

DRIVERS OF EXCHANGE RATE FLUCTUATIONS IN PAKISTAN: ECONOMETRIC EVIDENCE USING ARDL AND TAR MODELS

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Abstract

This study investigates the key drivers of exchange rate fluctuations in Pakistan over the period 1990–2022. A single equation econometric modeling framework, incorporating the Autoregressive Distributed Lag (ARDL) approach, is employed to examine the determinants of the exchange rate. The explanatory variables considered include gross domestic product, inflation rate, terms of trade, exports, imports, foreign direct investment, and general government expenditures. The short run ARDL estimates reveal that a decline in the demand for imported goods and an expansion in government expenditures contribute to short term improvements in the exchange rate. In the long run, the findings indicate that rising inflation and an increasing import bill exert downward pressure on the value of the Pakistani rupee. Conversely, improvements in the terms of trade, growth in exports, higher inflows of foreign direct investment, and increased government expenditures play a significant role in strengthening the currency. These results underscore the importance of targeted macroeconomic policies aimed at controlling inflation, managing import dependence, and enhancing external sector performance to stabilize Pakistan's exchange rate over time. The application of Autoregressive Threshold Analysis (TAR) indicates that regimes characterized by high economic growth, low inflation, improved terms of trade, elevated export volumes coupled with reduced import volumes, higher inflows of foreign direct investment, and increased government budgetary expenditures are vital for strengthening the value of the Pakistani rupee (PKR).

1. INTRODUCTION

Exchange rates symbolize the relationship or price of one currency with respect to that of another currency. Exchange rates are determined by inflation, interest rates, political stability and the state of the economy. Grabbing the movements of exchange rate is important for economic policy officials, business organizations and currency traders who seek to manage risks or take advantage of changing rates (World Bank Document, 2022).

The economic literature discusses the various exchange rate theories in greater detail. These theories are;

- Fixed Exchange Rate: In this system, a country's currency value is pegged or fixed to another major currency, like the U.S. dollar or gold. Governments maintain this fixed rate by intervening in foreign exchange markets, using their reserves to buy or sell currency as needed.

Countries like China have historically used fixed rates to stabilize their economies.

- **Floating Exchange Rate:** A floating exchange rate system allows market forces of supply and demand to determine the value of a currency. Most developed countries, including the United States and the Euro zone, operate under this system. It is often seen as more flexible and reflective of a nation's economic conditions.
- **Managed or Dirty Float:** This hybrid system involves a currency's value being primarily determined by the market but with occasional government intervention to stabilize or steer the currency. This approach allows for a balance between stability and flexibility.
- **Pegged Exchange Rate:** Similar to a fixed rate, but instead of being rigidly fixed, the currency is allowed to fluctuate within a narrow band around a central value. This system provides some flexibility while maintaining overall stability (NBER, 2022).

The relationship between exchange rates and macroeconomic variables is influenced by theories like purchasing power parity (PPP) and interest rate parity (IRP). PPP posits that exchange rates adjust to equalize price levels across countries, reflecting inflation differences. IRP links exchange rates to interest rate differentials, suggesting that capital flows toward economies offering higher returns (Stavrakeva & Tang, 2020).

Macroeconomic policies such as fiscal and monetary also have a profound influence on exchange rates. For instance, changes in interest rates by central banks may prompt foreign investors to cash funds into a particular country thus altering the demand and value of the currency in use. The amount of currency exchange, however, created any uncertainty regarding what a business or trade would look like which may put off investment or trading altogether. Therefore, for attaining stability and growth in the economy, it is critical to ensure that economic fundamentals and exchange rates are in harmony (Morina et al., 2020).

The connection between the exchange rate and fiscal and monetary policy in terms of the Mundell Flemming model plays the basis to understand these linkages. This class of models also indicates

that, under a fixed exchange rate system, states have less or no freedom to independently access monetary policy. Such is necessitated by the urge to safeguard the worth of domestic currency. On the contrary, under flexible exchange rate governments domestic fiscal policy is more effective in controlling the economy as it has the flexibility to adjust the exchange rates upon any change of current account. With a mixed exchange rate regime, theoretical principles like these are of very great importance for investigating the comparative effects of fiscal and monetary policies on the domestic exchange rate in a country like Pakistan.

The most important model to explain exchange rate shifts is Dornbusch's overshooting model. Foreign exchange rate changes in an immediate response to changes in fundamental economic conditions occur due to overreaction of market participants. Hence, in the short run, exchange rates are pushed off their long run equilibrium by expectation and flows and will tend to result in directional bias of exchange rates. This is something Pakistan sees happen over and over again when the central bank tightens up or loosens its monetary policy and the Pakistani Rupee (PKR) rises rapidly but then stabilizes.

Policy Strategies and Central Bank Interventions

There are various types of policies that central banks and governments have used to maintain the stability of exchange rates. For instance, the State Bank of Pakistan (SBP) is known to have managed the currency throughout inflationary and external shocks by systematically targeting and floating the exchange rate (IMF, 2021). The history of SBP also shows that it has intervened several times in the foreign exchange markets in order to avoid a drastic devaluation of the currency especially the PKR during economic turbulence. The reports of the IMF (2021) assert that although interventions may tend to lead to the stabilization of nominal exchange rates, their ability to correct real exchange rate misalignments is likely to be modest and rarely do these autonomous equilibrating forces balance through price changes within the country. Moreover, so far, Pakistan's strategy of inflation targeting has been crucial for the

formulation of the SBP's monetary policy. With the rising issues of inflation, especially with regards to food and energy supply, the SBP implements policy measures aimed at manipulating price levels with the aim of preventing protracted periods of depreciation of the PKR. However, the criticism goes on to point out that such measures might not always work as intended because inflation and exchange rates are determined by global variables such as commodity prices which are out of domestic influences (IMF, 2022).

Exchange Rate Volatility and Inflation in Pakistan

One striking feature of Pakistan's inflation is that the country's exchange rate has been going up and down quite often not only because of the energy dependence on import commodities but, by and large, on the import of most of the other basic goods. Some empirical studies, for example Aftab et al. (2021) have substantiated the correlation of depreciation of the exchange rate with the increase in consumer prices. The devaluation of currency has a very large pass-through effect in Pakistan that causes import prices to be high and this pushes up cost inflation. Similarly, the inflation increased during currency depreciation episodes in 2018, 2022 and others making it unfeasible for the State Bank of Pakistan (SBP) to pursue an expansionary monetary policy stance.

Literature Review

The relationship between overvalue of exchange rate and capital flows was examined by Ahmad (2009), using data from 1973 to 2007 with vector error correction model. The study revealed that trade openness has a major effect on exchange rates.

ARDL method was applied by Kumar (2010) to analyze Indian data from 1997 to 2009, and findings were not only trade but also term of trade both effect exchange rate in the long run. Specifically, currency appreciation, due to improvement in terms of trade, which was negatively affecting exchange rate, was observed. On the flip side, trade openness was positively

affecting exchange rate, increase led to depreciation.

Bergval (2004) studied exchange rate using Johansen's cointegration method in four Nordic countries excluding Finland. The study revealed that the exchange rate of a region is affected by terms of trade in that region. The researcher supported previous findings by proposing that improved trade terms lead to currency appreciation, underlining the importance of a country's external economic state in shaping exchange rate.

Bahmani-Oskooee and Tanku (2006) performed a study which included almost 38 African countries between 1970 to 1990, where the impact of trade terms on exchange rate fluctuations was studied. The research indicated that low import prices resulted in improved trade terms which led to currency strengthening as well, high export prices led to currency depreciation.

Mallick (2010) drawn a relationship between output growth and currency appreciation, which suggested that economic expansion strengthens currency value in the global market. On the other hand, Algieri (2011) observed depreciation in Russian exchange rate with increase in openness of trade.

Research on South Africa (De Bruyn et al., 2013) and Thailand (Liew et al., 2009), indicated that multiple factors like GDP, interest rates, and money supply play an important role in shaping exchange rate.

Research Methodology

Using the time period of 1990 to 2022, which is the duration of the study, we analyze factors affecting the exchange rates of Pakistan in this study. The data which covers a period of 32 years is available at the WGI as well as several editions of the Economic Survey of Pakistan which contains a Statistical Supplementary Report.

Econometrics Form of Model

While econometrics form of the model is presented as:

$$ER_t = \alpha_0 + \alpha_1 GDP_t + \alpha_2 INF_t + \alpha_3 TOT_t + \alpha_4 EXP_t + \alpha_5 IMP_t + \alpha_6 FDI_t + \alpha_7 GE_t + e_t \dots\dots\dots(1)$$

ER_t: Exchange Rate

GDP_t: Gross Domestic Product
 INF_t: Inflation Rate
 TOT_t: Terms of Trade
 EXP_t: Exports of the Country
 IMP_t: Imports of the Country
 FDI_t: Foreign Direct Investment
 GE_t: General Government Expenditures

Co-integration analysis

The ARDL model of co-integration developed by Pesaran and Pesaran (1997), and later by Pesaran and Shin (1999) and Pesaran et al. (2000, 2001), incorporates dynamic long-run relationships between variables for their joint interaction.

$$\begin{aligned} \Delta ER_t = & \gamma_0 + \gamma_1 \sum_{i=1}^p \Delta ER_{t-i} + \\ & \gamma_2 \sum_{i=1}^p \Delta GDP_{t-i} + \gamma_3 \sum_{i=1}^p \Delta INF_{t-i} + \\ & \gamma_4 \sum_{i=1}^p \Delta TOT_{t-i} + \gamma_5 \sum_{i=1}^p \Delta EXP_{t-i} + \\ & \gamma_6 \sum_{i=1}^p \Delta IMP_{t-i} + \gamma_7 \sum_{i=1}^p \Delta FDI_{t-i} + \\ & \gamma_8 \sum_{i=1}^p \Delta GE_{t-i} + \gamma_9 \sum_{i=1}^p \Delta CAD_{t-i} + \\ & \rho_1 ER_{t-1} + \rho_2 GDP_{t-1} + \rho_3 INF_{t-1} + \\ & \rho_4 TOT_{t-1} + \rho_5 EXP_{t-1} + \rho_6 IMP_{t-1} + \\ & \rho_7 FDI_{t-1} + \rho_8 GE_{t-1} \end{aligned} \quad (2)$$

Threshold Analysis:

ADF. Test Results

Variables	ADF :Level (Trend & Intercept)	P.	ADF: First Difference (Trend & Intercept)	P.	Order of Integration
ER _t	-2.378402	0.3812	-3.658217	0.0410	I(1)
GDP _t	-4.606441	0.0035	-	-	I(0)
INF _t	-2.841613	0.1983	-7.286734	0.0000	I(1)
TOT _t	-0.840545	0.9503	-3.858925	0.0268	I(1)
EXP _t	-2.607846	0.2789	-5.286856	0.0008	I(1)
IMP _t	-1.849638	0.6563	-5.000861	0.0016	I(1)
FDI _t	-2.136542	0.5067	-4.980452	0.0017	I(1)
GE _t	-2.280601	0.4302	-7.304763	0.0000	I(1)

*MacKinnon (1996) one-sided p-values.

Based on Augmented Dickey – Fuller (ADF), the properties of the variables are derived. GDP_t is found to be stationary at level i.e. I(0). But, all

Bound Test

This study also employs the threshold regression analysis (TAR) to identify the various regimes

The threshold regression models in economics are followed by Hansen (2000) and Hansen (2011). When there is single threshold γ then threshold regression with two regions can be stated as,

$$y_t = x_t \beta + z_t \delta_1 + \epsilon_t \text{ if } -\infty < w_t \leq \gamma \quad (3)$$

$$y_t = x_t \beta + z_t \delta_2 + \epsilon_t \text{ if } \gamma < w_t < \infty \quad (4)$$

y_t = Dependent variable

x_t = $1 \times k$ vector of covariates

β = $k \times 1$ vector of region-invariant parameters

ϵ_t = Error with mean 0 and variance σ_2

z_t = Vector of exogenous variables

δ_1 and δ_2 , and w_t is a threshold variable

Data Analysis

Adjusted R-squared lag selection criteria is preferred to select the optimal lag selection for the variables under study. Following are the important output generated by the adopted lag selection criteria. Maximum dependent lags: 2(Automatic Selection)

Selection Criteria: Adjusted R-Squared

Selected ARDL Model: 1, 1, 1, 1, 1, 1, 1, 1, 1

Significance Level	Lower Bound	Upper Bound
10%	1.84	2.83
5%	2.12	3.14
1%	2.61	3.75

F- Statistics value=6.565923

The obtained results of bund F-test recommends the existence of long run co-integration relationship between the variables under study.

Short Run Estimated Coefficients

Variables	Coefficients	Standard Error	t-Statistic	P.Value
$\Delta(\text{GDP}_t)$	0.001485	0.008249	0.175718	0.8603
$\Delta(\text{IMP}_t)$	0.274426	0.067606	4.055993	0.0013
$\Delta(\text{INF}_t)$	0.010207	0.010483	0.977873	0.3484
$\Delta(\text{GE}_t)$	-0.236645	0.079642	-2.972074	0.0102
$\Delta(\text{EXP}_t)$	-0.018526	0.063336	-0.292397	0.7734
$\Delta(\text{TOT}_t)$	-0.137245	0.075232	-1.824570	0.0859
$\Delta(\text{FDI}_t)$	-0.081483	0.078089	-1.919638	0.4374
Cointegration Equation (-1)*	-0.053269	0.005192	-10.38588	0.0000

The estimated short run coefficients of the model revealed the significance positive impact of country's imports over the exchange rate. While the obtained results confirms the significance inverse impact of government expenditure outlays.

Long Run Estimated Coefficients

Variables	Coefficients	Standard Error	t-Statistic	P.
$\text{ER}_t (-1)$	-0.053349	0.045577	-1.168497	0.2612
$\text{GDP}_t (-1)$	0.021475	0.028889	0.742510	0.4701
$\text{IMP}_t (-1)$	0.493216	0.136259	3.619043	0.0082
$\text{INF}_t (-1)$	0.045932	0.024937	1.838591	0.0837
$\text{GE}_t (-1)$	-0.573040	0.169793	-3.376026	0.0054
$\text{EXP}_t (-1)$	-0.301423	0.122645	-2.456039	0.0265
$\text{TOT}_t (-1)$	0.132259	0.053013	2.495645	0.0265
$\text{FDI}_t (-1)$	-0.081483	0.018089	-4.499638	0.0004

The long run results of the model displays the significance of imports, rate of inflation and terms of trade towards the country's rate of exchange. On the other hand it is also evidenced that

improved government expenditures and expansion in the volume of foreign direct investment is vital to bring down the country's exchange rate.

Results of Threshold Model

Variable	Regime	Discrete Threshold Detected	Coefficient	t.Statistic	P.
GDP _t	Regime-1	Coefficient<0.68	1.847922	33.69027	0.0000
	Regime-2	0.68<=Coefficient	1.748459	22.54039	0.0000
INF _t	Regime-1	Coefficient<0.74	1.946435	18.78366	0.0000
	Regime-2	0.74<=Coefficient	1.785508	36.55177	0.0000
TOT _t	Regime-1	Coefficient <2.05	2.027606	53.31373	0.0000
	Regime-2	2.05 <=Coefficient	1.614449	0.036896	0.0000
EXP _t	Regime-1	Coefficient <1.94	59.60381	36.54334	0.0000
	Regime-2	1.94<=Coefficient	30.38551	34.45629	0.0000
IMP _t	Regime-1	Coefficient <1.30	1.861659	36.54334	0.0000
	Regime-2	1.30 <=Coefficient	1.689723	20.31138	0.0000
FDI _t	Regime-1	Coefficient <0.28	1.958677	31.53428	0.0000
	Regime-2	0.28<=Coefficient	1.768717	28.40982	0.0000
GE _t	Regime-1	Coefficient <1.07	1.910365	42.59871	0.0000
	Regime-2	1.07<=Coefficient	1.459693	19.35671	0.0000

The threshold model generates the following results:

- ❖ High economic growth rates associates with low exchange rate and vice versa.
- ❖ Low inflationary regimes depreciate the currency value vice versa.
- ❖ Improved terms of trade are necessary to bring down the exchange rate vice versa

- ❖ The regimes with high exports and low import volume can push down the country's rate of exchange and vice versa.

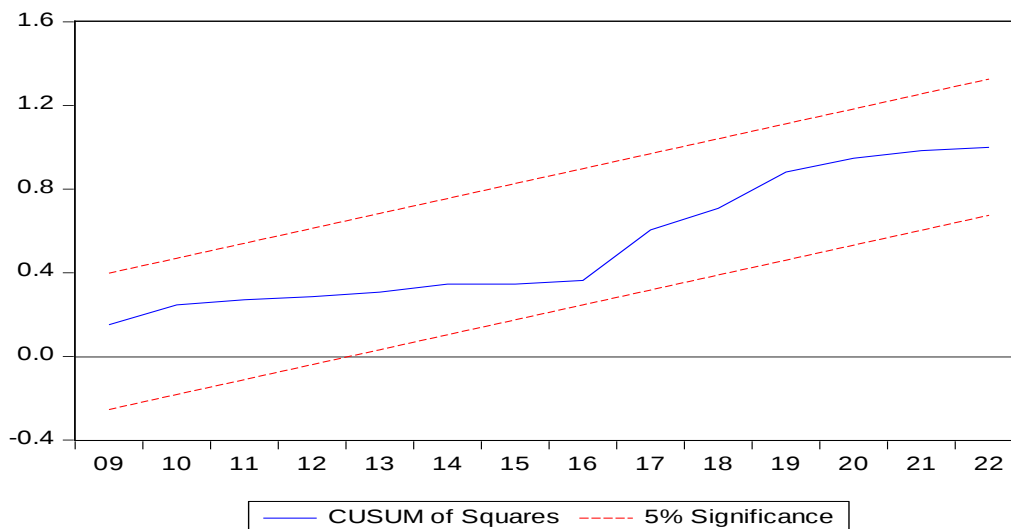
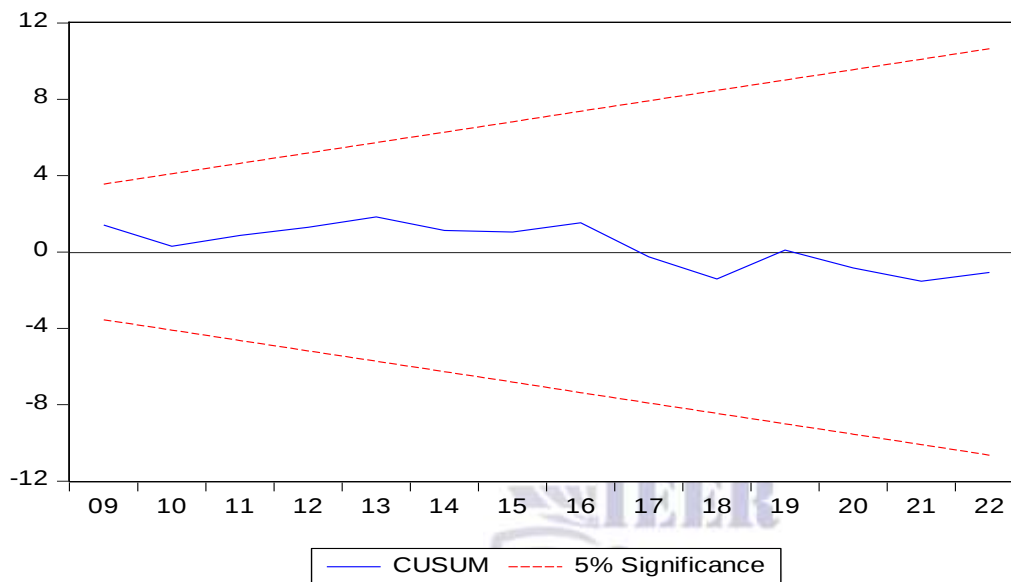
The regimes having the high FDI are essential to appreciate the country's currency value.

- ❖ Similarly the government budgetary expenditures are vital to improve the value of the Pakistan Rupee PKR.

Diagnostic Test

Problem	Test name	Hypothesis	F-Statistics	P.Value
Heteroscedasticity	Breusch Pagan-Godfrey	H ₀ =Residuals are Homoskedastic	0.684907	0.7729

Autocorrelation	Breusch-Godfrey test	H_0 =No autocorrelation exist	0.763837	0.3980
Specification error	Ramsey RESET test	H_0 =Correct specification of model	0.131125	0.7231
Normality of residuals	Jarque-Bera Normality test	H_0 =Residuals are normal	1.840270	0.3984



Policy Implications:

These results underscore the need for coordinated macroeconomic policies aimed at stabilizing Pakistan's external sector. Specifically:

- Including diversification of domestic production and targeted import substitution are essential to reduce pressure on the exchange rate (*Import management policies*).

- Prudent monetary policy and improved supply side management are critical to maintaining exchange rate stability (*Inflation control measures*).
- Through export quality improvements and value-added production can help strengthen the currency (*Enhancing the terms of trade*).
- Improving the business environment and regulatory frameworks can support long term exchange rate resilience (*Encouraging foreign direct investment*).
- Productive government expenditures can play a stabilizing role in both the short and long run (*Effective fiscal policy*).

Overall, a balanced combination of fiscal discipline, monetary stability, and external sector reforms is required to ensure sustainable exchange rate stability in Pakistan.

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