrelation in the residuals of the model.

Table-2: Augmented Dickey Fuller (ADF) Test Results

Variables	ADF test with Intercept (No Trend)	ADF test with Intercept & Trend	Order of Integration
	Test Statistics	Test Statistics	

EXR	-3.31 [0]* * (-2.98)	-3.23 [0]* (-3.23)	I(1)
RDGP	-5.00[0] ** (-3.72)	-4.91[0] ** (-4.37)	I(1)
CR	-4.38 [0] ** (-3.72)	-4.37 [0]* ** (-4.37)	I(1)
INF	-6.74[0]* ** (-3.72)	-6.64 [0] ** (-4.37)	I(1)
FR	-5.53 [0] ** (-3.72)	-5.57 [0]** * (-4.37)	I(1)
MS	-3.77 [0]* ** (-3.72)	-3.75 [0] ** (-3.60)	I(1)
TB	-4.08[0]* * * (-3.72)	-4.03 [0] * (-3.60)	I(1)

*, **, *** stands for 1%, 5% and 10% level of significance

Augmented Dickey Fuller test is used for checking the unit roots in data. This is important because the results obtained from non-stationary data leads to non reliable values of parameters and gives misleading results. The Data were checked both at Intercept and Intercept & Trend. The results derived are given in table-2. The results showed that ADF test failed in rejection of hypothesis of unit root at data for all variables of study at level i.e. I(0). However, after differencing the data at first level the ADF results showed that almost all the variables are stationary i.e. I(1) both at intercept and at intercept & trend. This shows that the data can be checked for long run relationship. Johansen Co-integration test is used to find out the long run relationship between the study variables. This is important econometric technique for checking whether the results obtained with the OLS are spurious or not. Table. 3 shows these results which is as below.

Table-3: Johansen Co integration Test Results

Hypotheses		**Johansen Co integration Test (Intercept no trend in CE and test VAR)**			
H0	H1	Trace Statistic	Critical Values	Max Eigen Statistic	Critical Values
r ≤ 0	r > 0	187.68**	125.61	54.66**	46.23
r ≤ 1	r > 1	133.20**	95.75	44.74**	40.08
r ≤ 2	r > 2	88.27**	69.82	21.56**	21.13
r ≤ 3	r > 3	57.35**	47.86	27.58**	23.81
r ≤ 4	r > 4	29.80	33.73	30.92	33.88
r ≤ 5	r > 5	12.16	15.49	12.14	14.26
r ≤ 6	r > 6	0.02	3.84	0.02	3.84
Hypotheses		**Johansen Co integration Test (Intercept & trend in CE and test VAR)**			
H0	H1	Trace Statistic	Critical Values	Max Eigen Statistic	Critical Values
r ≤ 0	r > 0	269.08**	150.55	95.51**	50.59
r ≤ 1	r > 1	173.56**	117.70	51.44**	44.49
r ≤ 2	r > 2	122.12**	88.80	44.74**	38.33
r ≤ 3	r > 3	77.38**	63.87	32.111**	29.6
r ≤ 4	r > 4	42.91	47.77	23.40	25.82
r ≤ 5	r > 5	24.36	25.87	14.33	19.38
r ≤ 6	r > 6	10.03	12.51	10.03	12.51

**shows 5% level of significance

Johansen Cointegration test is used to find out long run relationship between study variables. The test is used both at (Intercept (no trend) in CE and test VAR **&** (Intercept and trend in CE-no trend in VAR). Trace and Max Eigen Statistic are used as test statistic. The results derived are given in table 3 showed that there are 4 co integrating variables. This showed the robustness of the regression results derived by using Ordinary Least Squares Method.

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Table-4: Granger Causality Test Results

Dependent Variable	**Independent Variable**					
EXR	RGDP	INT	INF	lFR	lMS	TB
	4.39** ← →	5.30** ←	0.35** ← →	4.12** ← →	0.95** ←	1.11** ← →

The arrows (→ & ←) show the direction of between the variables

For checking the causal relationship between the study variables granger causality test is used. The results obtained are given in table 4. The results showed that the variables RGDP, INF, IFR, IMS, TB and INT granger cause the EXR. However, in case of the INT and IMS this relationship is uni-directional. Whereas, for the variables RGDP, INF, IFR and TB this relationship is bi-directional.

Conclusion

The paper investigated the determinants of the nominal exchange rate of Pakistan during the period, 1982-2008. The results showed that money supply, trade balance, foreign exchange reserves, inflation and interest rate have long run relationship with the exchange rate of Pak-rupee. However, the granger causality test results show that these relationships are bi-directional between most of these macroeconomic variables and the nominal exchange rate.

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