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Exchange Rate Dynamics and its Misalignment: A Case of Pakistan

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ABSTRACT

This paper is an attempt to investigate the long-run real exchange rate and its misalignment in the case of Pakistan from 1978 to 2018. The model based on previous theories to calculate the real exchange rate of equilibrium rooted on several macro-economic variables (Montiel 1997). After exploring the presence of a stable relationship between variables, the long-run effects of these variables on the RER balance and the short-run dynamics are calculated. The study looked at a persistent overvaluation in RER from 1978 to 2018 in Pakistan, except for 1986 to 1995, which is 21.86 percent in 2018 and is calculated using the misalignment index. This overvaluation is one of the main reasons for Pakistani exports to decline in economic performance and lose competitiveness in international markets. In order to improve the external sector, this study recommends that the competent authorities should adopt a rational exchange rate policy to strengthen the economy.

Keywords: Real exchange rate, misalignment, macroeconomic fundamentals, competitiveness, tradable and non-tradable, financial development, energy crises.

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1. INTRODUCTION

The exchange rate is a very significant macro-economic variable, with far-reaching implications for the monetary and real sectors of the economy. It plays a key role in domestic consumption, business investment and international export competitiveness [Caballero and Corbo (1989), Gala and Lucinda (2006), Algieri (2011), Mirchandani (2013)]. It is for this reason that the IMF recommends that economies under pressure from the external sector rationalize their exchange rate, as the IMF mission assessed around 5 percent of the PKR devaluation in December 2016, and as part of the recent Stand-By Agreement with Pakistan, the PKR devaluation occurred around 30 percent in 2019 in order to stabilize the exchange rate.

A long-run deviation of the actual exchange rate from the real exchange rate is defined as a misalignment that could be overvalued or undervalued. In the event of misalignment, the actual RER cannot perform its key

macroeconomic role and does not lead the economy to an efficient allocation of resources [Edwards (1988) and Montiel (2003)]. Overvalued real exchange rates cause weak export competitiveness in their markets, and undervaluation can lead to inflation (Gala and Lucindal 2006; Hyder and Mahboob 2006).

Economic theory suggests a variety of macroeconomic factors that cause exchange rate fluctuations, including price levels, interest rates, government debt, trade terms, current account deficits and speculation (Krugman and Obstfled 2012). In the case of Pakistan, studies are available to explore the determinants of the real exchange rate. Afridi (1995) revealed that large domestic loans, heavy capital inflows, and economic openness are important determinants of real exchange-rate balance that are affected by real and monetary factors (Chishti and Hasan (1993; Siddiqui, Afridi, and Mehmood (1996). Saeed *et al*. (2012) observed excessive money supply, the position of foreign reserves and the ratio of Pakistan's public debt to the USA had a significant impact on Pakistan's exchange rate. Another study found that the GDP growth rate, interest rate, inflation rate, and current account deficit caused significant fluctuations in the exchange rate of Pakistan Razi *et al*. (2012). The Raza and Afshan (2017) study found that trade openness, money supply, and economic development are key macroeconomic indicators responsible for Pakistan's exchange rate variability.

Quantifying the level of real exchange rate misalignment is a key area of research in the field of exchange rate dynamics. Not only does it reflect the nature and degree of misalignment, but it also draws the attention of policymakers to take concrete measures to minimize misalignment so that real exchange rates are effective for macroeconomic stability and competitiveness in international export markets.

Very few studies have been found in Pakistan to examine the magnitude of real exchange-rate misalignment and the results are highly inconclusive. For example, Ahmed (2009) found a persistent overvaluation of Pakistan's real exchange rate from 1972 to 2007; while Zakaria (2010) found a continuous devaluation of the real exchange rate from 1983 to 2005. So this paper covers a long period to examine the misalignment of the real exchange rate to fill this research gap. Second, many of these studies are not recent and, at national and global level, drastic business and financial developments have taken place over the last decade, including the 2007-2008 global financial crisis, so it is time to calculate the magnitude of Pakistan's real exchange rate misalignment with recent data. Third, Pakistan's exports fell by about 15 percent from 2014 to 2017, and many business and academic circles have described the misalignment of the real exchange rate as one reason for this steep fall. In this backdrop, it is high time to explore the nature of the misalignment of the country's real exchange rate.

This study has two purposes: (i) to specifically identify the effects of the various macroeconomic fundamentals advocated by economics theories on Pakistan's real exchange rate; and (ii) to estimate the degree of misalignment of the equilibrium exchange rate over the period 1978 to 2018.

Following the introduction, a review of the related field studies conducted in developing countries is presented in the second section. The theoretical discussion that may form part of the literature review is presented in the third section of the research methodology, which details the economic model, the selection and description of variables, the econometric application and the calculation of real exchange rate misalignment. The fourth section presents estimates and findings, while the last section consists of conclusions and recommendations to policymakers.

2. REVIEW OF LITERATURE

Research has been underway for decades to investigate factors affecting the real exchange rate, to analyze the extent of its fluctuations, and to explore the relationship between its misalignment and the economic performance of a nation. This section presents a review of research on the consequences of misalignment and the degree of misalignment in Pakistan.

2.1. Misalignment and Economic Performance

Most of the South East Asian economies were adversely affected by the Asian financial crisis of 1997. Jongwanich (2007) conducted a study to determine the level of RER misalignment in these countries. The study found that real RER overvaluation increased to 10-15 percent in South Kores, Malaysia, and Thailand before 1997, while it increased to 20 percent in Indonesia. Another study on misalignment in RER during the 1997-98 financial crisis in the Malaysian ringgit conducted by Ahmed *et al*. (2010). The study concluded that Malaysia's currency was overvalued during the pre-crisis period (1991-1997) and undervalued in the post-crisis period. Naseem and Hamza (2013) estimated misalignment of RERs in Malaysia and concluded that the correction of misalignment and stability of RERs is essential for economic stability and sustainable development in developing countries. Similar findings on Thai currency overvaluation before the 1997 financial crisis were found in the Hangsasuta and Jiravanichsakul studies (2011).

In order to investigate the Indian currency crises of 1991, Cerra and Saxena (2002) carried out a study using quarterly data for the period 1979-1997, which revealed that there was overvaluation in the Indian rupee at the time of currency crises due to strong trade and technological developments in the country. Similar findings have been reported in the Bhagwati *et al*. (2015) study, which reported the overvaluation of Indian currency.

There is a consensus in the economics literature on the negative correlation between export competitiveness and RER overvaluation. Devaluation of the competitiveness of exports in international markets is suggested [for example, Kemal and Qadir (2005), Mohammad and Jusof (2008), Auboin and Ruta (2011), Gherman *et al*. (2013), Toulaboe (2016), Wondemu and Potts (2016)]. While there is no consensus between overvaluation and imports that the inflow of imports into a country is price inelastic.

Real exchange rate misalignment was identified in Bangladesh and Taka overvaluation was 16.4 percent in 2014 due to inflows of remittances and export receipts resulting in inflation and instability in the financial sector [Hosain and Ahmed (2009) and Akhtaruzzaman and Begum (2015)].

Another dimension is the relationship between exchange rate fluctuations, either overvaluation or undervaluation, and the economic performance of open economies. Empirical work notes that exchange-rate shocks tend to converge towards mean, but the correction of misalignment occurs slowly so economic agents adjust their patterns of consumption and investment. Currency volatility deteriorates competitiveness and negatively affects economic growth. It is suggested that the fixed exchange rate system is better suited for easy adjustments in labor and asset markets [Schnabl (2008), Sanginabadi and Heidari (2012), Musyoki *et al*. (2012), Alagidede and Ibrahim (2016)]. While Aziz *et al*. (2005) investigated the consequences of exchange rate fluctuations in Pakistan's manufacturing sector, there was no significant relationship between them.

The conclusion could be drawn from the above review that the misalignment of the real exchange rate exhibits a negative correlation with the competitiveness and economic performance of a nation and may contribute to the deterioration of the country's monetary balance.

2.2. Misalignment in RER of Pakistan

The literature on real exchange rate misalignment in Pakistan is limited in the application of a econometric techniques but indicates diversified results. For example, Hyder and Mehboob (2006) reported a misalignment of the exchange rate ranging from -11.1 percent to 20.1 percent with a zero reversion means reflecting a long-term convergence trend from the actual RRSP to the RRSP balance for the period 1978 to 2005. Similar results were obtained by Janjua (2007), who estimated Pakistan's real exchange rate of balance between 1978 and 2006. The findings of his study pointed to the gradual convergence of long-term real exchange rates. On the contrary, Ahmed (2009) studied misalignment in RER Pakistan Rupee for the period 1972 to 2007 and found an overvaluation of 0.75 percent in 2001 to 22.9 percent in 2007.

In another study, Zakaria (2010) presented a contrasting result using quarterly data for the period 1983-2005 and found a persistent undervaluation at the actual real exchange rate. While Fida, Shah, and Zakaria (2011) used quarterly data for 1983-2010 and concluded that an overvaluation of the real exchange rate.

Given the above description, which relates to the empirical work on misalignment, there is no uniform understanding for Pakistan and, as a result, there is scope for further study.

2.3. Theoretical Framework

2.3.1. Real Exchange Rate

It is the price of one currency for another, called the nominal exchange rate (Mishkin 2004), which can be calculated as

$$NER = P_t^* / P_n \quad \text{----------Eq. (1)}$$

Where the NER is a nominal exchange rate, P_t^* denotes the foreign currency price of tradable goods and P_n domestic price of non-tradable goods. Due to the non-availability of data for tradable and non-tradable goods, alternative price indices are used for empirical purposes. The whole sales price index (WPI) which is heavily weighted by the Tradable Goods Index and the Consumer Price Index (CPI) is assumed to be heavily weighted by non-tradable goods. For the calculation of RER, "e", the entire US sales price index is taken as proxy of P_t^* , while the domestic CPI is used as Pn's proxy [see Ballasa 1964; Edwards (1988, 1989, 1990); Cottani *et al*. (1990); Domac and Shabsigh (1999); Ahmed (2009)], the following equation used:

$$e_{it} = NER_{it} \, WPI_{us} / CPI_{it} \quad \text{----------Eq. (2)}$$

The above equation indicates that an increase in the ratio implies a real devaluation of the exchange rate, leading to an increase in the competitiveness of the international market, while a decrease in the ratio, which leads to a real appreciation of the domestic currency, leading to a fall in the competitiveness of the export market.

For the period from 1978 to 2016, the nominal and real exchange rate movements are shown in Figure **1** below.

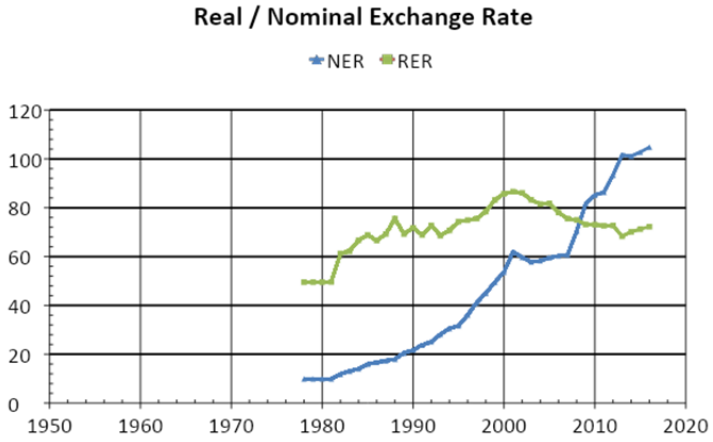

Figure 1: indicating the development of RER and NER during the study period from 1978 to 2016. It is reported that 2008 was the year in which RER has converged to NER since then, overvaluation has risen sharply.

2.3.2. Long Run Equilibrium RER

Similar to other economic variables, the RER value will be an equilibrium value if it has no tendency to change. Since RER is a key macro-economic indicator, it is therefore, an important player in the overall macroeconomic dynamics, and changes are underway when the economy is facing any shock. The theory of purchasing power parity (Cassel 1916) is a pioneer in determining the exchange rate of equilibrium; the exchange rate of equilibrium on the basis of this theory is constant and time-invariant for all periods. On the basis of the PPP theory, the exchange rate will be in balance when the prices of all goods of the same weight are equal when measured in the common currency. Mathematically balanced RER can be expressed in the following Eq. (3).

$$ERER = e\left(P_f \big/ P_d\right) = 1 \quad \text{----------Eq. (3)}$$

The above equation is a mathematical expression of PPP theory. Where ERER is an equilibrium real exchange rate, the nominal exchange rate is represented by 'e' which is equal to the foreign currency in terms of the local currency, P_f is the foreign price in foreign currency and P_d is the domestic price in local currency for the same goods and services. Equation (3) is the expression of PPP, which is based on the law of one price. This approach is criticized for two reasons. On the one hand, it assumes that the exchange rate of equilibrium has no link with other macro-economic fundamentals and, on the other hand, the exchange rate of equilibrium does not show any variation in the event of a sharp fluctuation in the macro-economic fundamentals. In this context, gaps in PPP theory with other approaches have been presented in literature such as the Fundamental Equilibrium Exchange Rate (Williamson 1993), the Natural Real Exchange Rate (NATREX) presented by Stein (1994), the Behavioral Equilibrium Exchange Rate (Clark and Mac Donald 1998) and the Real Equilibrium Exchange Rate (Edwards 1989; Hinkle and Montiel 1994).

2.3.3. Measuring Equilibrium RER

In order to capture other macro-economic factors to determine the RER balance, Williamson (1994) introduced the FEER approach, which is the exchange rate that maintains the internal and external balance between many countries at the given time.

An economy has an internal balance when it comes to full employment output at a low inflation rate. While a sustained balance of payment indicates an external balance for the economy that is the minimum requirement.

This study presents a model for the development of internal and external balance, as explained by Montiel (1999) for RER, as well as a number of macro-economic factors that determine RER. Internal balance is achieved when both the labor market in the economy and the market for non-traded goods are clear. Mathematically, this is represented as:

$$Y_n = C + G = (1 - \vartheta)C + G \quad \text{----------Eq. (4)}$$

Where Y_n is the total production of non-traded goods under full employment, C_n and G_n are private and government expenditure on non-tradable goods, ϑ is the share of expenditure on tradable goods. The Economic literature on external balance provides a diversified approach. After Elbdawi (1997), and Edwards (1989), the economy reaches an external balance when its net creditor position is at a steady-state level. Assuming that an economy with current account surplus is represented as follows:

$$F = b + n + rF$$
$$or \quad F = Y - (g + c) \text{ ---------- Eq. (5)}$$

The above Eq. (5) has two dimensions, one of which shows the foreign inflows and the economy is receiving, while the second is the state of the foreign trade balance. In the equation "F" indicates the total net foreign assets held by the economy and equal to 'b' the trade balance, and 'n' the net foreign aid and loans granted to the government, while 'r' is the return on foreign assets 'F'. The second equation of the lower side shows that net foreign assets are equivalent to the trade balance. The trade balance is the difference between 'Y_t' local production of tradable goods and the sum of 'g_t' government expenditure and 'c_t' private expenditure on those tradable goods.

3. RESEARCH METHODOLOGY

3.1. Specifying Model for Measuring RER

The theoretical framework explained in the previous section illustrates the long-run relationship between the RER balance and the macro-economic variables. The long-run relationship in log linear form is expressed as:

$$Ln(e_t^*) = \beta F_t^p \text{ ----------Eq. (6)}$$

Where e^* is the equilibrium RER at a given time 't' on the right side of the equation 'F' is the vector of the macro-economic fundamentals associated with RER, and 'β' is the vector of the long-run parameters indicating the nature of the relationship between RER and these fundamentals. Since the objective of the study is to determine the long-run relationship between equilibrium and macro-economic fundamentals, only real factors have been included in the Eq. (6), since monetary factors influence the RER equilibrium only in the short term (Edwards 1988), Chishti and Hassan (1993).

Misalignment in the real exchange rate will be calculated as the difference between the actual RER, e , in each time period, and the equilibrated RER, e^*, obtained by computed estimates.

Based on Eq. (6) and following Edwards (1988, 1989, 1994), Elbadwi (1994), Montiel (1997), Hyder and Mehboob (2006), Ahmed (2009), a reduced formula equation will be used for this study.

$$RER_t = \alpha + \beta_1 TOT_t + \beta_2 TO_t + \beta_3 WR_t + \beta_4 FDI_t + \beta_5 GC_t + \beta_6 RI_t + \mu_t \text{ ----------Eq. (7)}$$

Where

TOT [1] = Terms of trade

TO [2]= Trade policy measured through trade openness

[1] **Terms of Trade:** It is the ratio of the export price index to the import price index. The effect of rising terms of trade on RER influenced by resulting in its income and substitution effect in the economy. If the income effect is higher than the substitution effect, rising in terms of trade is likely to cause an appreciation in RER, while an opposite situation may depreciate RER. Data is collected from Hand-Book of Statistics on Pakistan Economy from SBP.

[2] **Trade Openness:** The ratio of exports plus imports to GDP is the Trade Openness and used as a proxy of trade policy (Cottani, Cavallo and Khan 1986) An increase in trade openness is likely to depreciate RER. Data on exports and imports is collected from various issues of the Economic Survey of Pakistan.

WR [3] = Foreign inflows identified as workers' remittances as proportion of GDP

FDI [4] = Another proxy for foreign capital inflows which is Foreign Direct Investment as percentage of GDP

GC [5] = Domestic consumption by government as percentage of GDP

RI [6] = Real capital investment for tradable as percentage of GDP

RER = Real Exchange Rate

α = Intercept or Constant, β represents slope coefficient or long run parameters

3.2. Research Hypothesis

1. Ho = There is no effect of terms of trade on real exchange rate
2. Ho = Trade openness has no effect on real exchange rate
3. Ho = Inflows of workers' remittances have no effect on real exchange rate
4. Ho = FDI has no effect on real exchange rate
5. Ho = Expenditures of government consumption have no effect on real exchange rate
6. Ho = There is no effect of real investment in the country on real exchange rate

3.3. Econometric Applications

The study begins its assessment by examining the nature of the stationarity of the all-time series included in the study. If these are stationary at the level, the ordinary least square (OLS) technique is used to estimate the parameters of all macro-economic fundamentals. If these time series are not stationary at the level, the OLS technique indicates false results so that we apply a different procedure. The nature of the stationary root test unit, such as ADF or PP, is examined.

Since our aim is to estimate long-run parameters for determining the real exchange rate of equilibrium, the second step is to analyze the long-term integration of all the fundamentals with the real exchange rate. The Johansen and Juselius (1990) co-integration test are used to determine long-term co-integration.

Vector Error Correction Model (VECM) is used as the third step of the analysis to estimate long-term parameters of all fundamentals. It is important to see whether the signs of the parameters are theoretically consistent and, secondly, the exchange rate of equilibrium is calculated at every point of time during the period of study from 1978 to 2018 using the values of the parameters.

Finally, the degree of misalignment in the actual RER is calculated from the RER equilibrium through Eq. (8). If the calculated misalignment index is zero, this means no misalignment. Positive index value indicates devaluation, while negative value reflects overvaluation.

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[3] **Workers Remittances:** It is one of the measures of the inflow of foreign funds. An increase in workers' remittances may cause an appreciation of RER (Haque & Montiel 1998b). Data has been taken from the World Bank (WDI).

[4] **Foreign Direct Investment:** It is another measure of capital inflows and if these inflows are higher than debt servicing obligations then it may appreciate RER (Baffes *et al*. (1999). Data is collected from the State Bank of Pakistan.

[5] **Government Consumption:** Raising government consumption on non-tradable goods is likely to appreciate RER while rising government consumption on tradable goods may cause depreciation of RER (Edwards 1989). Due to the non-availability of data of government consumption on tradable and non-tradable separately, data on whole government consumption is used (Ahmed 2009). Data is collected from the Economic Survey of Pakistan.

[6] **Real Investment:** If an investment is made on machinery equipment and plants for tradable goods it is likely to depreciate. But according to Edwards (1994), it also depends on the relative ordering of factor intensities across sectors on the basis of inter-temporal analysis. So the effect of real investment on RER is ambiguous. Data obtained from World Bank (WDI).

$$Misalignment\ \text{Index} = \frac{RER_t - ERER_t}{ERER_t} \text{ ---------- Eq. (8)}$$

4. ESTIMATION AND RESULTS

The first step is to explore the nature of stationarity in the time series used in this research to check the stationarity of the various root unit tests available in the literature. The ADF test is used to determine the nature of the stationarity of each time series. Each time series is tested at the level and the first difference in two equations, constant and constant and trend, while the null hypothesis is the time series has the root unit. The estimated value is compared to the official values at 1 percent, 5 percent and 10 percent levels of significance. The results are given in Table **1**.

Table 1. Results of Unit Root Test.

	Equation	**RER**	**GC**	**WR**	**TOT**	**TO**	**RI**	**FDI**
Level	Constant	-2.43	-1.52	-1.7	0.19	-2.15	-1.4	-2.68
	Con.& trend	-0.97	-1.77	-0.87	-1.64	-1.68	-2.29	-2.97
1st difference	Constant	-5.46	-5.36	-4.45	-3.2	-5.83	-5.68	-4.19
	Con.& Trend	-6.18	-5.29	-4.84	-3.31	-6.07	-5.71	-4.14

Note:

1. Critical values are -3.62 & -2.94 at 1% and 5% respectively for constant
2. Critical Values are -4.42. & -3.54 at 1% and 5% respectively for constant and trend
3. All variables are in log linear form except FDI
4. Test carried out on 9 lags selected by SIC automatic selection

Table **1** shows that the all-time series included in the model are non-stationary at the level while they are stationary at the 1st difference. It implies that the application of the OLS procedure to obtain the long-run coefficients will lead to false results. Alternatively, Johansen Cointegration Test is used to check long-run association between variables. The presence of long-run relationship is examined by means of Trace statistics and Maximum Self Values. Here the null hypothesis is no co-integration equations which may be 0, 1, 2, ... k. And this null hypothesis is rejected by < 0.05 p-values. The guideline for co-integration is the higher values of the Trace statistics and the maximum Own values than their critical values suggest the rejection of the null hypothesis. The null hypothesis is accepted at > 0.05 p-values for the existence of cointegration equations. The intercept test was performed and there was no trend with Lag 1. Which criteria were selected for the AIC. Table **2** shows the results of trace statistics and Table **3** shows the results of the maximum values of Eigen.

The results of both tests show that there is a long-run stable relationship between variables because the trace statistics explore 5 co-integration equations between variables in the study.

Once a long-term relationship between variables has been established, the coefficients of all macroeconomic fundamentals affecting the country's real exchange rate are determined. Using the direction and magnitude of the coefficients, the real exchange rate is calculated on the basis of Eq. (7).

Table 2. Results of Trace Test.

Null Hypothesis			
No. of C.E. Equations	Trace Statistics	C.V. at level 0.05	Probability**
R=0*	154.45	123.72	0.002
R≤ 1*	104.31	93.69	0.013
R≤ 2*	75.54	67.78	0.019
R≤ 3*	51.17	48.79	0.03
R≤ 4*	31.42	28.81	0.041
R≤ 5	12.79	14.51	0.088
R≤ 6	3.92	4.14	0.086

Table 3. Results of Maximum Eigen value Test.

Null Hypothesis			
No. of C.E. Equations	Maximum Eigen Statistics	C.V. at level0.05	Probablity**
R=0*	53.11	47.19	0.01
R≤ 1*	27.69	41.06	0.5
R≤ 2*	27.47	34.79	0.41
R≤ 3*	20.57	26.61	0.36
R≤ 4*	17.73	22.14	0.18
R≤ 5	11.87	16.27	0.16
R≤ 6	3.94	4.86	0.08

Note:

1. Maximum Eigen Values indicate 1 cointegration equation at level of 0.05
2. ** Mac Kinnon –Haug-Michelis(1999) p-values

The Vector Error Correction Model (VECM) is used to estimate long-run parameters of all fundamentals and short-run dynamics. The results of long-term coefficients are shown in Table **4**. All macro-economic fundamentals are significant except for trade openness, which implies that they are weakly exogenous so that the reversal of RER causality to variables is ruled out. The signs of the coefficients are in line with the theory described in the preceding sections. For example, the trade coefficient is -2.12 and statistically significant suggests that a 1 percent increase in Pakistan's trade is expected to increase RER by 2.12 percent, consistent with the theory and previous study conducted in Pakistan (Ahmed 2009). Thus, the null hypothesis relating to terms of trade is rejected. Results of worker's remittances for RER are also significant and theoretically consistent with previous studies [Hyder & Mahboob (2006); Ahmed (2009)]. The increase in workers ' dismissals by 1 percent is likely to increase the RER by 0.71 percent of ceteris paribus. This is consistent with Haque and Montiel (1998b); Ahmed (2009) FDI is another macro-economic fundamental included in the study to capture foreign fund inflows. We can therefore, reject our third null hypothesis. In this study, the effects of FDI on RER are significant and an increase of 1 percent of FDI is expected to increase by 0.83 percent of

ceteris paribus, consistent with Baffes *et al*. (1990); Montiel (1997); Ahmed (2009). The null hypothesis that FDI has no RER effect is rejected.

Real GDP investment has a significant role to play in Pakistan's RER. If this investment is made on non-tradable goods resulting in a decrease in the ratios of the tradable sector in the country, it will result in an RER depreciation. The results of real investment are theoretically consistent and an increase of 1 percent of a real investment may depreciate Pakistan's RER by approximately 5.48 percent of ceteris paribus. Government consumption of non-tradable goods leads to an increase in demand for these goods and causes an appreciation of RER while a large proportion of government consumption contains tradable goods, which deteriorates the current account balance resulting in an appreciation of RER. According to the results of our study, an increase in government consumption leads to an appreciation of RER. More precisely, an increase of 1 percent in government consumption is expected to increase RER by 0.73 percent. The null hypothesis relating to real investment and government consumption of tradable goods can be rejected, while the null hypothesis that trade openness has no effect on the real exchange rate cannot be rejected.

On the basis of the VECM estimation, the following equation is used to calculate the real exchange rate of equilibrium.

$$RER_t = 3.03 - 2.12 * TOT_t - 1.04 * TO_t - 0.71 * WR_t - 0.83 * FDI_t - 0.73 GC_t + 5.48 * RI_t$$

Table 4. Results of Long Run VECM Estimates.

Dependent Variable RER		
Regressors	**Coefficients**	***T*-values**
TO	-1.04	-0.77
TOT	-2.12	-5.16
WR	-0.71	-4.13
GC	-0.73	5.61
RI	5.48	-3.41
FDI	-0.83	-7.68
Constant	3.03	
Diagnostic Tests for Residuals		
White Heteroscedasicity Test	Chai sq value-365.34	Prob-0.79
Serial correlation LM Test	LM statistics 42.03	Prob-0.29
Cholesky Normality Test	JB-value 18.7	Prob-0.19

2. No of lag 1 on the basis of AIC lowest value
3. Trend Assumption: Linear Deterministic Trend

Short-run estimates and error corrections are shown in Table **5**. The direction of short-term RER coefficients is similar to the long-run, except for government consumption; FDI, real investment and trade openness are statistically insignificant. Conversely, the terms of trade and remittances of workers are significant. In the event of any shock or imbalance, the RER itself is likely to adjust to restore balance. However, the most important term in short-term estimates is the ECt-1 error correction term, which is-0.31 in our study and statistically

significant at 1 percent level, which implies a speed of adjustment in the next period in the event of any disequilibrium.

The negative significant term of error correction confirms the long-run association between variables as well as the stability of the model.

The R-square value of 0.719 indicates that the macroeconomic fundamentals included in this study explain RER variation by approximately 72 percent The F-statistics value, which is significant at the 5 percent level, also shows all the fitness of the model.

Residual diagnostic tests for serial correlation, heteroscedasticity and normal residual distribution have been performed after estimating long-term and short-term estimates. The results of the tests are presented at the end of Table **5** indicating that there is no serial correlation or heteroscedasticity in residues that are normally distributed.

4.1. Misalignment in Exchange Rate

The misalignment of the real exchange rate is calculated as the percentage deviation of the actual RER from the equilibrium RER given in Eq. (5) and the calculated misalignment index Figure **2**. Using macroeconomic fundamentals based on economic literature, we estimated the RER balance as a function of these fundamentals and obtained the RER Eq. (6) balance equation on the basis of long-term coefficients. This equation is used to calculate the RER for the point of time for the whole time period of the study, 1978-2018. During most of the study period, actual RER was overvalued except in 1988-1995, when the financial reforms were carried out to transform the financial sector from a controlled regime to a market-oriented approach, when actual RER decreased from 11 per cent in 1988 to 15.2 percent in 1995. From 1978 to 1987, the actual RER was overvalued by the RER balance of 3.2 percent in 1978 and reached 17.1 percent in 1987. This overvaluation of actual RERs was the result of a significant increase in workers ' remittances up to 11.1 percent of GDP in 1983 and improved terms of trade. The second episode of overvaluation began when Pakistan faced economic sanctions shortly after the nuclear test, and the government froze foreign currency accounts and fixed nominal exchange rates at Rs. 46 per US$. This overvaluation ranged from 3.4 percent from 1996 to 1999. This overvaluation of actual RERs continued due to the heavy flow of FDI, project aid funding from the USA and the increase in remittances and overvaluation of workers in 2004-2005 and approximately 21.86 percent in 2018 due to the devaluation of the nominal exchange rate from Rs. 118/USD to Rs. 98/USD in 1014.

Table 5. Error Correction and Short Run Estimates.

Regressors	Coefficients	t-Statistics	P-values
Δ RER_{t-1}	-0.41	2.27	0.016
Δ TOT_{t-1}	-0.72	-3.63	0.026
Δ TO_{t-1}	-0.32	-0.51	0.371
Δ WR_{t-1}	-1.62	-2.75	0.036
Δ RI_{t-1}	0.64	0.78	0.634
ΔGC_{t-1}	0.28	0.33	0.884
Δ FDI_{t-1}	-2.16	-1.27	0.823
EC_{t-1}	-0.31	-3.2	0.001

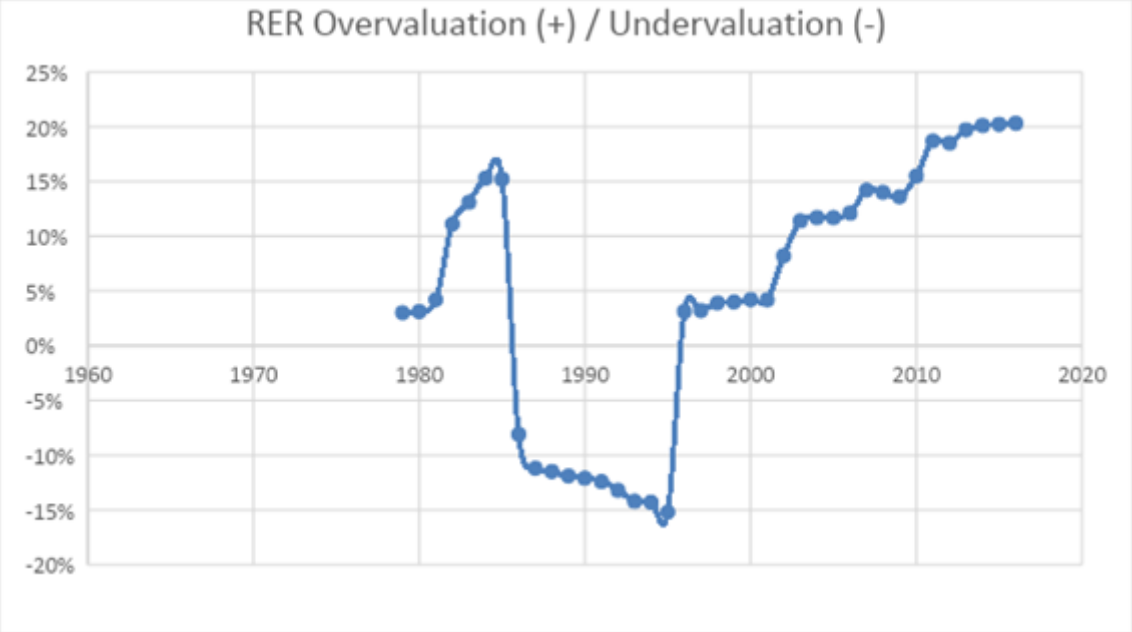

Figure 2: Misalignment Index % (+/-).

5. CONCLUSION AND RECOMMENDATIONS

The study attempted to estimate the effects of the macro-economic variables on Pakistan's real exchange rate from 1978 to 2018 and to examine the degree of misalignment of the actual RER from the equilibrium RER by constructing a misalignment index. On the basis of economic theory and empirical research by Edwards (1988, 1989, 1999), Elbadwi (1999), Montiel (1997), Hayder and Mehboob (2006) and Ahmed (2009), a model has been developed in which RER balance is determined on the basis of real investment, degree of openness, government consumption, trade terms and labor remittances as a percentage of GDP. The findings suggest that workers ' remittances, FDI and terms of trade play a significant role in the movement of real exchange rates, as they appreciate in response to the rise in these fundamentals, while, according to our results, RERs may be depreciated as government consumption rises. While real investments in the tradable sector are likely to appreciate RER.

Results of the misalignment index show that there is a rising trend in the overvaluation of the actual RER from the equilibrium RER over the entire study period, which is 3.2 percent in 1979 to 21.86 percent in 2018, with the exception of 1986 to 1995 when undervaluation is identified. The study showed clearly identifiable three phases of RER overvaluation, one starting in 1979 when overvaluation was 3.2 percent and ending in 1985 with 15.1 percent, mainly due to heavy remittances by workers, especially from the Gulf countries, and positive terms of trade.

The second phase of overvaluation was mainly due to economic sanctions against Pakistan on the basis of nuclear tests from 1997 to 2002. The nominal exchange rate was fixed at that stage and the RER overvaluation was around percent. The third phase started in 2003 when heavy inflows of official development assistance (ODA), FDI and worker’s remittances caused an 11 per cent overvaluation of the actual RER and continued to rise to 21,86 percent by 2018.

The results show the importance of foreign inflows in the form of ODA, FDI or remittances that provide strong support to the external sector of the country. The overvaluation of the real exchange rate was estimated at 21.86 per cent in 2018, resulting in a loss of competitiveness for its exports to international markets. It draws the attention of policymakers to taking concrete steps to streamline Pakistan's real exchange rate in order to

develop the sustainability of the country's external sector. In Pakistan's perspective, the following recommendations are essential to achieve this objective:

1- A prudent exchange-rate policy, along with monetary and fiscal policies, is needed by policymakers to optimize the country's economic performance. Policy consistency is important in order to minimize the volatility of real exchange rates.

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3- The policy of high tariffs and regulatory duties is required to restrict imports of finished consumer goods under the conditions of the WTO. It is recommended to boost domestic production by improving regulatory institutional capacity, minimizing corruption and making it easier to do business.

4- Improving exports is another area for strengthening the external sector and gaining capital inflows. Steps need to be taken to diversify exports, innovate and add value and improve quality and packaging. Incentives and subsidies are needed for exporters to increase their export competitiveness.

5- Fiscal discipline is needed to minimize the fiscal deficit as the widened fiscal deficit forces the government to use domestic and foreign borrowing to put pressure on the external sector. Pakistan needs to increase its tax net in order to raise its revenue collection.

6- Devaluation, along with tight monetary policy, is recommended in order to rationalize the real exchange rate, because increasing the money supply triggers inflation.

5.1. Scope of Further Research

The study constructed a model based on the previous literature presented by a large number of studies related to this field. The estimation results indicated the impact of the macro-economic indicators on the actual effective exchange rate and the degree of misalignment. Substantial variations in findings are observed, as indicated earlier in this paper, when different approaches are applied. In this area of research, it is necessary to apply all approaches to the exploration of a balanced real exchange rate over a longer period of time to a given data set for a specific time period. The results will make a significant contribution to economic literature in the case of Pakistan.

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