SBP Working Paper Series

No. 26 August, 2008

Sources of Real Exchange Rate Misalignment Evidence from Pakistan

Shah Hussain

STATE BANK OF PAKISTAN

SBP Working Paper Series

Editor: Riaz Riazuddin

The objective of the SBP Working Paper Series is to stimulate and generate discussions, on different aspects of macroeconomic issues, among the staff members of the State Bank of Pakistan. Papers published in this series are subject to intense internal review process. The views expressed in the paper are those of the author(s) and do not necessarily reflect those of the State Bank of Pakistan.

Price per Working Paper

Pakistan:	Rs 50 (inclusive of postage)
Foreign:	US$ 20 (inclusive of postage)

Purchase orders, accompanied with cheques/drafts drawn in favor of State Bank of Pakistan, should be sent to:

Chief Spokesperson
Corporate Services Department,
State Bank of Pakistan,
I.I. Chundrigar Road, P.O. Box No. 4456,
Karachi 74000. Pakistan

For all other correspondence:

Editor,
SBP Working Paper Series
Research Department,
State Bank of Pakistan,
I.I. Chundrigar Road, P.O. Box No. 4456,
Karachi 74000. Pakistan

Published by: Editor, SBP Working Paper Series, State Bank of Pakistan, I.I. Chundrigar Road, Karachi, Pakistan.

ISSN 1997-3802 (Print)
ISSN 1997-3810 (Online)

http://www.sbp.org.pk

Printed at the SBPBSC (Bank) – Printing Press, Karachi, Pakistan

Sources of Real Exchange Rate Misalignment
Evidence from Pakistan

Shah Hussain
Research Economist
Research Department
State Bank of Pakistan
Shah.Hussain@sbp.org.pk

Acknowledgment

The author is highly grateful to Omar Farooq Saqib for his valuable comments and suggestions and support in completing this paper. Author is also indebted to Riaz Riazuddin for his insightful comments particularly relating to the data. Views expressed here are those of the author and not necessarily of the State Bank of Pakistan.

Contact for correspondence:

Shah Hussain,
Research Department,
State Bank of Pakistan,
I. I. Chundrigar Road, Karachi,
Pakistan
Shah.Hussain@sbp.org.pk

Abstract

The objective of this study is to estimate the effects of fundamentals and their sustainable levels for measuring the equilibrium real exchange rate and its misalignment for Pakistan. Applying the theory of fundamentals of real exchange rate, it first establishes these variables as the long run determinants of Pakistan's real exchange rate and then it estimates their sustainable levels for the equilibrium real exchange rate. On the basis of the sustainable levels, the study then proposes their individual role in aligning real exchange rate towards its equilibrium level.

Keywords: fundamentals, real exchange rate, misalignment

JEL Codes: C53, E58, F31

1. Introduction

To identify the causes and consequences of the fluctuations in real exchange rate (RER) and to move it towards equilibrium it is of considerable importance to have information about its determinants. Because, movements in RER may or may not signal a loss in the competitiveness of the economy; no policy intervention is required when the co-movements in equilibrium RER (ERER) and RER accord changes in the fundamentals and vice versa. This theory confirms that ERER is a time path not a single value so ERER and RER misalignment must be identified for policy-making.

Accordingly, this study estimates the effects of real variables and their sustainable levels in the determination of Pakistan's ERER and RER misalignment. It then focuses on their contribution and individual role by dividing the sample of 1970 to 2007 into four periods on the basis of political regimes to capture the deviation of a fundamental from its sustainable level and its resulting effects on RER misalignment. In this way, the study identifies the sources of RER misalignment.

The investigation proceeds as follows. Section 2 is devoted to model building and the concepts of sustainability and misalignment. Section 3 presents data description and estimation methodology. Sections 4 and 5 present empirical results and analyses of the sources of RER misalignment. Concluding remarks follow in Section 6.

2. The Model, Sustainability, and Misalignment

RER is generally defined in two principal ways: (i) in external terms as the nominal exchange rate adjusted for price-level-differences between the concerned countries; (ii) in internal terms, as the ratio of the domestic price of tradable goods to nontradable goods in single country. Therefore, based on the latter definition, ERER is that relative price of tradables to nontradables that results in the simultaneous attainment of external and internal equilibrium.[1] This definition of ERER is the real departure from Purchasing Power Parity that assumes a single value for ERER throughout time and necessitates knowing the determinants of ERER.

While the consensus over the determinants of RER is limited, the seminal works of Khan and Montiel (1987), Edwards (1985, 1988, 1988a), Rodriguez (1989), and Elbadawi and Soto (1994, 1997) do offer insightful guidelines as the theory of fundamentals of real exchange

[1] As defined by Khan (1987), Leventakis (1987), Edwards (1988), and Faruquee (1995).

rate.[2] In particular, the theory predicts that the determinants of RER can be divided into two broad categories: (a) structural variables such as terms of trade (TOT), tariffs, government and private expenditure;[3] and (b) nominal variables such as interest rate and devaluation, usually proxy by nominal exchange rate.

Therefore, having no consensus over the determinants of RER, the literature nonetheless confirms the theory as the best option. Although the concept is important, no serious attempt is made with reference to Pakistan.[4] Hence, relying on this theory of real exchange rate and keeping in view a small open economy like Pakistan, we proceed with our ERER model specification as follows.

Consider an economy with three sectors (exportables, importables, and nontradables) for which the international price of tradables is given. The price of nontradables is endogenously determined by the supply and demand for it. The ratio of these prices times nominal exchange rate (S) can be defined as RER (e) as:

$$e = \frac{S\left[\left\{P_x^*\left(1-t_x\right)\right\}^{\alpha}\left\{P_m^*\left(1+t_m\right)\right\}^{(1-\alpha)}\right]}{P_n} \qquad (1)$$

Where e, P_x^*, P_m^*, P_n, t_x, t_m, and S stand for RER, foreign price of exports, foreign price of imports, domestic price of nontradables, tax on exports, tax on imports, and nominal exchange rate, respectively. α and $(1-\alpha)$ are the share of exports and imports in tradables. Converting Equation (1) from foreign currency denomination to domestic currency:

$$e = \frac{\left\{P_x\left(1-t_x\right)\right\}^{\alpha}\left\{P_m\left(1+t_m\right)\right\}^{(1-\alpha)}}{P_n} \qquad (2)$$

Where P_x and P_m are domestic price of export and import converted from foreign currency denomination to domestic currency at the market rate. Following Elbadawi and Soto (1994 and 1997), Equations (1) and (2) can be solved for the level of RER that ensures equilibrium in the nontraded goods market for given levels of exogenous policy fundamentals as:

---

[2] Also, see collection of studies in Williamson (1994).
[3] Fundamentals, structural and real variables are synonymously used.
[4] Contrary to the results of the aforementioned seminal literature, for Pakistan Chishti and Hasan (1993) conclude significant effects of nominal variables on real exchange rate in the long-run. Afridi (1995) estimates the impacts of structural variables on RER of Pakistan. His results confirm the theory but do not contain information about the stationarity of variables thus rendering the findings doubtful.

$$e = e(CF, TOT, t_x, t_m, G_n, G_T, TFP) \quad (3)$$

Where, CF, TOT, t_x, t_m, G_n, G_T, and TFP stand for capital inflow, terms of trade, export tax, import tax, government consumption of nontradables, government consumption of tradables, and total factor productivity, respectively.

Equation (3) is converted into logarithm and export and import taxes and government consumption on nontradables and tradables are replaced by trade liberalization (LIB) and total government consumption (GC) because data on the former are not available.

$$\ln e_t = \delta_1 \ln TOT_t + \delta_2 \ln LIB_t + \delta_3 \ln GC_t + \delta_4 \ln CF_t + \delta_5 \ln TFP_t + \varepsilon_t \quad (4)$$

To establish the model for ERER, estimate the sustainable level of every regressor in Equation (4) and plug those sustainable levels back into the same Equation (4):

$$\ln e_t^* = \delta_1 \ln TOT_t^s + \delta_2 \ln LIB_t^s + \delta_3 \ln GC_t^s + \delta_4 \ln CF_t^s + \delta_5 \ln TFP_t^s \quad (5)$$

Where, every regressor with superscript "s" represents sustainable level and is estimated by using the following methodology.

Sustainability

The basic intuition behind the 'sustainable level' of a series is to purge it of the transitory components. And for the estimation of a sustainable level of a variable a stochastic nonstationary process is a useful property. The permanent component of the variable can be obtained by using a suitable time-series decomposition technique. This study uses the Newbold (1990) approach of Beveridge and Nelson (BN)'s (1981) version that estimates the permanent component as follows.

Divide a series Y_t into permanent component Z_t and cyclical component C_t. Now, let $W_t = Z_t - Z_{t-1}$, which is the first difference. If W_t is stationary, it can be written as:

$$W_t = \mu + \varepsilon_t + \lambda_1 \varepsilon_{t-1} + \ldots \quad (6)$$

Where, ε_t are uncorrelated random innovations. From this, the expression for the change in permanent component is derived as:

$$\overline{Z}_t - \overline{Z}_{t-1} = \mu + \left(\sum_0^\infty \lambda_t\right)\varepsilon_t \text{ and } \lambda_0 = 1 \tag{7}$$

To implement this technique, I confine my attention to linear process of rational form as:

$$W_t = \mu + \frac{\left(1 - L\theta_1 - L^2\theta_2 \ldots L^q\theta_q\right)}{\left(1 - L\phi_1 - L^2\phi_2 \ldots L^p\phi_p\right)}\varepsilon_t \tag{8}$$

Where, μ, θ, and ϕ are parameters describing ARIMA (p,1,q) process of Y_t and ε_t are the innovations of original series. Using this equation and setting $L = 1$, the steady-state gain function becomes:

$$\overline{Z}_t - \overline{Z}_{t-1} = \mu + \frac{\left(1 - \theta_1 - \theta_2 \ldots \theta_q\right)}{\left(1 - \phi_1 - \phi_2 \ldots \phi_p\right)}\varepsilon_t \tag{9}$$

This difference equation describes the evolution of the permanent component of the time-series as the innovations ε_t occur [Cuddington and Winters (1987)]. Once the initial value, Z_0, which may be the mean or starting value, is determined, the remaining permanent values of the relevant variables can be computed.

Misalignment

Finally, to determine the level of misalignment, defined as the degree of deviation from ERER at the sustainable level, following equation can be used:

$$m_t = \ln e_t - \ln e_t^* = (\ln e_t - \hat{\delta}' F_t) + \hat{\delta}'(F_t - F_t^s) \tag{10}$$

Where, m_t, $\hat{\delta}'$, F_t, F_t^s stand for misalignment, estimators of fundamentals, fundamentals, and fundamentals at sustainable level, respectively. m_t is also decomposed into an error-correction term that captures the deviation of exchange rate from the fitted RER using long-run parameters and a term that captures the deviation of current fundamentals from the sustainable level.

3. Data Description and Estimation Methodology

The data used in the estimation is based on Equation (4) for Pakistan. Starting with the assumption of three goods economy (exportables, importables, and nontradables), RER is defined as: $e = (P_x^{\alpha} P_m^{(1-\alpha)}) / P_n$. Where, P_x, P_m, and P_n stand for domestic price of unit of export, unit of import, and nontradables, respectively. The value of α and $(1-\alpha)$ are the percentage shares of exports and imports in total trade. This definition is also given in Edwards (1988) and it closely corresponds to real effective exchange rate (REER) as available in international financial statistics (IFS) of International Monetary Fund (IMF) from 1980.

The regressors's description is as follows. Capital inflows (CF) include short and long term inflow such as foreign direct investment, portfolio investment, remittances and long-term external loans; Terms of Trade (TOT) is defined as the ratio of domestic price of unit value of export to the price of unit value of import; and Trade Liberalization (LIB) is defined as the ratio of exports plus imports to GDP [Elbadawi and Soto (1994), Baffes et al. (1999) and Tan (1998)]. Separate data on government consumption on tradables and nontradables is not available, therefore following Edwards (1985, 1988a) and Chishti and Hasan (1993) the study uses total Government Consumption (GC) as a proxy. The next regressor for knowing Blassa effect is the total factor productivity (TFP). For this variable I use the series estimated in Khan (2006).

The data consists of 48 years from Fiscal Year 60 (1960) to Fiscal Year 07 (2007) and its primary source is *Handbook* of *Statistics on Pakistan Economy* published by State Bank of Pakistan in 2005. Other sources include *International Financial Statistics* of the International Monetary Fund, *Direction of Trade* of the World Bank, and *Statistical Bulletin* of the State Bank of Pakistan.

Estimation Methodology

Given ample evidence regarding unit-root properties of time-series, the approach is to look for evidence of cointegration between RER and its aforementioned fundamentals. Therefore, all variables are tested to verify whether they can be represented as difference or trend stationary processes. For testing unit-root hypothesis I apply the Augmented Dickey Fuller (ADF) and Phillips Perron (PP) tests. The results show that all variables present evidence of non-stationarity at level. Rejection of unit-root hypothesis for the first difference ensures

integrated processes of first order, I(1). Consequently all these series can enter the cointegration equations.

I use the maximum likelihood cointegration procedure suggested by Johansen and Juselius (1990) in order to test for cointegration in a vector autoregressive (VAR) system. This methodology is based on full system estimation which can eliminate simultaneous equation bias and raise efficiency relative to the single equation method of Engle-Granger. Application of this methodology requires the determination of the rank of cointegration space. For this purpose I use likelihood ratio (LR) test based on maximum eigenvalue of the stochastic matrix and other is the value of LR based on the trace of the stochastic matrix.

The results in Table 1 show that the null hypothesis of $r = 0$ against alternative of $r > 0$ is rejected at 95 percent level of significance. Consequently, it is concluded that the relevant variables have significant cointegrating vector. Now to test the null hypothesis of $r = 0$ against the specific alternative $r = 1$, the null hypothesis of no cointegrating vector can be rejected. Lastly, as shown in the results it may be accepted that the null hypothesis of $r = 1$ against alternative of $r = 2$, and therefore, it can be concluded that there is only one cointegrating vector.

After confirming a significant cointegrating vector between the variables, I estimate the static long-run parameters of the VAR model. Although a long-run model for RER can easily be estimated, however, main task is the determination of ERER which involves finding a practical approximation to the concept of "sustainability" on the part of fundamentals. Using the combination of autoregressive and moving average (ARMA) process I remove the transitory shocks and obtain the permanent evolution of the fundamentals which are multiplied by their respective estimated coefficients of the cointegrating model which results in the determination of ERER. Finally, Granger causality test is used for testing cause and effect relationship among the relevant variables. The results in Table 2 show that these variables significantly Granger-cause RER.

Table 1. The λ_{max} and λ_{trace} Tests

Null Hypothesis	Alternative Hypothesis	Computed Value	95% critical value
λ_{trace}	λ_{trace}	λ_{trace}	
r = 0	r > 0	59.02*	58.9
r ≤ 1	r > 1	29.66	47.18
r ≤ 2	r > 2	9.55	29.5
λ_{max}	λ_{max}	λ_{max}	
r = 0	r = 1	29.36*	27.6
r = 1	r = 2	20.11	20.77
r = 2	r = 3	9.55	14.04

(*) is 95% level of significance

Table 2. Granger Causality Test

	RER	CF	TFP	GC	LIB	TOT
RER	-					
F-stat	-	(3.28)*	(3.68)*	(2.28)*	(2.90)*	(2.22)*

(*) 5% level of significance. Null hypothesis is that these variables pair does not cause RER.

4. Empirical Results

The results presented in Table 3 accord to the theoretical model outlined in Equation (4) as a long-run relationship. Note that an increase in the dependant variable (RER) implies depreciation. In this static model CF, as suggested by the theory and almost all empirical studies, has appreciating effects on RER. Theoretically, CF leads to increased domestic income and consequently to demand for nontradables that causes rise in the price level of domestic products thereby causing RER to appreciate.

Unlike the Balassa view that productivity takes place mostly in tradables that appreciates RER, the results in this study indicate that in the long-run productivity bears depreciating effects on RER, as shown by TFP. This result also supports the conclusion derived in Mongardini (1998) and Tan (1998) that productivity growth significantly depreciates RER.

The results for GC have appreciating impact on RER. The negative coefficient implies that the public sector concentrates more on nontradables that causes rise in its price and appreciating RER. Khan and Lizondo (1987) and Lizondo (1989) conclude the same results of GC on RER.

The interesting result in Table 3 is that of the LIB in determining the level of RER. The positive and significant sign supports the notion that reforms aimed at reducing tariffs and eliminating other trade restrictions are consistent with more depreciating RER.

Table 3. Long Run Estimates (dependent variable: LRER)

	CF	TFP	GC	LIB	TOT	LL
coefficient	-0.42*	0.08*	-0.04*	0.30*	0.73*	
std. error	0.13	0.02	0.017	0.18	0.33	79.83
t-stat	-3.10	3.75	-2.35	1.66	2.18	

(*) 5% level of significance

Table 4. ARIMA Models for Fundamentals (variables in first difference)

	CF	TFP	GC	LIB	TOT
AR(1)	0.94*	0.27*	0.99*	1.00*	0.96*
MA(1)		-1.28*			
R^2	0.97	0.59	0.99	0.98	0.87
DW	2.00	2.35	1.91	2.07	2.25
Gain Function	0.48*	0.06*	0.13*	0.09*	0.51*

(*) is 5% level of significance

While the effects of shocks to TOT are theoretically ambiguous, positive sign in Table 3 confirms the dominance of substitution over income effect. It implies that in the long-run TOT depreciates RER. This finding conforms to Elbadawi and Soto (1997), Tan (1989), and Edwards (1988a).

Sustainability

For computation of ERER and misalignment of RER, I use the estimated values of the static model reported in Table 3. As mentioned earlier, ERER is determined by the sustainable level of fundamentals; therefore, I interpret the estimated results of sustainability as reported in Table 4.

As described earlier, all variables in the model are nonstationary that proves to be useful property for the concept of sustainability. Because, in case of nonstationary variables their fluctuations correspond to combination of permanent and transitory shocks of which only the former are of interest when computing ERER. Estimating the gain function of every variable by using the BN method I can conclude that the value of the gain function for each of the variables is less than 1 which implies that these variables converge to their sustainable level in the long-run (Table 4).

Equilibrium RER and Misalignment

Equilibrium RER is that relative price of tradables to nontradables that for given long-run sustainable values of other real variables results in the simultaneous attainment of internal and external equilibrium. Therefore, the pre-requisite for RER is sustainable values of the concerned variables. These values are estimated and are plugged back into the estimated cointegrating equation as in Table 2 that gives the path of the values of ERER. The

percentage misalignment is computed as the deviating values from the corresponding ERER values.

Figure 1. RER: Acyual, Equilibrium, Misalignment

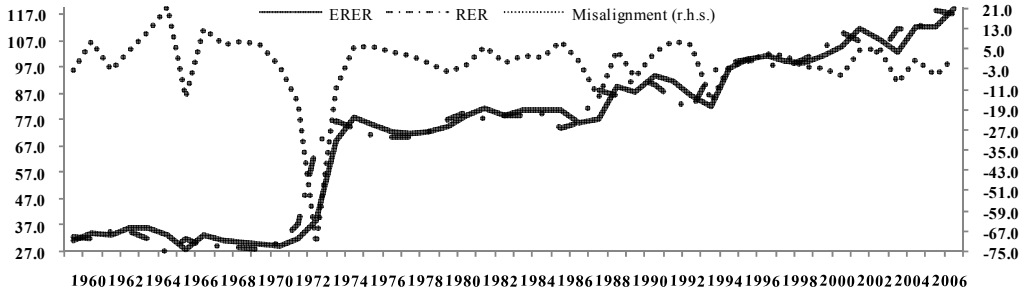

Table 5. Average Level of the Actual and Sustainable Fundamentals

	1970-1978	1979-1988	1989-1999	2000-2007
Mis (percent)	-8.71	0.22	-2.28	-1.20
Pinf (percent)	13.1	7.61	8.4	6.5
Winf (percent)	9.7	4.03	2.4	4.2
ACF (bil. of Rs)	9.064	54.170	257.741	819.467
SCF (bil. of Rs)	8.516	54.348	239.289	806.658
ATFP (percent)	0.98	2.77	1.17	3.28
STFP (percent)	1.95	2.48	1.63	2.80
AGC (bil. of Rs)	10.553	50.304	209.614	456.510
SGC (bil. of Rs)	10.177	47.157	214.136	465.392
ALIB (percent)	0.023	0.07	0.18	0.42
SLIB (percent)	0.022	0.07	0.20	0.29
ATOT (percent)	123.73	95.35	78.34	62.52
STOT (percent)	126.11	99.08	83.95	66.23

Note 1: Mis, Pinf, and Winf respectively stand for misalignment, inflation in Pakistan, and world inflation.
Note 2: ACF, ATFP, AGC, ALIB and ATOT respectively stand for actual capital inflow, total factor productivity, government consumption, volume of trade to GDP ratio, and terms of trade; where, "S" stands for their sustainable values.

These series are shown in the Figure 1, where horizontal axis represents time (years). The vertical axis on left is the scale for actual RER and ERER and the right side presents misalignment. It is clear from the figure that ERER is not a single value rather a time path responding to the changes in fundamentals. The apparent noise in the ERER reflects that it should be allowed to change when its fundamentals change.

5. Sources of RER misalignment: The Analysis

Although it is easy to know and interpret the effects of misalignment over the economy yet the difficult task is to explain the causes (the role of every variable) behind misalignment of

RER and propose policy guide-lines accordingly. For this purpose and for the sake of brevity, I divide the actual data into four periods as presented in Table 5.

Averages of both the actual and sustainable values for the respective periods are separately computed in order to analyze the factors that are responsible for the misalignment. Besides this comparison, I also attempt to point out the causes of misalignment in light of the inflationary trend both within the country and the rest of the world, particularly the price level in terms of US dollar. Further note that the following analyses are made while simultaneously consulting both the coefficients in Table 3 and the level of misalignment in RER.

First Period (1970-1978)

As reported in Table 5, on average RER appreciates about 8.71 percent during this period. Perhaps, the crisis in 1971-72 plays a significant role in the overvaluation of RER.[5] Besides impairness in other variables due to this crisis, inflation is about 13.1 percent that highly appreciates RER. Latter in the same period one of the main causes of RER appreciation is oil price shock in 1974-75. Though this shock was not confined to Pakistan, its negative effects over domestic price (Pinf) level are relatively more than the world price (Winf) level. On average, as compared to 9.7 percent growth rate in Winf, growth rate in Pinf is 13.1 percent. Another important factor behind the appreciation of RER is the deterioration in TOT; recall from Table 3 that improvement in TOT significantly depreciates RER. During this period, the estimated average sustainable level to maintain RER at equilibrium is about 126.11 percent which is greater than the actual level of 123.73 percent. This deterioration in TOT plays a vital role in the appreciation of RER because there is positive relation between RER and TOT and decrease in TOT to 123.73 percent causes decrease in RER, which is appreciation. Another important factor in appreciating RER is CF because its sustainable level is less than its actual level.

As the role of other variables such as TFP and LIB is concerned, the former bears appreciating effects on RER (Table 3). In this period, the average actual level of TFP is less than average sustainable level and its coefficient is significantly positive (Table 3); therefore, it can be concluded that TFP has also appreciated RER. In the case of LIB, positive coefficient and higher volume of actual trade than its sustainable level leads to a depreciated RER. As shown, the negative coefficient in Table 3, GC has appreciating impacts and its actual value of Rs 10.553 billion is more than the required sustainable value. It implies that

[5] War between India and Pakistan that led to the creation of Bangladesh.

GC appreciates RER. Although LIB has depreciating impacts on RER, its role is outpaced by the appreciating impacts of inflation, CF, GC and deterioration in TOT and TFP.

Second Period (1978-1988)

During this period average misalignment of RER is 0.22 percent. It implies that the average value of RER over this period remains close to equilibrium. As compared to the domestic price level, the world price level based on the world wholesale price index, is low which appreciates RER An important factor that plays a vital role in maintaining RER at equilibrium is LIB whose actual average level comes to its sustainable level. In this period, average TFP of 2.77 percent also causes depreciation of RER because the actual growth rate is more than the average sustainable level of 2.48 percent. In this period CF also depreciates RER because its average actual level is less than the sustainable value. On the other hand GC and TOT appreciate RER because the average actual level for the former is more and the average actual value for the latter is less than their average sustainable levels. To conclude the whole picture in this period, the overvaluation of RER due to GC, inflation and deterioration in TOT is neutralized by the depreciating impacts of TFP, CF and LIB.

Third Period (1989-1999)

In this period the average misalignment (overvaluation) of RER is at -2.28. This appreciation in RER can be traced to inflation, TFP, CF, LIB and deterioration in TOT. Average growth in Pinf, 8.4 percent, is relatively more than the Winf of 2.4 percent. One of the highly appreciating factors of RER is the increase in CF. As compared to the average sustainable level of Rs 239.289 billion, the average actual level amounts to Rs 257.741 billion per year so RER on average appreciates.

The role of TFP in appreciating RER is also important. In this period the average TFP is comparatively less than the sustainable level. Like the previous periods the deterioration in TOT to 78.34 percent from sustainable level of 83.95 percent causes overvaluation of RER. Though LIB has depreciating effects on RER, however, in this period it appreciates RER because its actual level is less than the sustainable level. Concerning the role of GC, it depreciates RER but its strength of depreciation is overtaken by the appreciating impacts of the above mentioned variables.

Fourth Period (2000-2007)

In this period RER remains appreciated by 1.2 percent. The main factors behind this appreciation seem to be Inflation, CF, and deterioration in TOT. TOT as shown in Table 3 has depreciating effects on RER. The actual value again is less than sustainable level so rather than depreciating, it appreciates RER in this period. The most important factor in appreciating RER in this period is CF because its actual average level of Rs 819.467 billion exceeds the sustainable level of Rs 806.658 billion. As compared to Winf, higher level of inflation in Pakistan (Pinf) also appreciates RER.

In this period GC, LIB and TFP cause depreciation of RER. The average actual level of GC is less than its sustainable value which leads to depreciation of RER. TFP and LIB also depreciate RER because their average actual levels exceed the sustainable levels, however, the depreciating impact of these variables is overtaken by the appreciating effects of other variables thus causing RER on average to remain overdervalued in this period.

6. Concluding Remarks

RER is a key macroeconomic variable so the concepts of equilibrium and misalignment of RER are very important for policymakers. Despite its importance no serious attempt has been made so far to compute Pakistan's ERER and its misalignment. Therefore, I make an attempt to determine the long-run cointegrated equilibrium and misalignment of RER having estimation of sustainability of the fundamentals to be consistent with internal and external balances.

After estimating the sustainable level for every variable I compute equilibrium RER and percentage level of misalignment. On average RER remains overvalued over the entire period. Like other empirical studies CF and GC appreciate RER in the long-run. Similarly TOT plays a vital role in affecting RER. In this case shocks to TOT show the dominance of substitution over income effects which depreciate RER. Despite this positive effect, TOT plays appreciating role because of its deterioration. To move RER towards equilibrium it is of considerable importance to have more exports of manufactured goods instead of primary goods.

Though this study confirms the theory of RER based on fundamentals, yet it can be improved by including more variables and enlarging the sample size. Furthermore, appropriate variables

such as government consumption on nontradables and tradables instead of total government consumption may be used.

References

Afridi, U. (1995). "Determining Real Exchange Rates." *Pakistan Development Review*, 34: 263-276.

Alper, C. A. and I. Saglam (1999). "Exchange Rate Volatility and International Trade." *Southern Economic Journal*, 66: 178-185.

Baffes, J., I. A. Elbadawi and S. A. O'Connel (1999). "Single-Equation Estimation of the Equilibrium Real Exchange Rate." In L. Hinkle and P. J. Montiel (eds.). *Exchange Rate Misalignment: Concepts and Measurement for Developing Countries*. New York: Oxford University Press. (pp. 405-464)

Beveridge, Stephen and Charles R. Nelson (1981). "A New Approach to Decomposition of Economic Time Series into Permanent and Transitory Components with Particular Attention to Measurement of the Business Cycle." *Journal of Monetary Economics*, 7: 151-174.

Chishti, S. and M. A. Hasan (1993). "What Determines the Behavior of Real Exchange Rate in Pakistan?" *Pakistan Development Review*, 32: 1015-1029.

Clark, P. B. and R. MacDonald (1998). *Exchange Rates and Economic Fundamentals: A Methodological Comparison of BEERs and FEERs*. Working Paper WP/67/98. Washington, D.C.: International Monetary Fund.

Cuddington, J. T. and L. A. Winters (1987). "The Bveridge-Nelson Decomposition of Economic Time-Series." *Journal of Monetary Economics*, 19: 125-127.

Edwards, S. (1985). *The Behavior of Interest Rates and Real Exchange Rates during Liberalization Episode: The Case of Chile 1973-83*. NBER Working Paper No. 1702. Massachusetts: National Bureau of Economic Research.

Edwards, S. (1988). *Exchange Rate Misalignment in Developing Countries*. Baltimore: Johns Hopkins University Press.

Edwards, S. (1988a). "Real and Monetary Determinants of Real Exchange Rate Behavior: Theory and Evidence from Developing Countries." *Journal of Development Economics*, 29: 311-341.

Elbadawi, I. A. and R. Soto (1994). *Capital flows and Long-term Equilibrium Real Exchange Rates in Chile*. Policy Research Paper 1306. Washington, D.C.: World Bank.

Elbadawi, I. A. and R. Soto (1997). "Real Exchange Rates and Macroeconomic Adjustments in Sub-Saharan Africa and other Developing Countries." *Journal of African Economics*, 6: 1-56.

Enders, W. (1995). *Applied Econometric Time Series*. New York: John Wiley.

Faruquee, H. (1995). "Long-Run Determinants of the Real Exchange Rate: A Stock-Flow Perspective." IMF *Staff Papers*, 42: 80-105.

Hyder, Z. and Mahboob Adil (2006). "Equlibrium Real Effective Exchange Rate and Exchange Rate Misalignment in Pakistan."*SBP Research Bulletin,* 2: 237-263.

Johansen, S. and K. Juselius (1990). "Maximum Likelihood Estimation and Inference on Cointegration—with applications to the Demand for Money." *Oxford Bulletin of Economics and Statistics* 52: 169-210.

Khan, M. S. (1986). "Developing Country Exchange Rate Policy Responses to Exogenous Shocks." *American Economic Review*, 76: 84-87.

Khan, M. S. and J. S. Lizondo (1987). "Devaluation, Fiscal Deficits and the Real Exchange Rate." *World Economic Review*, 1: 357-374.

Khan, M. S. and M. D. Knight (1982). "Some Theoretical and Empirical Issues Relating to Economic Stabilization in Developing Countries." *World Development*, 10: 709-730.

Khan, M. S. and P. J. Montiel (1987). "Real Exchange Rate Dynamics in a Small, Primary-Exporting Country." IMF *Staff Papers*, 34: 681-706.

Khan, S. U (2006). "Macro Determinants of Total Factor Productivity in Pakistan." *SBP Research Bulletin,* 2: 383-401.

Leventakis, John A (1987). "Exchange Rate Models: Do they Work?" *Review of World Economics*, 123: 363-376.

Lizondo, J. S. (1989). *Overvalued and Undervalued Exchange Rates in an Equilibrium Optimizing Model*. Policy Research Working Paper WPS-223. Washington, D.C.: World Bank.

Mongardini, J. (1998). *Estimating Egypt's Equilibrium Real Exchange Rate*. Working Paper WP/98/5. Washington, D.C.: International Monetary Fund.

Newbold, P. (1990). "Precise and Efficient Computation of the Beveridge-Nelson Decomposition of Economic Time-Series." *Journal of Monetary Economics*, 26: 453-457.

Paleologos, J. M. and S. E. Georgantelis (1997). "Exchange Rate Movements and the Trade Balance Deficit: A Multivariate Cointegration Analysis." *Economie Internazionle*, 50: 459-473.

Rodriguez, C. A. (1989). *Macroeconomic Policies for structural adjustment.* Policy Research Paper 247. Washington, D. C.: World Bank.

Rao, B. B. (1994). *Cointegration for the Applied Economist*. New York: St. Martin's.

Tan, E. C. (1998). "Was the Real Exchange Rate of Malaysia Misaligned? A Cointegration Approach." *Indian Economic Journal*, 46: 77-90.

Williamson, J. (eds.) (1994). *Estimating Equilibrium Exchange Rates.* Washington, D.C.: Institute for International Economics.