NUML Journal of Economics (NJE)

Volume 2, Number 1, June 2025, PP. 1-14

DOI: https://doi.org/10.52015/numljournalofeconomics.v2i1.39

Net Portfolio Investment Inflows to Pakistan: Does Exchange Rate Volatility Matter?

Israr Ahmad Shah Hashmi[1], Adeel Ahmed Sheikh[2], Wasif Ali Wajahat[3]

Article History:

Received Date:
21st April

Revised Date:
21st June 2025

Accepted Date:
28th June 2025

Published:
30th June 2025

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Abstract

This study investigates the impact of ER volatility on net portfolio investment flows to Pakistan, utilizing quarterly data for the period of 1994Q3 to 2022Q4. We use ARDL model for the analysis. The unit root test results suggest that a few variables are stationary while some are unit root processes. The ARDL bound test results validate the existence of cointegrating relationship among the variables. The findings of the study reveal that in the short run domestic inflation has positive impact on net portfolio investment balance, while domestic IPI, interest rate differential, stock price and ER volatility impact net portfolio investment balance negatively in Pakistan. Further, in the long run, domestic IPI and interest rate differential cast favourable impact on net portfolio investment balance, while domestic inflation, ER volatility, REER and stock prices have negative and significant effect on net portfolio investment position of Pakistan. Grounded on the findings of the study, we recommend that the policymakers should take suitable measures to control ER volatility in order to improve net portfolio investment position of the country.

Keywords: Net Portfolio Investment, Exchange Rate Volatility, Industrial Production Index, ARDL Model

JEL Classification: F31, B27, C31, C33

1 Introduction

An uncertain and risky economic environment deeply influences the decisions of economic agents. When uncertainty overcasts the economic horizon, economic agents, particularly, investors do not act quickly and become more reserved. It is well documented in the literature that economic uncertainty hinders real economic activity and growth (Colombo, 2013; Bloom, 2009). Moreover,

[1]Department of Business and Economics, FG Sir Syed College, the Mall, Rawalpindi, Pakistan (ahmadisrareco@gmail.com)
[2]Department of Business and Economics, FG Sir Syed College, the Mall, Rawalpindi, Pakistan (aahmedsheikh87@gmail.com)
[3]Department of Business and Economics, FG Sir Syed College, the Mall, Rawalpindi, Pakistan

a string of research views that exchange rate (henceforth ER) volatility compresses trade volume across economies (Ekanayake & Dissanayake, 2022; Dada, 2021; Bahmani-Oskooee & Hegerty, 2007; Ozturk, 2006). Since trade openness and economic integration of an economy plays significant role in enhancing its productive capacity, ER volatility is very likely to affect overall economic growth and development of the economy through multiple channels (Olamide et al., 2022; Morina et al., 2020)

Moreover, FDI and portfolio investment (henceforth PI) inflows to a country play pivotal role in its economic development and growth (Dzingirai et al., 2024; Oigbo, 2021). This is particularly true for developing countries, which lack local investment potential, and need foreign investment for infrastructure development, capacity building and employment generation. Additionally, developing countries often confront the problems of soaring inflation, dwindling foreign exchange reserves, and looming poverty. Foreign investment can help mitigate these issues by boosting domestic production, reducing reliance on imports, and creating employment opportunities.

Pakistan, like many developing economies, has been grappling with many economic challenges, particularly on its external front. The importance of foreign linvestment flows to Pakistan, in the current scenario, cannot be overstated. Some researchers have investigated the role of foreign investment in Pakistan's development and growth. For instance, Shabbir et al. (2021) substantiate that while foreign private investment hinders economic growth in the long run, it has favourable short-term impact. In the same vein, Shabbir and Muhammad (2019) document the significant effects of PI inflows on the stock prices of Pakistan, emphasizing the need for tangible measures to attract foreign investment. Globally, economies are competing to offer incentives to foster foreign investors' confidence. In this context, a volatile ER may undermine investors' confidence, impacting the decisions of domestic as well as foreign investors, and ultimately resulting in investment outflows (Nguyen et al., 2022; Canh et al., 2020).

Further, the ER regimes adopted by a country have a close link with the ER volatility. The literature generally discusses three distinct ER regimes: fixed, managed float and free float ER regimes. The fixed ER regime results in least (even zero) ER volatility, but it is hard for a developing country – especially the one confronting the problem of depleting foreign exchange reserves – to pursue because it requires substantial foreign exchange reserves for intervention, and it also undermines the autonomy of monetary policy. The managed float regime reasonably controls ER volatility, but it also requires the availability of foreign exchange reserves and also affects the autonomy of the monetary decisions. The free float regime is, however, relatively easier for developing economy to pursue, but it is characterized by high ER volatility.

Pakistan has been pursuing varying ER policy approaches during the tenures of different governments. For instance, during 1990s, Pakistan to some extent adopted managed float regime, during which the value of one dollar in terms of Pakistani rupee rises from Rs. 20 in 1990 to Rs. 55 in 2000. It shows that the Pakistan's currency underwent a substantial depreciation during this period. During 2001 to 2007, the value of Pakistan rupee viz-a-viz US dollar remained stable, as the ER remained between Rs. 60 per dollar to Rs. 62 per dollar. From 2007 to 2013, Pakistan's

currency again depreciated from Rs. 60 per dollar in 2007 to Rs. 101 per dollar in 2013. During 2013 to 2018, Pakistan's currency remained stable, where the value of one US dollar remained between Rs. 101 to Rs. 105. Afterward, Pakistan's currency underwent depreciation, as the ER rises from Rs 121 per dollar in 2021 to Rs. 175 in October 2021 (Fiaz et al., 2021).

Realizing the crucial role of foreign investment in Pakistan's development and significant impact of ER volatility on foreign capital flows, this study investigates the relationship between ER volatility and net PI in Pakistan, using quarterly data from 1994Q3 to 2022Q4. Identifying the drivers of foreign portfolio inflows, with special focus the role of ER volatility, this research endeavour may provide potential insights to the decisionmakers in optimizing drivers of foreign PI inflows, particularly ER regime.

The remainder of this paper proceeds as follows. Its second section presents the review of existing literature. Third section describes the data utilized and the methodology exploited to achieve the objectives of the study. Fourth section discusses results and findings derived from the analyses, and the last section contains conclusion and policy recommendations.

2 Literature Review

The global economic framework's divorce from the Bretton Woods System ushered in an era of floating ERs. This new system of floating ER, where currencies could trade at changing values with each other over time along with the liberalization of the financial industry, opened sizable opportunities for investments and profits, especially, in the case of foreign PI. PIs are but a part of a broader foreign capital investments. While the industrialized west has been quick to capitalize on the benefits offered through these evolved circumstances, the relatively underdeveloped east has been slow in catching up with the tide especially when the orthodox neoclassical economic theory predicts foreign capital flows from developed economies to developing economies in pursuit of higher productivity potential (Lucas, 1990).

FPI, often termed 'hot money' in finance jargon (Lipsey et al.,1999), is a relatively temporary investment in the host country's capital market that has gained significant importance and momentum in recent times, but in underdeveloped economies, especially, it has grown as a viable source of financing the saving-investment gap (Baghebo et al., 2014). This development has led to the creation and use of a wide range of purely financial models as well as financial and economic models focused specifically on PI and their impact on major economic variables. Some of those models are Modern Portfolio Theory (Markowitz, 1952), International Capital Asset Pricing Model (ICAPM) (Merton., 1973), Arbitrage Pricing Theory (Roll et al., 1995). Insights from the financial models have later been used in larger economic models that are collectively known as 'Portfolio Balance Models' (PBM). These models such as Dornbusch & Fischer (1980) and Branson (1983, 1984) were dominant in the discourse throughout the 70s and 80s. PBMs attempted to use current account balance, rate of asset accumulation and their prices and asset market interactions to determine ER and portfolio inflows, while assuming foreign and domestic assets to be imperfectly substitutable. Though PBMs showed promise in explanation of variations in ER yet their validity was challenged by some empirical studies.

Another approach that gained traction in the 90s was the 'Push and Pull' theory (Calvo, 1993). This theory suggests that there are global (push) factors as well as country specific (pull) factors

that have the ability to sufficiently explain the inflow of FPI into different economies. The Push factors relate to the economic conditions prevailing in country of origination of the investment such as interest rates, low growth potential and portfolio diversification. These factors contribute to the availability of capital to be flown in to the recipient economies. On the other hand, the pull factors relate to the economic situation in the country willing to receive such investment, such as high growth potential, trade openness, inflation that determine whether the investment will land or not.

The currency crisis not too far in the past such as the Latin American and East Asian currency crisis has led economists to explore the relationship between ERs and capital inflows. As developing and emerging economies have a relatively more fragile capital markets, the importance of studying ER dynamics in these economies have been stressed (Obstfeld and Rogoff 1998; Aghion et al., 2009; Ganguly and Breuer, 2010). Obstfeld and Rogoff (1998) argue that ER volatility does not bear positive economic outcomes especially for investment as well as trade in the developing economies compared to developed ones. In recent years, there have been massive inflows of investments of the speculative nature into developing economies fueling the fear of economic uncertainty when seen as a determinant responsible for causing volatility in the ER. Governments have, thus, as a result resorted to some varying form of intervention to stabilize ERs and studies in this respect have sought to investigate the viability of these interventions (Grossmann et al., 2014; Grossmann and Orlov, 2022; Berganza and Broto, 2012).

As far as empirical studies that identify the determinants of FPI inflows are concerned, substantial of those argue the availability of liquidity as one of the deciding factors (Calvo et al., 1993; Duasa, 2011; Taylor, 2004) arguing that a higher growth in developed economies lead to lower portfolio inflows into developing economies. Besides, liquidity, a score of studies has highlighted the importance of interest rates (Levy and Sarnat, 1970; Tran and Shawney, 1988) and interest rate differential (hereafter INTDF) (Kosi et al., 2016; Haynes, 1988; Waqas et al, 2015) for determination of the level of portfolio inflows. A host of studies have also looked into how ER impacts foreign PIs. Some of these studies argue that appreciating ER promotes PIs because it provides foreign investors with the opportunity to access additional returns (Garg and Dua, 2014; Haider et al., 2016; Wong, 2017). Bleaney and Greenaway (2001) finds the opposite result. There have also been studies that find no relationship between ER and foreign PIs (Baek, 2006; Cenedese et al. 2014).

There are very few studies, however, that have investigated a direct relationship between ER volatility and foreign PIs. Dua and Suri (2018) investigate this relationship in the case of India, while Rafi (2018) investigates it for 10 emerging economies and Caporale (2017) does it for Asian economies. All these works find significant relationships between ER volatility and foreign portfolio inflows and suggest policies ranging from central bank intervention to capital controls and effective use of monetary policy to stabilize macroeconomic environment.

3 Data and Methodology

This section opens with the description and data sources of the variables exploited by this study. Giving an overview of the econometric techniques utilized in the literature to investigate the problem of this kind, it specifies and sketched the econometric model utilized in this investigation.

3.1 Data Description and Sources

This study utilizes quarterly data ranging from 1994Q3 to 2022Q4 for Pakistan. The data on net PI has been extracted from Balance of Payments Statistics, IMF and that on Industrial production index (henceforth IPI), REER, CPI, domestic interest rate and stock price of Pakistan and foreign interest rate (interest rate of the US) has been taken from IFS. We calculate INTDF as the difference of interest rates of Pakistan and the US. Domestic inflation rate is estimated as the percentage change in CPI of Pakistan. The ER volatility is estimated by GARCH (1, 1) process on the value of Pakistani rupee viz-a-viz US dollar.

3.2 Econometric Model

Since the study utilizes time series analysis, it starts with the examination of the order of integration of variables. For the purpose, we get insight from the literature and use Augmented Dickey-Fuller (ADF) test, the most widely used test in the literature. Further, one of the main thrusts of time series analyses is to explore long run relationships among variables by exploiting cointegration analysis. The popular tests for cointegration are Johansen, Engle-Granger, and ARDL bounds tests. We use ARDL model because some series are stationary at their levels, and some other are at their first difference i.e. I(1). The cointegration specification of the model for the ARDL bounds test designed by Pesaran et al. (2001) can be expressed as:

$$\Delta PI = \alpha + \beta LSTP_{t-1} + \gamma LIPID_{t-1} + \delta INFD_{t-1} + \eta INTDF_{t-1} + \theta ERVOL_{t-1} + \vartheta REER_{t-1} + \sum_{i=0}^{I} \nu_i \Delta LSTP_{t-i} + \sum_{j=0}^{J} \pi_j \Delta LIPID_{t-j} + \sum_{k=0}^{K} \rho_k \Delta INFD_{t-k} + \sum_{l=0}^{L} \sigma_l \Delta INTDF_{t-l} + \sum_{m=0}^{M} \tau_m \Delta ERVOL_{t-m} + \sum_{n=0}^{N} \varphi_n \Delta REER_{t-n} + \sum_{p=1}^{P} \phi_p \Delta PI_{t-p} + \varepsilon_t \quad \dots (1)$$

Where the null hypothesis is: $H_0: \beta = \gamma = \delta = \eta = \theta = \vartheta = 0$

And alternative hypothesis is: at least one of them is not zero. Stating other way it becomes:

$H_1: \beta \neq \gamma \neq \delta \neq \eta \neq \theta \neq \vartheta \neq 0$

The null hypothesis of the test is there is no cointegration against the alternative that there is cointegration. Further, the model exhibiting long-run relationships can be expressed as:

$$PI_t = \alpha + \gamma LSTP_t + \delta LIPID_t + \eta INFD_t + \theta INTDF_t + \vartheta ERVOL_t + \varepsilon_t \quad \dots (2)$$

And the regression equation describing short-run relationships can be sketched as:

$$\Delta PI_t = \varpi + \sum_{j=0}^{J} \nu_j \Delta LSTP_{t-j} + \sum_{k=0}^{K} \pi_k \Delta LIPID_{t-k} + \sum_{l=0}^{L} \rho_l \Delta INFD_{t-l} + \sum_{m=0}^{M} \sigma_m \Delta INTDF_{t-m} + \sum_{n=0}^{N} \tau_n \Delta ERVOL_{t-n} + \sum_{p=0}^{P} \varphi_n \Delta REER_{t-p} + \sum_{p=1}^{P} \delta_n \Delta PI_{t-p} + \lambda ECM_{t-1} + \varepsilon_t \quad \dots (3)$$

Here, PI_t is the PI in time t, $LSTP_t$ is the logarithm of stock price index in time t, $LIPID_t$ is the log of IPI in time t, $INFD_t$ is the domestic inflation in time t, $INTDF_t$ is the INTDF in time t, $ERVOL_t$ is the ER volatility in time t, $REER_t$ is the REER in time t, $ECM$is the error correction component, and ε_t is the white noise and Δ is the difference operator.

Further, the ARDL model requires post-estimation diagnostics to check the authenticity of the findings. It is generally reckoned that whether the problems of serial correlation, heteroscedasticity, incorrect specification of functional form of the model and instability of parameters estimates persist or not. In this regard, we employ Breusch-Godfrey serial correlation Lagrange-Multiplier (LM) test with lag length 8 to diagnose the issue of serial correlation. To detect the presence of heteroscedasticity, we use Breusch-Pagan-Godfrey test. We employ

Ramsey's RESET test to check correct specification of functional form, and CUSUM and CUSUMSQ plots to examine the stability of the estimates of parameter over the time.

3.3 Descriptive Statistics

Table1 demonstrates the descriptive statistics of the variables exploited in the analysis. It is evident from the table that mean and median values of almost every variable are approximately close to each other, except for net PI inflows whose mean value is smaller than its median value. It substantiates that the variables under investigation are approximately normally distributed.

Table1: Descriptive Statistics of the Variables

Variable	Obs	Mean	Median	Std. Dev.	Maximum	Minimum
LSTP	114	9.048	9.271	1.3192	10.805	6.821
LIPID	114	4.512	4.581	0.3172	5.188	3.772
INFD	114	0.021	0.018	0.016	0.097	-0.013
INTDF	114	8.581	8.58	3.252	15.001	2.751
ERVOL	114	1.541	0.977	1.257	6.273	-0.595
REER	114	105.818	102.734	8.537	124.487	93.179
PI	114	-98.936	-7.501	580.577	1321.001	-3064.001

Note: LIPID is the log of IPI of Pakistan; LSTP is the log of stock price index; INFD is domestic inflation; INTDF is interest rate differential; ERVOL is ER volatility, REER is real effective ER, and PI is the net PI inflows to Pakistan.

Table 2 presents the magnitudes of pair-wise correlation among the variables. It is apparent from the table that the strongest and positive association is between stock price index and IPI of Pakistan with the magnitude of the coefficient of correlation being 0.897, and the weakest association is between REER and INTDF with coefficient of correlation being 0.002. However, the net PI flows are negatively associated with stock price index, IPI and REER, while these are positively associated with all other variables.

Table 2: Correlation Matrix of the Variables

	LSTP	LIPID	INFD	INTDF	ERVOL	REER	PI
LSTP	1						
LIPID	0.897	1					
INFD	0.131	0.184	1				
INTDF	-0.269	-0.211	0.401	1			
ERVOL	0.453	0.586	0.331	0.231	1		
REER	-0.192	-0.434	-0.243	0.002	-0.429	1	
PI	-0.098	-0.032	0.157	0.166	0.116	- 0.131	1

4 Results and Discussion

4.1 Unit Root Test

The results of the unit root test showed that the PI was stationary at its level as the null hypothesis of nonstationary was rejected at even 1% level of significance. Further, all other

variables, LSTP, LIPID, INFD, INTDF, ERVOL and REER were stationary at their first difference, but not at their levels. The corresponding P-values of the test indicated that all these variables were first order integrated.

Table 3: Results of ADF Test

Variable	Level		First Difference	
	T-stat	P-value	T-stat	P-value
PI	-9.792	0.000	…	…
LSTP	-0.271	0.924	-8.606	0.000
LIPID	-0.323	0.916	-16.902	0.000
INFD	-4.783	0.001	-11.705	0.000
INTDF	-2.323	0.166	-7.769	0.000
ERVOL	-1.317	0.619	-10.024	0.000
REER	-2.069	0.257	-9.745	0.000

4.2 Granger Causality Test

The results of pairwise Granger causality test substantiated that ER volatility Granger caused net PI inflows to Pakistan, but not the other way round. The null hypothesis of no Granger causality in case of ER volatility to net PI was rejected as the associated P-value was smaller than 0.05, while for the case of net PI to ER volatility could not be rejected as the corresponding P-value was 0.1667.

Table 4: Granger Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.
ERVOL does not Granger Cause PI	108	2.60676	0.0221
PI does not Granger Cause ERVOL	108	1.56223	0.1667

4.3 Cointegration Test

Table 5 showcases the results of ARDL bounds test employed to determine whether there exist long-run connections among the variables or not. Since the *F*- statistic was significant at 1%, the outcomes of the test validated the existence of cointegrating relationships among the variables. Further, the upper-bound of the statistic was 3.99 and lower bound was 2.88, and the calculated value of *F-s*tatistic was 8.544.

Table 5: ARDL Bounds Test Results

F-Statistic	Number of Parameters	Level of Significance	Lower Bound	Upper Bound
	6	10%	1.99	2.94
	6	5%	2.27	3.28
	6	2.50%	2.55	3.61
	6	1%	2.88	3.99

F-Statistic (Calculated)	8.544	P-Value	0.00

4.4 Long-Run Relationships

Table 6 presents the results of long run drivers of net PI position of Pakistan. It is apparent from the table that domestic economic activity (IPID) had no significant impact on the net PI position. Further INTDF had positive and significant impact on the net PI position. A unit increase in INTDF, on average, had increased net PI position by 65.84 units. Domestic inflation had significantly worsened net PI position of Pakistan. One unit increase in domestic inflation (INFD), on average, had decreased net PI flows to Pakistan by 24.94 units in the long run.

Further, ER volatility had negative impact on net PI. Further, a one unit increase in ER volatility had led to, on average, around 129 units decrease in net PI, provided that other factors remained same. REER also had negative and significant impact on net PI. One unit increase in REER had decreased net PI position by 16.84 units in the long run. Stock price (STP) showed the negative impact on net PI and significant at 5% level of significance. A one percent increase in stock price had led to, on average,59.26 units decrease in on net PI, provided that other factors remained same.

Table 6: Long Run Drivers

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPID	489.566	548.376	0.892	0.375
INTDF	65.848	19.821	3.322	0.001
INFD	-24.941	6525.007	-3.773	0.001
ERVOL	-129.527	43.682	-2.965	0.004
REER	-16.847	7.1058	-2.371	0.021
LSTP	-59.267	114.104	-0.519	0.605
C	290.991	2041.611	0.142	0.887

4.5 Short-Run Relationships

Table 7 shows that the coefficients of first two lags of net PI were positive and significant. It implied that the lags of net PI had improved net PI position in Pakistan in the short run. Further, the third to sixth lags of domestic economic activity (IPID) were negative and significant, which indicated that domestic economic activity had exacerbated net PI position in Pakistan. The coefficient of the third lag of INTDF was negative and significant at 5% level of significance. The coefficients of current and all seven lags of INFD were positive and significant. It showed domestic inflation had improved net PI in the short run. The coefficients of first, fifth and sixth lags of STP were negative and significant. The current value of ERVOL was negative and significant. It substantiated that ER volatility had negative impact on net PI position. Moreover, the coefficient

of ECM was smaller than one and carried negative sign, which reflected that in case of any divergence from the long run equilibrium path, the relationship had the tendency of reverting back to the equilibrium path at the speed of 64% per unit of time.

Table 7: Short Run Drivers

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PI(-1))	0.512	0.1435	3.567	0.000
D(PI(-2))	0.258	0.099	2.605	0.011
D(LIPID)	-426.831	851.159	-0.501	0.617
D(LIPID(-1))	-1320.671	968.091	-1.364	0.176
D(LIPID(-2))	-1805.109	999.598	-1.805	0.075
D(LIPID(-3))	-3292.634	919.633	-3.581	0.000
D(LIPID(-4))	-3244.693	1077.601	-3.011	0.003
D(LIPID(-5))	-1972.427	1039.212	-1.898	0.061
D(LIPID(-6))	-2281.706	831.654	-2.743	0.007
D(INTDF)	98.462	58.730	1.676	0.098
D(INTDF(-1))	-148.369	68.441	-2.167	0.033
D(INTDF(-2))	-127.833	70.889	-1.803	0.075
D(INTDF(-3))	-143.723	67.515	-2.128	0.036
D(INFD)	9590.823	4443.766	2.158	0.034
D(INFD(-1))	52747.181	7617.576	6.924	0.000
D(INFD(-2))	47251.191	8637.902	5.470	0.000
D(INFD(-3))	58907.151	8281.129	7.113	0.000
D(INFD(-4))	45082.941	8505.940	5.301	0.000
D(INFD(-5))	34136.581	7123.538	4.792	0.000
D(INFD(-6))	28090.740	5655.397	4.967	0.000
D(INFD(-7))	11055.101	4927.090	2.243	0.028
D(LSTP)	-1531.076	492.558	-3.108	0.002
D(LSTP(-1))	-237.602	530.085	-0.448	0.655
D(LSTP(-2))	-951.574	534.052	-1.781	0.079
D(LSTP(-3))	-786.189	476.500	-1.649	0.103
D(LSTP(-4))	279.530	459.017	0.608	0.544
D(LSTP(-5))	-948.925	466.186	-2.035	0.045
D(LSTP(-6))	-1186.108	480.614	-2.467	0.016
ERVOL	-256.851	78.169	-3.285	0.001
CointEq(-1)*	-0.649	0.191	-3.397	0.001
R-squared	0.725	Mean dependent var		10.463
Adjusted R-squared	0.625	S.D. dependent var		806.344
S.E. of regression	493.515	Akaike info criterion		15.468
Sum squared resid	187539	Schwarz criterion		16.197
Log likelihood	-790.831	Hannan-Quinn criter.		15.763

Durbin-Watson stat	1.980

4.5 Post-Estimation Diagnostics

The Ramsey RESET test was used to determine whether the functional form of a regression model was properly specified or not. It is evident from table 8 that the magnitude of Ramsey RESET *F*-statistic was 2.562 and a p-value of 0.431. It indicates that the functional form of the model was correctly specified. The BG serial correlation LM test was used to detect the presence of any residual correlation between the error components of the model, which could challenge the authenticity of the inferences drawn from the outcomes of regression analysis. Since the coefficient of *F*-statistic of LM test was 0.301 with a p-value of 0.740, we could not reject the null hypothesis of no serial correlation and could maintain that the analysis did not have the problem of serial correlation. Further, the BPG test for heteroskedasticity validated that the analysis did not suffer from the problem of heteroscedasticity, as the null hypothesis of no heteroscedasticity had not been rejected at even 10% level of significance.

Table 8: Results of Post-Estimation Diagnostics

		Statistic Value	P-Value
Ramsey RESET Test	***F-statistic***	2.562	0.431
Breusch-Godfrey Serial Correlation LM Test	***F-statistic***	0.301	0.740
Heteroskedasticity Test: Breusch-Pagan-Godfrey	***F-statistic***	1.158	0.296

Finally, the CUSUM function lied within the confidence band over the entire sample period, as shown in figure 1, which indicated that the estimates of the parameters are stable over the entire period. The plot of CUSUMSQ function also lied within confidence band. However, it tipped out of confidence band for a brief period of time, and then drifted back to confidence band. It also validated the stability of parameters over the period of investigation.

Figure 1: CUSUM Plot

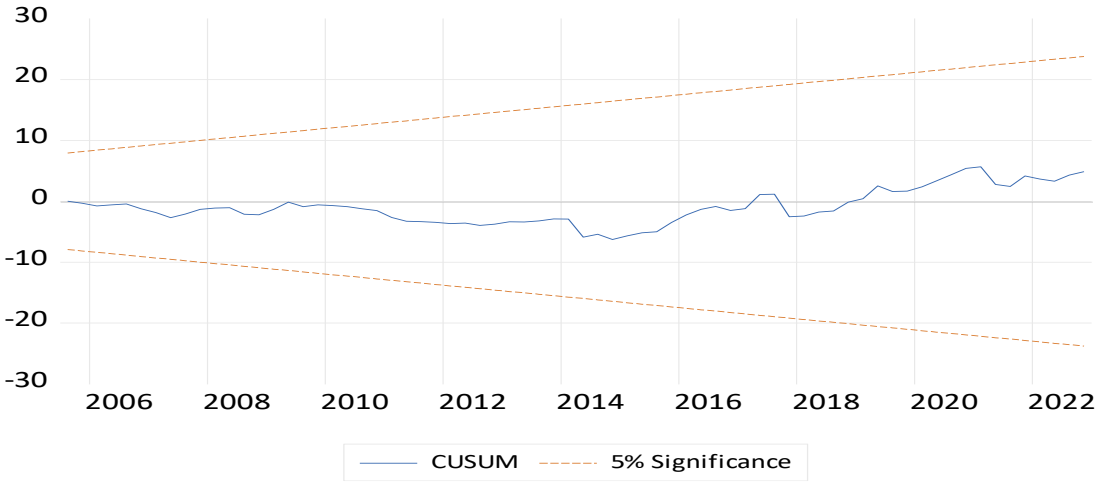
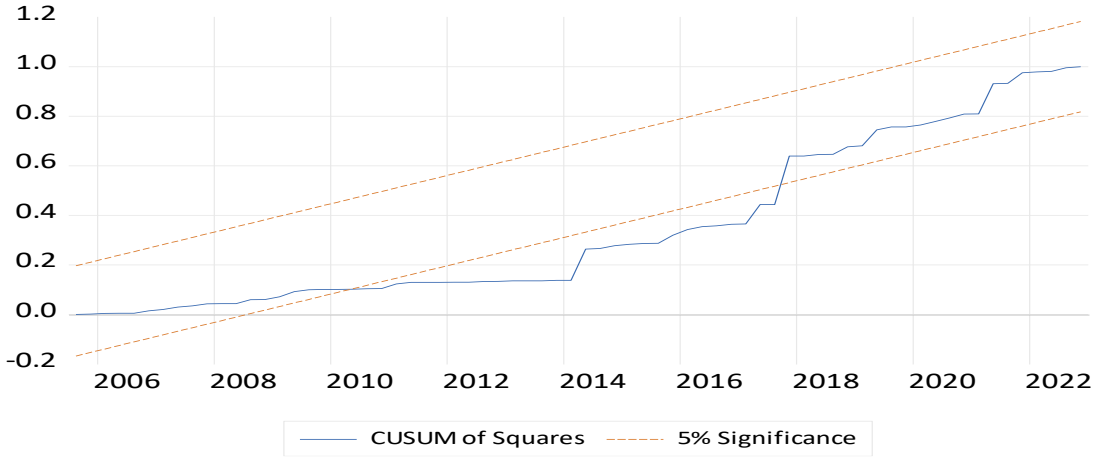


Figure 2: CUSUMSQ Plot



5 Conclusion and Policy Recommendations

This study investigated the role of ER volatility in determining net PI position of Pakistan, utilizing quarterly data for the period of 1994Q3 to 2022Q4. The outcomes of the unit root test showed that the net PI flows were stationary at their level. However, all other variables such as stock price index, IPI, inflation, INTDF, ER volatility, and REER were first order integrated. Given the varied order of integration of variables, we exploited ARDL bounds test to determine to the existence of cointegrating relationships among the variables. The findings of the ARDL bounds test confirmed the existence of long-run relationships among the variables.

Further, we investigated the short-run and long-run dynamics of the relationships of the variables. The short run analysis showed that coefficients of first two lags of net PI were positive and significant. The third to sixth lags of domestic economic activity casted negative and significant impact on net PI position of Pakistan. Analogously, the third lag of INTDF also deteriorated PI position of Pakistan. The impact of current and all seven lags of domestic inflation remained positive and significant. However, the current period ER volatility had negative and significant impact on net PI position. Moreover, the coefficient of ECM was smaller than one and

carried negative sign, which reflected that in case of any divergence from the long run equilibrium path, the relationship had the tendency of reverting back to the equilibrium path at the speed of 64% per unit of time.

The long-run analysis indicated that domestic economic activity had no significant impact on the net PI position. However, INTDF had positive and significant impact, while domestic inflation, REER, stock price index, and ER volatility had negative and significant impact on the PI position of Pakistan. Further, we also executed post-estimation diagnostics to check the authenticity of our analysis. All the post-estimation diagnostic tests corroborated the authenticity of our analysis.

Given the findings of the study, we suggest that policymakers and investors should prioritize risk management strategies that address ER risk. The economic agents and decisionmakers should undertake appropriate steps to damp down excessive fluctuations in the ER during the period of any economic turmoil. We also recommend the investigation of asymmetric effects of ER volatility and the drivers of ER volatility for future research endeavours.

References

Aghion, P., Bacchetta, P., Ranciere, R., & Rogoff, K. (2009). Exchange rate volatility and productivity growth: The role of financial development. *Journal of monetary economics*, *56*(4), 494-513.

Baek, J. (2013). Does the exchange rate matter to bilateral trade between Korea and Japan? Evidence from commodity trade data. *Economic Modelling*, *30*, 856-862.

Baghebo, M., & Apere, T. (2014). Foreign portfolio investment and economic growth in Nigeria (1986-2011). *International Journal of Business and Social Science*, *5*(11), 108-115.

Bahmani-Oskooee, M., & Hegerty, S. W. (2007). Exchange rate volatility and trade flows: a review article. *Journal of Economic studies*, *34*(3), 211-255.

Berganza, J. C., & Broto, C. (2012). Flexible inflation targets, forex interventions and exchange rate volatility in emerging countries. *Journal of International Money and finance*, *31*(2), 428-444.

Bleaney, M., & Greenaway, D. (2001). The impact of terms of trade and real exchange rate volatility on investment and growth in sub-Saharan Africa. *Journal of development Economics*, *65*(2), 491-500.

Branson, W. H. (1983). A model of exchange-rate determination with policy reaction: evidence from monthly data.

Branson, W. H. (1984). Exchange Rate Policy after a Decade of" Floating". In *Exchange rate theory and practice* (pp. 79-118). University of Chicago Press.

Calvo, G. A., Leiderman, L., & Reinhart, C. M. (1993). Capital inflows and real exchange rate appreciation in Latin America: the role of external factors. *Staff Papers*, *40*(1), 108-151.

Caporale, G. M., Ali, F. M., Spagnolo, F., & Spagnolo, N. (2017). International portfolio flows and exchange rate volatility in emerging Asian markets. *Journal of International Money and Finance*, *76*, 1-15.

Cenedese, G., Sarno, L., & Tsiakas, I. (2014). Foreign exchange risk and the predictability of carry trade returns. *Journal of Banking & Finance*, *42*, 302-313.

Dada, J. T. (2021). Asymmetric effect of exchange rate volatility on trade in sub-Saharan African countries. *Journal of Economic and Administrative Sciences*, *37*(2), 149-162.

Dornbusch, R., & Fischer, S. (1980). Exchange rates and the current account. *The American economic review*, *70*(5), 960-971.

Dua, P., & Suri, R. (2018). Exchange Rate And Central Bank Intervention In India: An Empirical Analysis. *The Journal of Developing Areas*, *52*(2), 127-143.

Duasa, J. (2011). Terms of trade and economic growth: An estimate of the threshold level of terms of trade for Malaysia. *International Journal of Economic Perspectives*, *5*(1), 29-43.

Dzingirai, C., Kunaka, B. W., & Masarirevhu, T. D. (2024). Asymmetric effects of foreign portfolio investment on economic growth of selected SADC countries. In *Responsible Business and Sustainable Development* (pp. 158-180). Routledge.

Ekanayake, E. M., & Dissanayake, A. (2022). Effects of real exchange rate volatility on trade: Empirical analysis of the United States exports to BRICS. *Journal of Risk and Financial Management*, *15*(2), 73.

Fiaz, A., Khurshid, N., Satti, A., & Malik, M. S. (2021). Real exchange rate misalignment in Pakistan: An application of regime switching model. *The Journal of Asian Finance, Economics and Business*, *8*(12), 63-73.

Ganguly, S., & Breuer, J. B. (2010). Nominal exchange rate volatility, relative price volatility, and the real exchange rate. *Journal of International Money and Finance*, *29*(5), 840-856.

Garg, R., & Dua, P. (2014). Foreign portfolio investment flows to India: determinants and analysis. *World development*, *59*, 16-28.

Grossmann, A., Love, I., & Orlov, A. G. (2014). The dynamics of exchange rate volatility: A panel VAR approach. *Journal of International Financial Markets, Institutions and Money*, *33*, 1-27.

Grossmann, A., & Orlov, A. G. (2022). Exchange rate misalignments, capital flows and volatility. *The North American Journal of Economics and Finance*, *60*, 101640.

Haider, M. A., Khan, M. A., & Abdulahi, E. (2016). Determinants of foreign portfolio investment and its effects on China. *International Journal of Economics and Finance*, *8*(12), 143-150.

Haynes, S. E. (1988). Identification of interest rates and international capital flows. *The Review of Economics and Statistics*, 103-111.

Makhetha-Kosi, P., Mishi, S., & Ngonyama, N. (2016). The response of capital flows to interest rate differentials: The case of South Africa. *Journal of Economics*, *7*(2-3), 119-129.

Levy, H., & Sarnat, M. (1970). International diversification of investment portfolios. *The American Economic Review*, *60*(4), 668-675.

Lucas Jr, R. E. (1990). Liquidity and interest rates. *Journal of economic theory*, *50*(2), 237-264.

Markowitz, H. (1952). Modern portfolio theory. Journal of Finance, 7(11), 77-91.

Meese, R. A., & Rogoff, K. (1983). Empirical exchange rate models of the seventies: Do they fit out of sample?. *Journal of international economics*, *14*(1-2), 3-24.

Merton, R. C. (1973). An intertemporal capital asset pricing model. *Econometrica: Journal of the Econometric Society, 867-887*.

Morina, F., Hysa, E., Ergün, U., Panait, M., & Voica, M. C. (2020). The effect of exchange rate volatility on economic growth: Case of the CEE countries. *Journal of Risk and Financial Management*, *13*(8), 177.

Nguyen, P. C., Schinckus, C., Nguyen, B. Q., & Tran, D. L. T. (2022). International portfolio investment: does the uncertainty matter?. *Journal of Economics and Development*, *24*(4), 309-328.

Obstfeld, M., & Rogoff, K. S. (1998). Risk and exchange rates. *NBER Working Paper*.

Olamide, E., Ogujiuba, K., & Maredza, A. (2022). Exchange rate volatility, inflation and economic growth in developing countries: Panel data approach for SADC. *Economies*, *10*(3), 67.

Ozigbo, A. S. (2021). Foreign direct investment, portfolio flows and economic growth in Nigeria. *International Journal of Development and Economic Sustainability*, *9*(1), 63-76.

Ozturk, I. (2006). Exchange rate volatility and trade: A literature survey. *International Journal of Applied Econometrics and Quantitative Studies*, *3*(1).

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), 289-326.

Rafi, O. M., & Ramachandran, M. (2018). Capital flows and exchange rate volatility: experience of emerging economies. *Indian Economic Review*, *53*, 183-205.

Roll, R., & Ross, S. A. (1995). The arbitrage pricing theory approach to strategic portfolio planning. *Financial Analysts Journal*, *51*(1), 122-131.

Shabbir, M. S., & Muhammad, I. (2019). The dynamic impact of foreign portfolio investment on stock prices in Pakistan. *Transnational Corporations Review*, *11*(2), 166-178.

Shabbir, M. S., Bashir, M., Abbasi, H. M., Yahya, G., & Abbasi, B. A. (2021). Effect of domestic and foreign private investment on economic growth of Pakistan. *Transnational Corporations Review*, *13*(4), 437-449.

Tran, D. T., & Sawhney, B. L. (1988). Government deficits, capital flows, and interest rates. *Applied Economics*, *20*(6), 753-765.

Waqas, Y., Hashmi, S. H., & Nazir, M. I. (2015). Macroeconomic factors and foreign portfolio investment volatility: A case of South Asian countries. *Future Business Journal*, *1*(1-2), 65-74.