Real Exchange Rate Behavior and Exchange Rate Misalignments in Bangladesh: A Single Equation Approach

by

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Abstract

The paper adopts a single equation approach to examine the real exchange rate behavior and exchange rate misalignment in Bangladesh. The paper finds that real exchange rate and the macroeconomic fundamentals affecting real exchange rate forms a cointrigrating vector. It observes that trade liberalization and increase in debt service burden results in a real depreciation of currency; while increase in capital inflow, improvement in terms of trade, and increase in government consumption of non-tradable results in a real appreciation of currency. Nominal devaluation has been able to partly retain its effect to have a real devaluation in the short run. Estimation of long run equilibrium real exchange rate reveals that our currency was considerably overvalued until late 1980s. However, real exchange rate broadly was in equilibrium during the 1990s except very lately.

I. Introduction

Many of the developing countries pursued to sustain their fixed exchange parities for a considerable amount of time even after the collapse of the Bretton Woods system. As a result, it is believe that most of the developing countries experienced an "overvalued" currency for a long time that had been inherited from the import-substitution regime. Developing countries though never left the exchange rate determination to the market, over time they moved to an arrangement where exchange rate was frequently adjusted. In the recent era of trade liberalization, foreign exchange liberalization and devaluation of local currency have appeared as a common feature of the development policy. Such policies are intended to make the real exchange rate more aligned to the market determined "equilibrium" exchange rate and to enhance the competitiveness in the

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international market. However, “equilibrium” real exchange rate is an unobservable variable. It depends on a number of macroeconomic fundamentals, many of which are endogenously determined within the economy. Devaluation of currency is just one exogenous policy instrument that affects the real exchange rate. Formulation of a correct exchange rate policy, to a large extent, depends on proper understanding of real exchange rate behavior and some objective conjecture about the value of equilibrium exchange rate. Based on this motivation, in recent years, a few case studies have been conducted on real exchange rate behavior and exchange rate misalignment in developing countries. (see Mongaerdini, 1998; Mahar and Naqvi, 1998; Baffes et. al., 1997). This paper attempts to make a similar analysis for Bangladesh based on single equation approach—a relatively modern technique of analyzing real exchange rate behavior.

Official exchange rate in Bangladesh is set by Bangladesh Bank, the central Bank of the country. Bangladesh undertook two largest devaluation in 1971 and in 1975, basically to correct its exchange rate for high domestic inflation. Inflation came down to a tolerable range at the late 1970s. Since then, Bangladesh had gone through a series of micro devaluation. Decisions on devaluation were made on the backdrop of several economic considerations; the most important ones were to reduce exchange rate misalignment and to improve the country’s external balance. It is now imperative to examine whether our currency is still overvalued after a long history of devaluation. A managed and moderately flexible exchange rate policy is adopted in Bangladesh since 1994 when the domestic currency was made convertible for current account transaction. Exchange rate is adjusted periodically based on changes in real effective exchange rate (REER) index constructed by Bangladesh Bank, and other relevant considerations like foreign exchange reserve, inter-bank market exchange rate, unofficial exchange rates etc. While maintaining a stable REER helps to attain relative purchasing power parity, it is not sufficient to ensure a real exchange rate that is close to the equilibrium exchange rate implied by the macroeconomic equilibrium of the economy. Thus, the examination of real exchange rate misalignment still remains an important issue.

Despite a strong need of examination of real exchange rate behavior and possible exchange rate misalignment, no significant formal study has been made in this regard in Bangladesh. This paper makes an attempt to fill up this gap. Several approaches have been developed in the literature to estimate equilibrium real exchange rate. The traditional methods of estimations of real exchange rate are based on purchasing power parity (PPP), on the trade equations, and on simulations of empirical general equilibrium models. Though each of them can be useful under appropriate circumstances, they have their own pitfalls. Recently, a single equation reduced-form general-equilibrium approach has been developed for estimation of equilibrium real exchange rate (i.e., Elbadawi, 1994; Elbadawi and Soto, 1995). Baffes et. al., (1997) details the econometric methodology of this approach. Although this approach is not free from limitations, it has at least two advantages. First, it requires fewer time series data compared to general equilibrium or trade equation approach (Montiel and Hinkle 1999). Second, unlike the PPP approach, this approach allows for changes in equilibrium exchange rate over time. This paper adopts this single equation approach to analyze the real exchange rate behavior and to examine the exchange rate misalignment in Bangladesh.

The structure of the paper is as follows: Section II outlines the methodology of single equation approach to analyze the real exchange rate behavior and exchange rate misalignment. Section III discusses the empirical model of estimating real exchange rate in Bangladesh. Long run behavior and short run dynamics of real exchange rate in Bangladesh is examined in section IV. Section V attempts to measure degree of exchange rate misalignment. Concluding remarks appear in section VI.

II. Single Equation Approach of Equilibrium Exchange rate: The Methodology

Estimation of equilibrium real exchange rate and the degree of exchange rate misalignment is a challenging empirical problem, because equilibrium real exchange rate is not observable directly. Simplest and most commonly used method of estimating equilibrium real exchange rate is the PPP approach. According to this approach, equilibrium in real exchange is achieved in the year when the economy is considered to be in a macroeconomic equilibrium. Exchange rate misalignment is measured as the deviation of real exchange rate form its value at this "base" period. PPP approach, thus, has a major problem in that it chooses a single equilibrium rate for all period. In contrast, the single equation approach to estimate equilibrium real exchange rate defines the equilibrium real exchange rate as a function of several fundamentals. As the fundamentals themselves move over time, equilibrium real exchange rate should also move over time. Single equation method uses unit root econometric methodologies to estimate the equilibrium real exchange rate from observable variables. Implementation of this method involves three steps: identification of the long run relationship between equilibrium real exchange rate and its determinants, estimation of this relationship using technique appropriate to time series characteristics of data, and estimation of equilibrium real exchange rate and exchange rate misalignment. A brief sketch of the method is provided below, following the details of Baffes et.al (1997).

Assuming a linear relationship between the equilibrium real exchange rate and the fundamentals, we can express the model of equilibrium real exchange rate as

$$\ln e^{*}_{t} = \beta F^{p}_{t} \qquad (1)$$

Where, e^*_t is the equilibrium real exchange rate, $F^p{}_t$ is the vector of permanent or sustainable values of fundamentals, and β is the vector of long run parameters of interest. Recently, there have been quite a few studies exploring the theory of equilibrium real exchange rate such as Edwards (1989), Rodriguez (1994), and Montiel (1999), which identifies the fundamental determinants of the (unobservable) equilibrium real exchange rate. Two features of the theory of equilibrium real exchange rate are helpful in estimation of β from observable variables: (a) equation (1) comes from steady state relationship between actual values of real exchange rate and fundamentals, and (b) the steady state is dynamically stable. The first property requires that, the stochastic term in the following equation is stationary variable with a zero mean.

$$\ln e_t = \beta F_t + w_t \tag{2}$$

The second feature of the equilibrium implies that deviation of the exchange rate from its equilibrium value that arises due to shocks should produce eventual convergence to the equilibrium value. The following general error correction model can capture this crucial feature of the equilibrium:

$$\Delta \ln e_t = \alpha(\ln e_{t-1} - \beta' F_{t-1}) + \sum_{j=1}^{p} \mu_j \Delta \ln e_{t-j} + \sum_{j=0}^{p} \gamma'_j \Delta F_{t-j} + v_t \tag{3}$$

Where, v_t is an independent and identically distributed, mean zero, stationary random variables. Stability requires that $-2 < \alpha < 0$.

If the variables are all I(1), then the stationarity of w_t in equation implies that real exchange rate and its fundamentals are cointegrated. On the other hand, if all variables are I(0), them the long run equilibrium exchange rate is just its mean. As we will see that relevant variables for Bangladesh are I(1), we need not go further discussion of the I(0) case. In case of non-stationary data, estimation of long run relationship like equation (2) may produce a spurious regression if the variables are not cointegrated. When variables are co-integrated, static regression like model (2) may be a sensible one as the estimated coefficients are super consistent in this case of Stock, 1987. However, estimated coefficients may have small sample bias and they may have non-standard distribution (Banerjee et. all, 1993). Estimated short run parameters from the error correction model, however, are free from these limitations because all variables in this model are stationary. We can also incorporate other variables that are relevant for short-term dynamics into the above error correction model[1].

Misalignment in exchange rate can be estimated as the percentage difference between actual and "equilibrium" exchange rate. Assuming long run parameters are stable within the sample period, we can estimate "equilibrium" exchange rate by using equation (1). Sustainable values of fundamentals can be obtained either through time series based estimates or through counterfactual simulations. The first approach is an ex-post approach where data is decomposed into permanent and transitory component, or a moving average is employed to remove short run fluctuation in data. This method relies on underlying data generating process of fundamentals, and requires a longer time series. Average misalignment in the sample period becomes zero if all the permanent values of fundamental are estimated in this approach. Counterfactual simulation, on the other hand, is an ex-anti approach where we estimate a sustainable path of fundamentals based on judgement and wisdom about the economy. The latter approach becomes more meaningful in a country like Bangladesh where data span is short, and where misalignment is believed to be present for a long time.

[1] The general error correction model of equation (3) is not the same as Engle-Granger error correction model, as the latter does not include contemporaneous changes of the explanatory variables at the right hand side.

III. Empirical Model of Equilibrium Real Exchange Rate in Bangladesh

The long run equilibrium real exchange rate is defined as the one that prevails when the economy is in internal and external balance (for sustainable values of policy and exogenous variable). Based on an analytical model of equilibrium real exchange rate, Montiel (1999) identifies four sets of factors that determines real exchange rate. The first is the domestic supply side factor that refers to the venerable theory of Balassa-Samulalson effect. According to this theory, exchange rate appreciates if relative productivity in the tradable sector increases because it creates excess demand in the non-tradable sector, as well as it improves trade balance. Second set of factors relates to fiscal policy. A tax-financed increase in government spending in non-traded goods creates an excess demand for the later, and thus appreciates the equilibrium real exchange rate. The opposite will happen if there is an increase in government spending of non-traded goods. Thus, the share of government spending in traded versus non-traded goods appears to be important in determining equilibrium real exchange rate. The third set of factors is related to international economic environment that includes terms of trade, world real interest rate, world inflation rate, and the availability international transfer. Improvement in terms of trade increases national income in terms of imported goods which in turn nay increase demand for tradable goods requiring an appreciation of currency. An increase in flow of transfer requires an appreciation. Increase in world interest rate leads to capital outflow and thus requires depreciation of equilibrium real exchange rate. A change in world inflation rate affects equilibrium exchange rate through its effect on transaction cost associated with change in real balance. Finally, commercial policy could have important effect on equilibrium real exchange rate. Trade liberalization lowers support to import competing industries and resources are channeled to non-traded goods sector, which ultimately results in a depreciation.

In Bangladesh, commercial borrowing and private capital inflow is virtually absent until very recent years. Hence external transfer becomes exogenous as basically it depends on long run aid disbursement and short run emergency lending by IMF. There is a pure restriction of investing fund abroad. Hence, world interest rate and world inflation rate becomes irrelevant in determining real exchange rate. On the other hand debt service to export ratio has an important implication for real exchange rate. A permanent rise in the ratio will worsen the sustainability of the current account, and thus requires a depreciation of real exchange rate to restore balance. Thus, the list of fundamentals include the following:

$$F = (Gn, Gt, Rb, \partial, \psi, \eta, \tau) \qquad (4)$$

where, Gn is the government spending on non-traded goods, Gt is the governments spending on traded goods, Rb is external resource balance, ∂ is the productivity differential in the traded versus non traded sector, ψ is the debt service to export ratio, η is commercial policy, and τ is terms of trade.

Empirical considerations require further compromise. First, it is not possible to construct a meaningful time series regarding productivity differential between traded and non-traded goods producing sectors because of data limitations. So we ignore the Balassa- Samualson effect. Second data on government spending on tradables and non-tradables are not available as such. Government consumption mostly includes non-tradable items. Hence, we take the ratio of government consumption to total government spending to capture the effects of government spending of tradables and nontradables. We also try with Investment share of GDP as an alternative as suggested by Baffes et al (1999). Given the high import content of investment, a rise in investment share in GDP is supposed to increase demand for tradables and thus affect the equilibrium real exchange rate. Finally, it is very difficult to a have a correct and comprehensive measure of trade policy over a long time series. Hence, like other studies in the present field, we proxy the trade policy by a measure of openness, i.e., the ratio of export plus import to GDP. An increase in this ratio is supposed to be associated with trade liberalization. Thus our list of fundamentals affecting equilibrium real exchange rate includes ratio of government consumption to total government spending (or investment share of GDP), resource balance, openness, terms of trade, and debt service to export ratio.

The concept of real exchange rate that is relevant for single equation approach is the two goods internal measure of real exchange rate that is defined as the nominal exchange rate times the ratio of price of tradables to that of nontradables. Empirically it is measured by the ratio of wholesale price index to consumer price index. We have used a version of the concept real effective exchange rate (REER) as outlined in Oskoee-Bahmani (1994) to estimate the real exchange rate appropriate for our study[2]. Thus, we explore following two alternative models of long run equilibrium real exchange rate.

Alternative Models

	Dependent Variable	Independent Variables				
Model 1	LREER	LGOVCON	LOPEN	LRESBAL	LTOT	LDEBT
Model 2	LREER	LINVEST	LOPEN	LRESBAL	LTOT	LDEBT
Where, REER is real effective exchange rate, OPEN stands for openness, INVEST is investment as a % of GDP, GOVCON refers to ratio of government consumption to total government spending, RESBAL is for resource balance as a percentage of GDP, TOT is terms of trade, and DEBT is the debt service as a percentage of export. All models are estimated in log linear form. L stands for natural log.						

[2] Details of construction of variables are provided in the appendix

IV. Real Exchange Rate Behavior in Bangladesh

As a first step we checked for order of integration in all relevant data set[3]. We have used augmented Dickey-Fuller (ADF) test to test for unit roots. Lag length of ADF test has been determined by the data dependent method as suggested by Perron and Ng (1993)[4]. Table 1 shows that we can not reject the null of unit root at 5% level for any of the variables when we conduct ADF test in the log levels of data without any trend. We get similar results except terms of trade when ADF test is conducted with trend. Thus, all variables (except terms of trade) are nonstationary. However, first differences of all of them are stationary. So the variables are integrated of order one. Hence, the first econometric methodology as suggested by Baffes et. al., will be applicable for analyzing the real exchange rate behavior in Bangladesh.

Table 1: Test of Stationarity

	ADF test on levels, Without trend		ADF test on levels, with trend			ADF test on difference		
	ADF T-stat	Lags	ADF T-stat	T-stat on Trend	Lag	ADF T-stat	Lag	Order of Integration
LREER	-2.96	0	-2.32	-0.35	0	-5.93*	0	I(1)
LOPEN	-1.59	0	-3.011	2.85	5	-6.08*	0	I(1)
LRESBAL	-1.58	0	-2.48	-1.84	0	-4.64*	0	I(1)
LGOVCON	-2.87	5	-3.21	1.45	5	-5.93*	0	I(1)
LINVEST	-1.91	4	-3.07	2.31	4	-4.14*	0	I(1)
LTOT	-2.87	0	-4.55*	3.06	0	-6.64*	0	I(1), I(0)
LDEBT	-1.10	2	-0.43	-1.08	2	-5.85*	0	I(1)

MacKinnon critical values for rejection of a unit root depend on lag length. * denotes significance at 5% level.

MacKinnon critical values for rejection of a unit root at 5% significance level

lag	0	1	2	3	4	5
Without trend	3.00	3.00	3.00	3.01	3.02	3.03
With trend	3.63	3.63	3.63	3.65	3.65	3.67

[3] We used annual data from FY 1977 to FY 1998. This small number of observation results in a low power of tests. However, we do not have much choice as we have to drop few available data of post independence period to ensure stability of the regression results. There are many researches regarding Bangladesh and other developing countries that applied unit root-cointigration methodology with data of similar short span.

[4] In the data dependent method we start with a high lag in the ADF test and then we reduce the lag length successively by one unless we get the last lag as statistically significant.

As the variables are basically I(1), we have to examine whether real exchange rate is cointegrated with the vector of fundamentals. Summary results of Johansen's likelihood test are reported in table 2. The table reports that there is one cointigrating vector in both models when no trend in data is assumed. When linear trend in data is assumed, we find a cointigrating vector in the second model, but we are unable to find any cointigrating vector in the first model at 5% significance level. However, as we see in the table 1 that trend in REER (the dependent variable) is not significant, we should not count much on the cointigration test with trend in data. Johansen's test explores the number of cointigrating rank in a system of VAR, and we have found presence of at most one cointigrating vector in each model. Alternatively, we can apply Engle-Granger (1987) two step procedure to test for cointegration in the context of single equation approach. Part B of the table 2 report results from Engle-Granger test. We find is strong evidence of the presence of cointegration in both models of real exchange rate.

Table 2. Test of Cointegration
Part A: Results of Johansen's Likelihood Ratio Test of Cointigrating Rank

MODEL 1:

	Hypothesized No. of CE(s)	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Decision
A. No trend in data; No Intercept, no trend in cointegrating equation	None* At most One	88.92 53.09 31.05	82.49 59.46 39.28	90.45 66.52 45.58	One cointegrating equation at 5% level
B. No trend in data; Intercept, but no trend in cointegrating equation	None* At most One	102.47 66.47 42.18	102.14 76.07 53.12	111.01 84.45 60.16	One cointegrating equation at 5% level
C. Linear trend in data, No Intercept; no trend in ointegrating equation	None At most One At most Two	90.02 58.01 36.06	94.15 68.52 47.27	103.18 76.07 54.46	No cointegrating equations at 5% level

MODEL 2:

	Hypothesized No. of CE(s)	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Decision
A. No trend in data; No Intercept, no trend in cointegrating equation	None At most One	95.57 56.08 32.31	82.49 59.46 39.28	90.45 66.52 45.58	One cointegrating equation at 1% level
B. No trend in data; Intercept, but no trend in cointegrating equation	None At most One	132.08 70.08 41.73	102.14 76.07 53.12	111.01 84.45 60.16	One cointegrating equation at 1% level
C. Linear trend in data, No Intercept; no trend in ointegrating equation	None At most One At most Two	121.99 61.02 33.64	94.15 68.52 47.27	103.18 76.07 54.46	One cointegrating equation at 1% level

Part B. Results on Engle-Granger Two step Procedure for Testing Cointegration
(Unit root test of the residuals from the long run relations)

	ADF Test Statistics	Order of Integration
Model 1	-4.77	I(0)
Model 2	-4.77	I(0)

Engle and Yoo (1987) critical values for rejection of null of no cointigration are 4.15 and 3.85 at 5% and 10% levels respectively.

Table 3: Long Run Parameter Estimates

	Model 1	Model 2
Constant	5.488 (10.61)	6.105 (12.19)
LTOT	-0.191 (-2.39)	-0.206 (-2.27)
LOPEN	0.280 (3.57)	0.262 (1.65)
LRESBAL	-0.097 (-3.24)	-0.055 (-2.10)
LDEBT	0.106 (2.52)	0.115 (2.39)
LGOVCON	-0.226 (-2.27)	
LINVEST		0.085 (0.63)
LPFOR		
Adjusted R2	0.697	0.609

t-ratios are in the parenthesis

We estimate the long run cointigrating relationship to examine the long run behavior in real exchange rate. Results are reported in table 3. Column 1 and column 2 show estimated OLS regression results for model 1 and model 2 respectively. It can be said that estimated long run parameters strongly corroborate the theory. Coefficients of openness and debt appear as positive. Thus, trade liberalization and increased debt service burden depreciate the real exchange rate. On the other hand coefficients of terms of trade, resource balance, and government consumption appear as negative. Improvement in terms of trade appreciates the real exchange rate as suggested in theory and reported by many other empirical studies. Increased capital inflow (as proxied by resource balance) appreciates real exchange rate as expected. An increase in the ratio of government consumption to its total expenditure also marks an appreciation in real exchange rate as suggested by theory. Column 2 shows that increased investment depreciate real exchange rate that is also consistent with theory. Regression results show that model (1) performs slightly better than the model (2) in explaining long run relationship. Hence, we will take the first model as the basis of long run real exchange rate behavior.

Table 4: Short Run Dynamics
Dependent Variable: DREER1

	1	2	3	4
Constant	0.001 (0.08)	0.000 (0.06)	-0.026 (-2.20)	-0.026 (-2.20)
ERR(-1)	- 0.850 (-3.57)	-0.855 (-3.48)	-0.449 (-1.73)	-0.467 (-1.85)
DREER(-1)	0.075 (0.37)	0.080 (0.40)	0.018 (0.11)	0.031 (0.18)
DLTOT	-0.129 (-2.25)	-0.129 (-2.26)	-0.064 (-1.19)	-0.064 (-1.20)
DLOPEN	-0.307 (2.29)	0.302 (2.08)	0.175 (1.43)	0.167 (1.27)
LRESBAL	-0.102 (-2.95)	-0.102 (-2.96)	-0.076 (-2.52)	-0.075 (-2.49)
DLDEBT	0.111 (2.96)	0.111 (2.05)	0.049 (0.96)	0.052 (1.03)
DLGOVCON	-0.007 (-.10)		-0.021 (-0.34)	
DLINVEST		0.011		0.021

		(0.12)		(0.28)
DPFOR			0.354 (2.64)	0.351 (2.62)
Adjusted R2	0.607	0.607	0.751	0.750

We examined the short run dynamics of real exchange rate by estimating an error correction model of the form of equation (3). In order to maintain reasonable degrees of freedom, we have taken only one period values of relevant right hand variables. Table 4 reports the OLS estimation results of the error correction model. It is to note that all the variables in this model are I(0), so the t-tests are asymptotically normal. Hence, we can carry out conventional significance test of the estimated parameters. Results on column (1) and (2) show that long run fundamentals also insert their effects in the short run dynamics of the real exchange rate in the same direction. All the fundamentals except government consumption (or investment share) are statistically significant as well. Though the theory of real exchange rate suggests that long run equilibrium real exchange rate is homogenous of degree zero in prices, short run behavior of real exchange rate may be affected by change in nominal exchange rate or foreign price level. To capture the effects of nominal devaluation, we included change in foreign price as a regressor in the error correction model. Results of the estimated short run models including foreign price are reported in column 3 and 4[5]. The result shows that change in foreign price have a significant effect on short run behavior of real exchange rate. However, inclusion of foreign price partly soaks the effects of other variables on the short run behavior of the real exchange rate. It is evident that nominal devaluation had retained about 35% of its effectiveness to have a real devaluation even controlling for other factors. The result implies that nominal devaluations were not completely offset by domestic inflation during the sample period[6].

[5] Another relevant variable is domestic credit supply, but in our estimation it did not appeared as significant. Hence, to be parsimonious, we dropped it from our model.
[6] This is consistent with the arguments and findings about the relationship between devaluation and inflation in Hossain and Kapoor (1999).

Error correction coefficient is always less than unity in absolute value and it is statistically significant. Hence, there is stability in the long run equilibrium exchange rate. Error correction coefficient of 0.45 (as in the third column) implies that elimination of 95% of the shock to the real exchange rate will require about 5 years[7]. Error correction coefficient is much larger and speed of adjustment is much higher when foreign price is not included in the model. In the first column absolute value of error correction coefficient is 0.85; elimination of 95% of shock to real exchange rate will take less than two years. This is because the error correction term soaks some of the effects of nominal devaluation when foreign price is not included in the model. This gives a clear indication that nominal devaluation by the central bank had indeed helped towards restoration of equilibrium in the real exchange rate.

V. Exchange Rate Misalignment

Exchange rate misalignment can be measured as the percentage difference between actual and equilibrium real exchange rate. Using the long run parameters of the first column of table 3, we have constructed two series of equilibrium real exchange rate to assess the extent of misalignment over the period 1977-1998 as shown in table 5. Column 1 reports the actual real exchange rate while column 2 presents the fitted exchange rate from the first equation of table 3 by using actual values of fundamentals. Average deviation of the fitted values from the actual ones will be zero by construction. Hence, deviation of actual index from the fitted one shows merely the short run misalignment.

[7] The time required to elinimate x percent of a shock is determined according to $(1-|\phi|^{t}) = 1-x$, where t is the number of years, and ϕ is the speed of adjustment parameter.

Table 5: Exchange Rate Misalignment

	1	2	3	4
	REER	Fitted	"Sustainable"	Overvaluation
1977	87.1	91.6	100.0	14.8
1978	89.7	92.0	100.8	12.4
1979	94.1	90.4	100.5	6.7
1980	96.3	98.2	105.4	9.5
1981	98.8	97.0	103.5	4.8
1982	106.5	101.0	107.2	0.7
1983	106.6	107.0	109.1	2.4
1984	98.0	97.9	106.9	9.0
1985	97.1	95.1	106.6	9.9
1986	98.0	98.6	101.7	3.8
1987	99.1	99.2	97.9	-1.2
1988	98.8	98.0	101.6	2.9
1989	92.7	98.6	101.3	9.2
1990	100.0	98.7	99.9	-0.1
1991	100.2	99.0	98.8	-1.4
1992	104.6	103.1	102.5	-2.0
1993	102.3	99.3	101.7	-0.5
1994	102.9	105.6	101.0	-1.8
1995	103.8	103.5	104.1	0.3
1996	105.5	101.8	104.2	-1.2
1997	104.0	104.8	102.7	-1.3
1998	98.2	102.6	102.4	4.3

What is of more interest is the exchange rate misalignment from its long run equilibrium. We have calculated long run equilibrium real exchange rate using sustainable values of fundamentals. Sustainable values of the fundamentals are generated trough counterfactual simulations. We assume that foreign capital inflow of more than 5% of GDP is not sustainable in the long run in the context of Bangladesh. Hence, we substituted this value for RESBAL in the years when it exceeded 5%. Following the suggestion made by Klein (1994) we assumed that sustainable debt service to export ratio is at most 20%, and sustituted this value during the years actual rate exceeded this value. Estimation of sustainable value of openness ratio requires some more insight. First we have calculated a sustainable investment GDP ratio assuming 5% GDP growth[8] as the sustainable growth rate for the economy and using the average incremental capital

[8] This is done so by assuming 3% growth in per capita income as the long run growth and average population growth rate of 2%.

output ratio. Import content of investment in Bangladesh is estimated as 0.35. We have calculated required import of capital goods and raw materials for capital based on the estimated import content of investment and the sustainable import ratio. Target import ratio is calculated by adding up this required import of capital goods and actual import of consumer goods. Target export of the country is calculated based on the sustainable resource balance and the target import ratio. Long run sustainable openness ratio is calculated by combining these target import and export ratios. Bangladesh is a small economy by world standard, and it is a price taker in the world market. Terms of trade, which the ratio of prices of export and import is an exogenous variable for Bangladesh. Also there is no basis about what could be a sustainable terms of trade. Hence, we took a three-year moving average as the sustainable value of terms of trade. Similarly, there is hardly any benchmark about the sustainability of the ratio of government consumption to total expenditure. Again we proxy the sustainable value of this variable by a three-year moving average.

Column 3 reports the “sustainable” or long run equilibrium real exchange rate that are calculated by substituting the sustainable values of fundamental in the estimated cointegrating vector. It is evident that equilibrium real exchange is much higher than the observed real exchange rate during the early years of the study period. Overvaluation in our currency is remarkable in 1970s and most of the years of 1980s. However, the situation has changed during 1990s. There is no overvaluation during this period except the terminal year of the study period. Rather, our currency was slightly undervalued in most of the recent years according to our estimation. Given the fluctuation in real data, changing trade shares with trading partners, and a small deviation of actual exchange rate from the estimated ‘equilibrium’ exchange rate, one can also view that our exchange rate was broadly in equilibrium during the 1990s. As our results on misalignment are sensitive to specific counterfactual simulation, results might change with alternative assumptions about the sustainable values of fundamentals. However, the results will be qualitatively similar, and hence we can say at a minimum that overvaluation has reduced by substantial amount in the recent years.

Overvaluation of about 4% in the terminal year (fiscal year 1998) deserves special attention. This is the year that coincides with the East Asian crises when the some of our trading partners of East Asia marked a huge devaluation of their currencies. At the same time Bangladesh just continued its regular mini devaluation policy. As a result our real effective exchange rate depreciated by about 6% from the previous year though 'sustainable' exchange rate virtually remained same. Hence it is the overvaluation of our currency. Though we do not have data on REER and sustainable exchange rate after fiscal year 1998, huge pressure on foreign exchange reserve along with a high mark-up in the price of foreign exchange in the curb market provides some signal that there may be still some overvaluation in our currency.

VI. Concluding Remarks

The paper examined the long run real exchange rate behavior in Bangladesh using a relatively modern approach. Though the nominal exchange rate in Bangladesh is set by Bangladesh Bank, the real exchange rate in Bangladesh is found to be affected by macroeconomic fundamentals as suggested by recent theories of real exchange rate. It is notable that all the fundamentals affect the real exchange rate in the same direction as suggested by theory. Policymakers must not ignore these effects while formulating a policy that affects macroeconomic fundamentals. Another important observation is that nominal devaluation partially retained its effectiveness to have a real devaluation in the short run. Hence, despite domestic inflation and devaluation of trading partners, nominal devaluation can be an effective tool to affect our real exchange rate at least in the short period.

Our analysis of exchange rate misalignment reveals that our currency was overvalued during the late seventies and eighties. However, during 90s, our currency was broadly in equilibrium. During this period Bangladesh implemented trade liberalization and other economic reforms, pursued a policy of mini-devaluation as signaled by Bangladesh Bank's REER index, and the macro economy was in a better shape compared to previous decades. Real exchange rate was not only close to its equilibrium value, but also the fluctuation in real exchange rate deviation was minimum during this decade. Thus, economic reforms along with mini-devaluation policy as demanded by Bangladesh Bank's REER index have been successful restoring equilibrium in real exchange rate (except very recent times). As our exchange rate is already close to its equilibrium during the last decade of the study period, one might argue that there is little room for further devaluation on the ground of exchange rate misalignment. However, equilibrium value of real exchange rate is not a fixed one in our single equation approach, hence adjustment in exchange rate may be demanded at any time according to the change in fundamentals. More importantly, as most of our trading partners are also going through some process of devaluation, we may have to continue the process of devaluation to maintain equilibrium in the real effective exchange rate.

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APPENDIX : Data Source and Construction of Variables

The data were taken from several sources. Data on GDP, export, import, exchange rates, price indices, gross fixed capital formation, private and public consumption are taken from IFS yearbook, 1999. Data on government spending is taken from statistical yearbook of Bangladesh. Debt service data is taken from Bangladesh economic Review. Terms trade data is from taken from World Bank growth data base. Data on remittances comes from Economic Trend, published by Bangladesh Bank. The variables are constructed as follows:

Real Effective Exchange Rate (REER) is constructed as a version of REER as defined by Oskoee-Bahmani (1994). Oskoee-Bahmani defines real effective exchange rate as the trade weighted bilateral RER among trading parners, i.e., $REER=\sum w_j.(e_j.P_j/P)$, where, ej is the bilateral nominal exchnge rate of the home country with its trading partner, j ; w_j is the trade share of the home country with country j, Pj is the price level in the foreign country, and P is the domestic price level. To be consistent with empirical concept of our internal exchange rate we measure P and Pj by local CPI and Foreign WPI respectively. Thus we construct REER as $\sum w_j.(e_j.WPI_j/CPI)$. From top 15 trading partners of Bangladesh we 10 trading partners for which all the relevant data are available. About 70% of Bangladeshi trade is covered by this ten countries

Resource Balance to GDP Ratio (RESBAL) is constructed as value of import minus sum of value of export and remittances divided by GDP.

Openness (OPEN) is simply constructed as ratio of export plus import to GDP.

Investment Share (INVEST) is constructed as the ratio of gross fixed capital formation divided by the sum of gross fixed capital formation, private consumption, and public consumption.

GOVCON is simply the ratio of government consumption expenditure to total government expenditure

DEBT is the ratio of debt service to export expressed in percentage.

Foreign Price (PFOR) is the trade-weighted index of foreign wholesale prices expressed in local currency. Thus, PFOR = $\sum w_j.(e_j.WPI_j)$ = REER *CPI.