Exchange Rate Policy under Floating Regime in Bangladesh: An Assessment and Strategic Policy Options

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Working Paper No. 2

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October, 2009

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List of Abbreviations and Acronyms

ADB	Asian Development Bank
ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
BIDS	Bangladesh Institute of Development Studies
BEER	Behavioural Equilibrium Exchange Rate
CPI	Consumer Price Index
DOT	Direction of Trade
EMP	Exchange Market Pressure
EU	European Union
FDI	Foreign Direct Investment
FEER	Fundamental Equilibrium Exchange Rate
GDP	Gross Domestic Product
IC	Indicator of Crisis
IFS	International Financial Statistics
IMF	International Monetary Fund
L/C	Letter of Credit
NEER	Nominal Effective Exchange Rate
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
PP	Phillips-Perron
PRP	Policy Resource Programme
REER	Real Effective Exchange Rate
RER	Real Exchange Rate
TOT	Terms of Trade
VAR	Vector Auto Regression
VECM	Vector Error Correction Model
WPI	Wholesale Price Index

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Monzur Hossain

Mansur Ahmed

Executive Summary

Exchange rate management is one of the central issues of macroeconomic policy. This has received particular attention from policy makers and researchers when Bangladesh adopted the floating exchange rate system. This study analyzes exchange rate policies in Bangladesh for the period 2000-2008 covering pre and post-floating regimes and provides a discussion of alternative policy options.

Floating Exchange Rate Regime in Bangladesh

The transition to a floating regime on May 31, 2003 was peaceful and the first ten months can be viewed as "honeymoon period" as the exchange rate remained fairly stable, experiencing a depreciation of less than 1 percent from June 2003 to April 2004. Exchange rate kept on depreciating gradually from mid 2004 reaching Tk. 70/USD in 2006 from Tk. 58/USD, accounting for a 20 percent fall. Since then it remained fairly stable, fluctuating between Taka 68 and 70. The floating regime is thus characterized by both volatility and stability. To this end, it is of interest to know how the Bangladesh Bank manages the exchange rate.

Exchange Rate Management in Bangladesh: *de jure* vs. *de facto*

Officially (de jure) Bangladesh maintains a floating exchange rate system. In a floating regime, reserves are expected to exhibit relatively low volatility with high nominal exchange rate volatility. However, our estimates of relative volatilities of the exchange rate, reserves and interest rates are found to be very low for the period 2006:5–2008:6, indicating active intervention in the foreign exchange market, particularly after March 2006. This has led the nominal exchange rate to remain almost fixed or to move within a very narrow range for the period. We find that the *de facto* exchange rate regime of Bangladesh was never completely freely floating rather Bangladesh pursued a managed floating system from the very beginning of its transition to the floating regime.

Why Bangladesh intervenes in the foreign exchange market?

Two issues are investigated that may justify intervention in the foreign exchange market. One is the *exchange market pressure* and the other is *exchange rate pass-through*. We find that the *exchange rate pass-through* effect is high and statistically significant for Bangladesh—87 percent for international price, 95 percent for Indian price. This indicates that a change in international or Indian prices will almost completely translate into a change in domestic prices. Therefore, any depreciation of the taka will lead to an increase in inflation in Bangladesh. This partly justifies the intervention activities in the foreign exchange market. However, a positive link between domestic credit growth (or reserve depletion) and exchange rate market pressure is observed, indicating that any sterilized intervention would lead to exchange rate market pressure.

The important policy question in this regard is, therefore, whether the current exchange rate management is good or bad for the economy. To answer this question, we look into the behaviour of the real exchange rates and exchange rate misalignment.

Behaviour of the Real Effective Exchange Rate (REER)

An estimate of the real effective exchange rate (REER) and its equilibrium position will help us recognize whether the exchange rate is overvalued or undervalued. We have estimated the REER following the method that Bangladesh bank uses. Our findings suggest that the REER has depreciated around 20 percent from the year 2000 in an unstable fashion before appreciating from September 2008.The real euro was also unstable, which contributed to the overall instability in the REER.

The estimated equilibrium REER suggests that it has been overvalued on average by 3 percent from the second quarter of 2004, indicating that the exchange rate tends to remain very close to its equilibrium. However, considering the modest overvaluation of the taka, there was some scope for a 3-4 percent depreciation of the nominal exchange rate, particularly during the second half of 2008, when the export sector was confronted with the global economic recession. Net foreign assets were found to have a significant effect on the REER appreciation while terms of trade, real interest rate differential and government budget deficits were found to be significantly related to the REER depreciation.

Trade Performance and Exchange Rate

The study examines the effect of real exchange rate volatility on exports. Several long-run export demand functions were estimated. Overall exports from Bangladesh were found to be inversely related to international prices, and the relationship is statistically significant implying price support is crucial for the export sector. However, although REER volatility has a positive effect on overall exports, the impact is small. The low magnitude of the coefficient of volatility indicates that lower the REER volatility, the more will be the positive impact on overall exports. This finding calls for the stabilization of the REER.

Moreover, estimating demand functions for knitwear and woven garments in the US and EU market, we find significant impact of price and income on woven and knitwear exports respectively. This might explain the decline of woven exports in these markets in the latter half of 2008, in the face of economic recession in the EU and USA. Although income is also found to be significant for export demand of the USA and EU for knitwear and woven, exports of these items are expected to be less affected by the current global recession due to low income elasticity.

Policy Options

Exchange rate management in Bangladesh can be rated as good since the exchange rate remains very close to its equilibrium as warranted by economic fundamentals. However, there is scope to improve exchange rate management with some pragmatic policies as indicated below:

- A managed floating exchange rate system with a policy of short-term stability and long-to-medium term flexibility might be appropriate for Bangladesh. Exchange rate can be allowed to move along the market trend to a certain extent and intervention would be desirable to smooth out the pace of depreciation/appreciation.

- The management of the nominal exchange rate must not be ad-hoc; rather it can be managed by taking the policy of REER stabilization. Since Bangladesh's trade is dollar-denominated, we propose to create a REER basket of four major currencies (instead of eight currencies in the current system) including the US dollar, the Euro, the UK pound sterling and the Japanese yen with proper weights. In that case, it would be easier for the central bank to maintain the stability of the REER easily.
- For managing floats, an active intervention in the foreign exchange market requires the *accumulation of a sufficiently large stock of reserves*. A frequent and small adjustment to the exchange rate can be appropriate in the sense that it may help sustain a reasonable levels of international reserves.
- A trigger mechanism needs to be adopted for additional adjustments in the face of a real shock which cannot be absorbed by gradual adjustments in domestic prices and wages. In the face of a crisis, it is better to stabilize the NEER instead of the REER when other trading-partner currencies are fluctuating against each other.
- Finally, it is necessary for Bangladesh to work toward institutional development such as inter-bank bond market with greater emphasis given to financial liberalization in order to bring depth and efficiency to the foreign exchange market.

I. INTRODUCTION

While the advantages of freely floating regime are well known, it is still debated whether this regime is suitable for less developed countries. The problem of destabilizing speculation and consequent excessive exchange rate volatility appears to be exacerbated in developing countries, making a floating regime especially unviable/unsuitable, particularly in the absence of a resilient and developed financial system (Hossain, 2009; Grenville and Gruen, 1999). After the Asian and Latin American crises in the 1990s, there has been a growing tendency among countries to adopt a corner regime—either a fixed or a floating regime. However, many studies document that the way developing countries float is not consistent with the characteristics of clean floats (Hausmann et al., 2001; Hernandez and Montiel, 2003).

Bangladesh adopted a freely floating regime on May 30, 2003 by abandoning the adjustable pegged system[1]. The transition to the floating regime was smooth and the first ten months can be viewed as the "honeymoon period" for Bangladesh because the exchange rate remained stable, experiencing a depreciation of less than 1 percent from June 2003 to April 2004. Exchange rate kept on depreciating gradually from mid-2004 and it reached its peak at Tk. 70/USD in 2006 from Tk. 58/USD, accounting for a 20 percent depreciation. Since then (2007-2009), it remained fairly stable and has been fluctuating between Taka 68 and 69. Is this behaviour consistent with the characteristics of a floating regime? Or, can the behaviour of the nominal exchange rate be explained in a way that the authority allows the nominal bilateral rate to move to its equilibrium level and then intervene only to prevent excessive volatility around that level?

Exporters often demand depreciation to offset domestic price and wage inflation and regain competitiveness. Depreciation affects the objectives of the central bank (output and inflation) through three different channels. First, depreciation directly affects the rate of inflation. The impact of depreciation on inflation will depend on the level of the pass-through. Second, depreciation affects output through a *balance sheet* effect: the depreciation increases the cost of repayment of foreign currency denominated debt, reducing profits in this period, and thus the capital stock and output in the second period. Third, a larger depreciation entails a smaller increase in interest rates. Thus, a larger depreciation increases output in the second period, since the reduction in interest rate eases the credit constraint (we call this *the credit channel* effect). The overall effect on income will depend on which of the two channels dominate. If the credit channel dominates over the balance sheet channel, depreciation is expansionary. Otherwise, it is contractionary.

Caught in this dilemma, the monetary authorities have chosen to keep the exchange rate nominally fixed or almost fixed for the last two years, by intervening in the foreign exchange market. Occasional intervention in the foreign exchange market brings some positive benefits, particularly for developing countries like Bangladesh if the intervention

[1] Historically, Bangladesh had been maintaining various pegged exchange rate regimes, such as pegged to pound sterling (£):1972–1979; pegged to a basket of major trading partners' currencies (£ as the intervening currency) 1980–1982; pegged to a basket of major trading partners' currencies (US$ as the intervening currency): 1983–1999; crawling band: 2000-2003; floating exchange rate: May 30, 2003- Present.

is targeted to achieve some economic objectives such as stable inflation or trade competitiveness. However, if nominal exchange rate moves along a continuum for a long time—it may create distortions in the market, e.g. *irrational exuberance*, which include strong growth, accelerating inflation, rising international reserves, and gradual overvaluation. This situation would be troublesome for the economy if it proceeds too far. In this context, the concern is whether the Bangladesh Taka is overvalued and to what extent. At the same time, it is of policy concern as to how the *real effective exchange rates* (REER) are managed. To have a clear idea about exchange rate management, this study analyzes contemporary exchange rate policies of Bangladesh, particularly under the floating exchange rate regime.

The main objectives of this study are: (i) to characterize the exchange rate policies Bangladesh is currently pursuing; (ii) to evaluate the appropriateness of such policies in the light of both contemporary international and domestic economic conditions, and (iii) to provide some alternative policy options that might be of assistance in managing exchange rates under the floating regime.

The study takes into account behaviour of both the nominal and real exchange rates, behaviour of economic fundamentals, intervention activities, exchange rate market pressure, exchange rate pass-through, exchange rate misalignment, impact of the real exchange rate on exports etc. This paper makes use of data from various sources including Bangladesh Bank, IFS (International Financial Statistics) of the IMF, and DOT (Direction of Trade Statistics) of the IMF.

The paper is organized as follows: section II reviews the literature on exchange rate issues of Bangladesh. Section III analyzes the behaviour of the nominal exchange rate by focusing on the behaviour of interest rates and international reserves during floating and pre-floating regimes. In Section IV, we assess the *de facto* exchange rate regime of Bangladesh by characterizing the extent of intervention in the foreign exchange market. In section V, we estimate an Exchange Market Pressure Index to understand how frequently exchange rate shocks are observed and explore the determinants of that shock. Section VI estimates the exchange rate pass-through coefficients to understand the impact of exchange rate changes on domestic price changes. In section VII, the behaviour of the REER and NEER and its implication for international price competitiveness are analyzed. In section VIII, we estimate the equilibrium real exchange rate and its misalignment. Section IX estimates a set of export demand functions in order to examine the effect of REER volatility on exports. Section X provides some policy recommendations based on our findings that could act as guiding principles in exchange rate management. Finally, section XI concludes the paper.

II. LITERATURE REVIEW: EXCHANGE RATE POLICIES OF BANGLADESH

This section surveys empirical contributions on various aspects of exchange rate policies in Bangladesh. Several studies have attempted to analyze the behaviour of exchange rates in Bangladesh. Hossain (2002) investigates the exchange rate responses to inflation in Bangladesh for the period 1973-1999. He finds that the effect of devaluation on inflation during the fixed exchange rate regime was not significant, and he claims the results to be robust for the whole sample period. By analyzing the movement of the real exchange rate and trade balance in Bangladesh for the period 1973-1996, Hossain (1997) finds that the continued inflows of foreign capital—foreign aid and overseas worker's remittances—have caused an appreciation of the real exchange rate by increasing the relative demand for non-tradables.

Rahman and Basher (2001) have estimated the equilibrium real exchange rate as well as exchange rate misalignment for the period 1977-1998. They find that trade liberalization and increase in debt service burden results in a real depreciation of the currency; while increase in capital inflow, improvement in terms of trade, and increase in government consumption of non-tradables results in a real appreciation of the currency. From the estimated long run equilibrium real exchange rate, they find that Bangladesh currency was considerably overvalued until late 1980s. However, the real exchange rate broadly was in equilibrium during the 1990s. An ADB study concludes that the misalignment between the actual and equilibrium exchange rate for the period 1997-2001 has been small and has progressively narrowed since 1998. During 2001, the misalignment was only 2.2 percent.

Prior to adopting floating exchange rate regime, Islam (2003) concludes that the economic and institutional prerequisites of a floating exchange rate regime are not met in Bangladesh. Some recent studies have tried to explain the behaviour of nominal exchange rates of Bangladesh after its transition to the floating rate regime. By doing a correlation analysis, Rahman and Barua (2006) explore the possible explanation of the exchange rate movement. They found that there is a strong correlation (-0.40) between depreciation and export-import gap as a share of reserves, L/C openings for imports also have a positive correlation (0.45) with volatility of the exchange rate which implies that the higher the L/C openings the more volatile is the exchange rate. They conclude that high seasonal demand for foreign currency because of increased import bills, systematic withdrawal of excess liquidity by Bangladesh Bank, relatively faster expansion of credit and higher interest rates on various national savings instruments are the reasons behind the interest rate hike in the money market and depreciation of the nominal exchange rate.

Younus and Chowdhury (2006) made an attempt to analyze Bangladesh's transition to floating regime and its impact on macroeconomic variables. They find that output growth in Bangladesh performed well in the intermediate and floating exchange rate regimes. Inflation is lower in the intermediate regime despite higher money supply and exchange rate depreciation. They also find that currency depreciation boosted export growth in the floating regime.

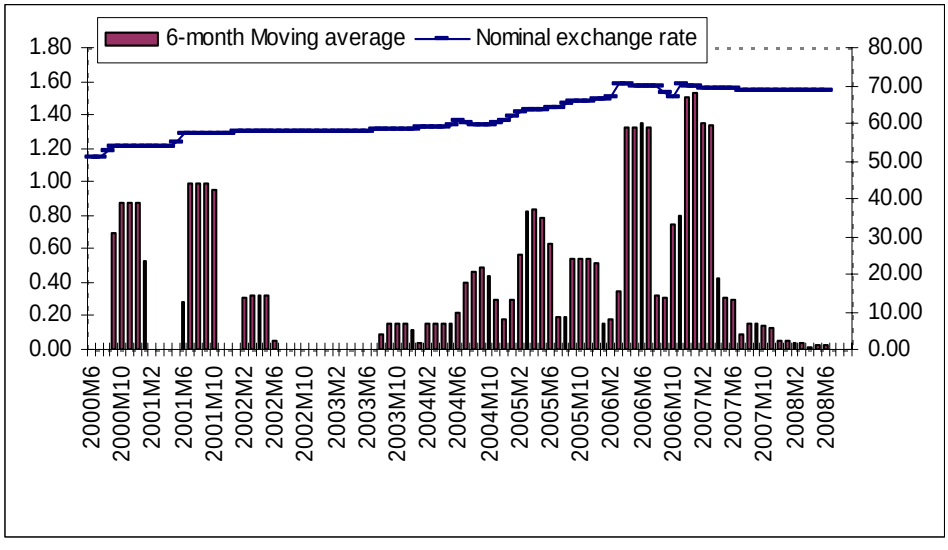
Chowdhury and Siddique (2006) have analyzed the exchange rate pass-through to domestic inflation in Bangladesh. Analyzing the data for the period 1997:07 to 2005:03, they have not found any significant pass-through effect of exchange rate in Bangladesh. They have applied Vector Auto Regression (VAR) technique in their analysis. If their findings are correct, its policy implication would be to allow the currency to depreciate further in order to give a boost to the economy. The findings however, appear to have been affected by measurement errors.

The above survey indicates that a systematic and comprehensive study on contemporary exchange rate policies of Bangladesh, particularly under the floating exchange rate regime is necessary.

III. EXCHANGE RATE MANAGEMENT IN BANGLADESH (2000-2008)

This section describes how the nominal exchange rates behave by focusing on three aspects of exchange rate management: i) the stock of reserves; ii) the extent to which Bangladesh uses these reserves to stabilize the exchange rate; and iii) the extent to which interest rates are used to stabilize the exchange rate. Figure 1 plots nominal exchange rate movements (level) as well as volatility of nominal exchange rate, measured by the 6-month moving average standard deviation. The figure shows that during intermediate regime (adjustable pegged regime), nominal exchange rate moves occasionally because of official devaluation and for the first six months of the floating regime, the nominal exchange rate remained almost fixed. It is seen that from April, 2004, nominal exchange rate was somewhat volatile, but remained fairly stable after March 2006.

Figure 1: Nominal exchange rate movement and its volatility



To what extent Bangladesh attempts to stabilize exchange rates by intervening in the foreign exchange market? In order to answer this question, we look at relative volatilities of the exchange rate, reserves and interest rates. We choose to work with relative volatilities, because we think that comparisons based solely on the volatility of exchange rates alone, or of reserves alone, could be misleading. The exchange rate could be more volatile simply because it is subject to larger external shocks. Comparing exchange rate volatilities does not provide a complete idea of the willingness of the authority to defend its parity. It may be the case that the central bank is intervening in the foreign exchange market to keep the exchange rate within certain limits, while during the period of less volatility the authority is letting the exchange rate float independently. Similarly, comparing volatility of reserves may be problematic too. It is possible for reserves during a particular period to be relatively stable due to the absence of shocks that would have warranted a movement in the exchange rate, or in case the authority intervenes heavily, if a shock warrants it. However, a possible drawback of using relative volatilities is that one

does not know if the ratio is high because of the numerator being unusually high or the denominator unusually low. But intervention in the foreign exchange market is not the only channel that monetary authorities have in order to influence movements in the exchange rate. They can also affect it by tightening or loosening monetary policy. Thus, in this section we will look at relative volatility of exchange rates and interest rates as another indication of the degree to which monetary authorities are willing to let the exchange rate float freely.

As a measure of exchange rate volatility, we use the standard deviation of the level of the exchange rate. As a measure of the volatility of reserves, we use the standard deviation of the stock of reserves, normalized by the dollar value of the stock of base money (M0). As a measure of volatility of interest rates, we use the standard deviation of call money interest rate. Table 1 presents the volatility of reserves, exchange rates as well as volatility of market (call money) interest rate. From these volatilities, we have estimated two relative volatilities—one is relative volatility of exchange rate over international reserves, the other one is relative volatility of exchange rate over interest rate.

The estimates in Table 1 show that the nominal exchange rate remained very stable after March 2006, while it was highly volatile during earlier periods of the floating regime (April, 2004 to Feb. 2006). Table 1 also shows that the behaviour of reserves and call money interest rate in pre-floating regime and in floating regime after March 2006 was higher than the so-called turbulent period, 2004:4 to 2006:2. Our estimates also indicate that relative volatilities were very low during 2006:3 to 2008:5, providing an evidence of certain amount of intervention in the foreign exchange market after March 2006.

Table 1: Relative volatilities of the nominal exchange rate, international reserve and call money rate

	Volatility of Nominal Exchange Rate (Tk./$)			Volatility of Reserve	Volatility of Interest Rate			Rel. Vol (ER/Res)	Rel. Vol (ER/IR)
	Std. Dev.	Max.	Min.	Std. Dev.	Std. Dev.	Max.	Min.		
Pre-Floating Regime (Jan 2000-May 2003) N=41	2.65	57.9	51.0	0.052	2.97	16.75	4.25	50.96	0.89
Floating Regime (Jun 2003-Feb 2006) N=33	3.03	67.13	57.9	0.046	3.30	15.97	4.95	65.57	0.92
Floating Regime (Mar 2006-June 2008) N=28	0.71	70.27	67.11	0.061	3.62	21.54	6.9	11.64	0.20

We also compare volatility of nominal exchange rates against major trading partner currencies using the coefficient of variation. It shows that Bangladeshi Taka remained stable against all of our trading partner's currencies except the US dollar.

Table 2: Comparison of Volatility of Exchange Rates (Coefficient of Variation)

	Taka/US dollar	Taka/ Rupee	Taka/ RMB	Taka/ Pound	Taka/ Yen	Taka/ Euro	Taka/ Sing $
Pre-Floating Regime (Jan 2000-May 2003) N=41	0.047	0.019	0.050	0.066	0.039	0.101	0.039
Floating Regime (Jun 2003-Feb 2006) N=33	0.50	0.065	0.057	0.075	0.055	0.069	0.065
Floating Regime (Mar 2006-Nov 2008) N=33	0.11	0.063	0.055	0.058	0.064	0.076	0.050

The findings in this section indicate that the way Bangladesh manages exchange rate is, by and large, not consistent with the characteristics of freely floating exchange rate regime. Evidence suggests that Bangladesh Bank often intervenes in the foreign exchange market in order to keep the nominal exchange rate almost fixed or to allow it to move within a very narrow range (also see Table 3). However, the extent of intervention and its impact on exchange rate regime is not clear from the analysis of this section. For this reason, we assess the *de facto* exchange rate regime of Bangladesh in the next section.

Table 3: Sale and Purchase of Foreign Exchange by Bangladesh Bank (in Million USD)

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09 (Jul-Apr)
Sale	0	459	413.1	0	735.5	70
Purchase	313.95	147.1	0	649.5	202.5	815.2
Net Injection	-313.95	311.9	413.1	-649.5	533	-745.2

Source: Forex Reserve and Treasury Management Department (FRTMD), Bangladesh Bank

IV. DE FACTO REGIME CLASSIFICATION FOR BANGLADESH

It is recognized in the literature that countries, particularly non OECD countries often deviate from their official exchange rate commitments. Therefore, some authors made an attempt to characterize the de facto regimes of countries (see Levy Yeyati and Sturgenegger, 2002; Bubula and Otker Robe, 2000; Reinhart and Rogoff, 2004). All these de facto classifications take the following three variables into account, *exchange rate volatility* (σ_e), *volatility of exchange rate changes* ($\Delta\sigma_e$) and *volatility of reserves* (σ_r).

In this study, we follow the one developed by Levy-Yeyati and Sturzenegger (2002) in Table 4.

Table 4: De facto regime classification criteria

	σ_e	$\Delta\sigma_e$	σ_r
Inconclusive	Low	Low	Low
Flexible	High	High	Low
Dirty Float	High	High	High
Crawling Peg	High	Low	High
Fixed	Low	Low	High

Table 4 sets the criteria according to textbook description. Flexible exchange rates are characterized by little intervention in the exchange rate markets together with unlimited volatility of the nominal exchange rate. Conversely, a fixed exchange rate regime occurs when the nominal exchange rate does not move while reserves are allowed to fluctuate. A crawling peg corresponds to the case where changes in the nominal exchange rates occur with stable increments (i.e. low volatility in the rate of the exchange rate) while active intervention keeps the exchange rate along that path. A dirty float should be associated to the case in which volatility is relatively high across all variables, with intervention only partially smoothing exchange rate fluctuations.

Following the methodology adopted by Levy-Yeyati and Sturgeneger, we estimate *exchange rate volatility* by monthly absolute percentage change of nominal exchange rate (σ_e), *volatility of exchange rate changes* ($\Delta\sigma_e$) by the standard deviation of monthly percentage change of nominal exchange rate, and *volatility of reserves* (σ_r) by the absolute change of reserves in classifying a de facto regime. A word of caution is in order for reserves. Reserves are notoriously difficult to measure and there is usually a large difference between changes in reserves and interventions. Therefore, we take particular care in reserves for intervention. First we define net reserves in dollar by subtracting foreign liabilities from foreign assets and deflating it by the nominal exchange rate (e_t) as follows.

$$R_t = \frac{Foreign\,Assets_t - Foreign\,Liabilities_t}{e_t}$$

Next we measure the monthly intervention in the foreign exchange market, r_t, as follows:

$$r_t = \frac{R_t - R_{t-1}}{Monetary\,Base_{t-1}(M_0)/e_{t-1}}$$

Our measure of volatility here is the average of the absolute monthly change in *r*, i.e. the average of the absolute monthly change in net dollar international reserves relative to the monetary base in the previous month, also in dollars.

The estimates of volatility are shown in Table 5 for the period 2000-2008. Following the classification criteria, we identify the *de facto* exchange rate regime of Bangladesh for the period 2000-2003:5 as an adjustable pegged regime. The behaviour of the nominal exchange rates and reserves for the first ten months of the *de jure* floating regime was puzzling (inconclusive) as volatilities of all the three variables were fairly low, which cannot be explained from the text-book context. One of the reasons perhaps is that Bangladesh Bank intervenes in the market not by buying or selling dollars, but by imposing some quantitative restrictions on LC margins. On the other hand, the period 2004:5 to 2006:12 was characterized by high nominal exchange rate volatility with high reserve volatility, which indicates that the *de facto* exchange rate regime was a *dirty float*. Finally, the de facto analysis of exchange rate regime for the recent period (2007:1-2008:6) reveals that the behaviour of exchange rates are more close to a fixed (pegged) exchange rate system. Despite some limitations of de facto regime classifications, it may be concluded that Bangladesh's exchange rate policy is not consistent with a freely floating regime. Rather, it can be broadly defined as a managed floating regime.

Table 5: De facto classification of exchange rate regime in Bangladesh, 2000-2008

Period	σ_e	$\Delta\sigma_e$	σ_r	Comments
Jan 2000-May 2003	0.33 (L)	1.28 (H)	4.56 (H)	Adjustable peg
June 2003- April 2004	0.22 (L)	0.31 (L)	1.15 (L)	Inconclusive
May 2004 – Dec 2006	1.05 (H)	1.23 (H)	3.65 (H)	Dirty Float
Jan 2007 – June 2008	0.15 (L)	0.18 (L)	5.97 (H)	Fixed

Notes: We term an indicator high (H) if it exceeds its long-term estimates, otherwise it is termed as low (L). Long-term estimates are: $\sigma_e = 0.98$, $\Delta\sigma_e = 1.16$ and $\sigma_r = 4.15$.

Why Bangladesh has deviated from its floating regime commitment? To answer this question, it is necessary to examine whether the economy is vulnerable to high exchange rate pass-through and high frequency of exchange rate shocks. These two issues are addressed in the following two sections.

V. EXCHANE MARKET PRESSURE

The exchange market disequilibrium can be captured by the changes in international reserves or changes in exchange rates or combination of both. Under the fixed and floating regime, the extent of imbalance in the Forex market can be estimated more directly by looking at the changes in reserves and changes in exchange rates, respectively. However, in a managed floating or an intermediate regime, monetary authorities usually allow either changes in reserves or exchange rate or combination of both in order to restore equilibrium in the foreign exchange market. The monetary approach to the balance of payments suggests that exchange market disequilibrium arises when there is an excess demand for domestic money. Based on this proposition, Girton and Roper (1977) proposes an exchange market pressure (EMP) index as the weighted sum of monthly changes in nominal exchange rate and monthly changes in the stock of international reserves scaled by monetary base in order to capture disequilibrium in the foreign exchange market. The Girton-Roper model has been extensively applied to many countries (see, Modeste, 1981; Bahmani-Oskooee et al., 1998; Taslim, 2003).

Given that Bangladesh has been maintaining a managed float regime instead of a pure float as evident from our analyses in the previous sections, in this section we use the composite variable EMP (Exchange Market Pressure) as proposed by Girton and Roper (1977) to study the interaction between monetary variables and external sector and the severity of exchange rate shocks in Bangladesh during the period 2000:1 to 2008:9.

We have computed the EMP index by calculating the weighted sum of monthly changes in nominal exchange rate and monthly changes in the stock of international reserves scaled by monetary base. The weights are inversely proportional to the relative variances of nominal exchange rate changes and international reserve changes. As proposed by Eichengreen, Rose and Wyplosz (1996), a standardized indicator of crisis (IC) is calculated based on EMP as: IC = $\frac{EMP - \mu_{EMP}}{\sigma_{EMP}}$. According to them, a crisis is signalled if IC > 1.5, while Kaminsky and Reinhart (1999) set a critical value of 3 for the IC. Both EMP and IC indices are plotted in Figure 2.

Figure 2: Exchange market pressure index

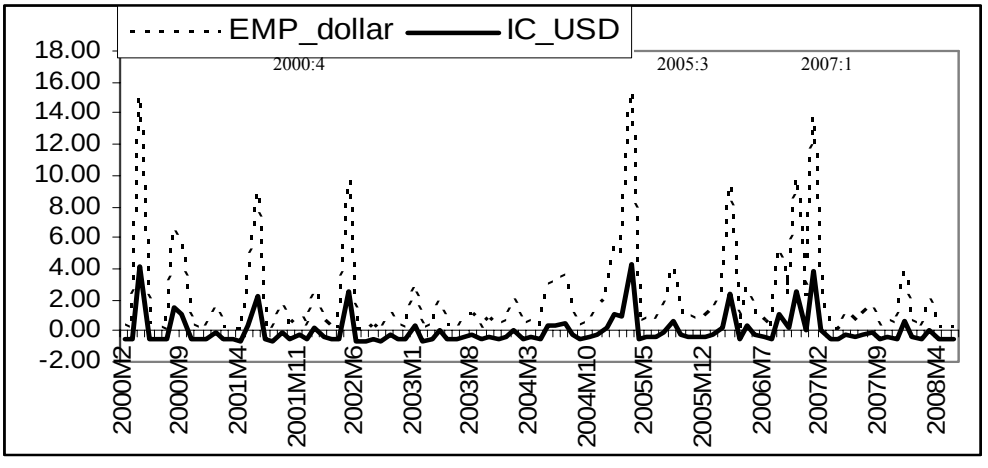
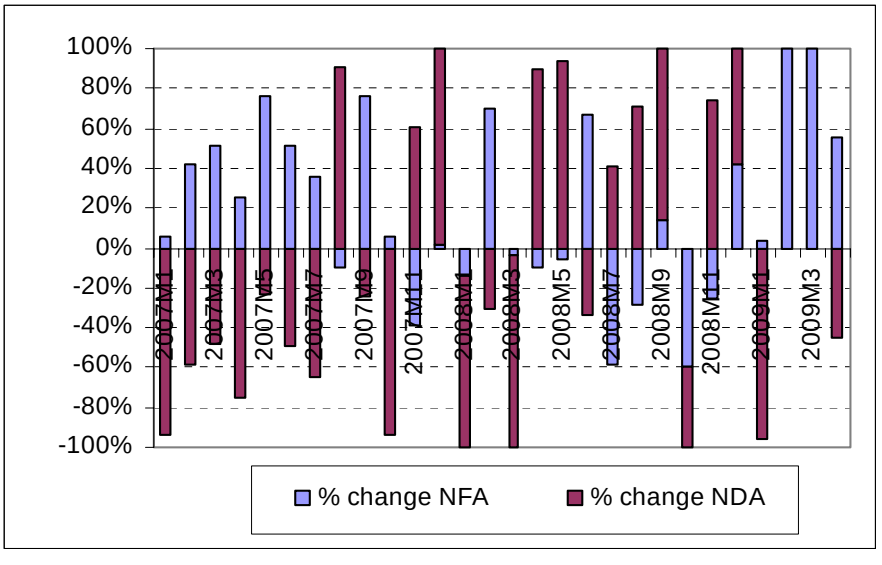


Figure 2 shows that Exchange market pressure (EMP) is positive in Bangladesh during the period under consideration; however, during 2005-2006 the extent of imbalance in the foreign exchange market was severe. It appears from the index IC that shocks were more frequent and several times it crosses the crisis threshold during the period 2005-2006, which was characterized as turbulent period. However, for the period 2007-08 the EMP is found to be very low, indicating equilibrium in the foreign exchange rate market.

The main theoretical proposition of Girton and Roper (1977) is that the domestic money market equilibrium if disturbed is restored through some combination of the currency depreciation/appreciation and reserves outflow/inflow. The excess domestic money supply will cause a combination of currency depreciation and reserves outflow while excess domestic money demand will cause some combination of currency appreciation and reserves inflow to restore the money market equilibrium. Therefore, it may be hypothesized a positive and contemporaneous impact of shock to domestic credit growth upon exchange market pressure—an increase in domestic credit causes the exchange rate to depreciate or the foreign exchange reserves to deplete or some combination of the two. To this end, we plot the percentage change in net foreign asset and net domestic asset in Figure 3 to see the relationship.

From the Figure 3, it may be concluded that intervention was almost sterilized for the period 2005:8 to 2007:9. Comparing Figures 2 and 3, a positive relationship between domestic credit growth (or growth of money supply) and exchange market shock is observed. That is, when Bangladesh bank chooses to increase domestic money supply, some combination of reserve depletion or currency depreciation occurs. Since the interest rate channel of monetary policy transmission is almost ineffective, this exaggerated the situation as it prevents Bangladesh Bank from lowering the interest rate, which leads to sterilized interventions that ultimately contributes to exchange rate shocks.

Figure 3: Percentage change in net foreign assets (nfa) and percentage change in net domestic Assets (nda)



From figures 2 and 3, we may conclude that sterilized intervention in Bangladesh causes extra pressure on the foreign exchange market. However, an incomplete sterilized intervention is seen from 2007:9 onwards, which might have contributed to an increase in inflation[2]. Therefore, if there is a likelihood of exchange market pressure, it would be a good option for Bangladesh Bank to tighten the money supply through high interest rates. In what follows, Bangladesh Bank should work hard on making the financial sector more competitive in order to ensure smooth transmission of monetary policy stimuli through the interest rate channel, and only then, can they enjoy the "low inflation benefit" of non-sterilized interventions. At the same time, tight monetary policy must be accompanied by fiscal adjustments; otherwise, it might increase the burden on the inter-temporal budget and may thus be counterproductive.

[2] In a recent monetary policy statement (July 19, 2009), Bangladesh Bank admitted that they purchased 1.48 billion dollar in 2008-09 from the currency market, most of which remains unsterilized.

VI. EXCHANGE RATE PASS-THROUGH

In this section, we estimate the exchange rate pass-through for Bangladesh for the period 2000-2008 using a simple methodology applied for Australia by de Brower and Ericsson (1995), for Mexico by Garces Diaz (1999) and for a cross-country analysis by Hausmann et al. (2001). Although for drawing the complete picture of exchange rate pass-through requires a complete paper, we take a simplistic approach here to estimate the pass-through coefficients just to see whether the intervention in the foreign exchange market is done in order to contain inflationary effects on the Bangladesh economy. Our sample period includes intermediate exchange rate regime (2000:1 to 2003:5) also, because during this period exchange rates were allowed to move within a narrow band.

We consider the model of domestic prices using a mark-up equation as follows:

$$P = \alpha W^{\theta} F^{\gamma} \qquad (1)$$

Where P is domestic price, W wages, F international prices in domestic currency (obtained by multiplying the exchange rate with an index of international prices) and α, θ, and γ are three parameters representing mark up and the long run elasticity of wages and external prices. By taking the natural logarithm of the above equation it is possible to estimate the long run relationship among wages, international prices and local prices. Since we do not have monthly data for wages, we estimate the following long-run equation:

$$p = ln(\alpha) + \gamma f \ , \qquad (2)$$

where lower case letters represents the log of the corresponding upper case variables defined above.

All the series we use are monthly and can be described as having a unit root process. Hence, we need to study the long-run relationship between internal and external prices using cointegration analysis. To understand the speed of adjustment, we also estimate the error correction model.

We measure *p* using the log of the CPI of Bangladesh and use three different definitions of *f*. In the first definition, we add the log of the US dollar exchange rate to the log of an index of international non-fuel commodity prices (from IFS). In the second definition, we substitute the index of commodity prices by the U.S. CPI, and in the third definition, we substitute commodity price index by the Indian CPI. Table 6 reports the results.

Table 6: Estimates of inflation pass-through (2000-2008)

	Changes in internal prices	Changes in US prices	Changes in Indian prices
γ	0.87 (0.14)***	1.26 (0.15)***	0.95 (0.09)***
Constant	2.96	6.37	3.61
ECT (Error correction term)	-0.02 (0.005)**	-0.03 (0.01)**	-0.04 (0.02)**

***, ** indicate significance at 1 percent and 5 percent level respectively.

Table 6 shows that the long run pass-through coefficient is very high and significant for Bangladesh. It is 0.87 for international price, 1.26 for the US price and 0.95 for the Indian prices, which indicates that a change in international or US or Indian prices will almost completely translate into a change in domestic prices. The estimated error correction term is negative and significant—the speed of adjustment to equilibrium is 2 percent for international prices and 3 percent for US prices, while it is 4 percent for Indian prices. Although our result is based on a simple univariate analysis, we find that exchange rate pass-through has some role in explaining the low volatility (stability) of exchange rate in Bangladesh, particularly after March 2006, when the World was facing high inflationary episodes.

Up to this section, we have completed our analysis on the behaviour of the nominal exchange rates. In the following sections, we concentrate on the behaviour of the real exchange rates.

VII. BEHAVIOUR OF REER AND NEER

The real effective exchange rate (REER) is the inflation-adjusted and trade-weighted exchange rate, which is used as a popular index of international trade competitiveness of a country. On the other hand, nominal effective exchange rate (NEER) is a trade-weighted index, which is also used to represent trade competitiveness. This section is devoted to a discussion of the movements of both the REER and the NEER. Following Bangladesh Bank's procedure, we calculated the REER and the NEER considering the year 2000 as base and using trade-weights of eight major trading partners (see Table A2 of the Appendix), namely USA, UK, Japan, EU, China, India, Hong Kong and Singapore. We have also estimated bilateral real exchange rates (RER) against major trading partners.

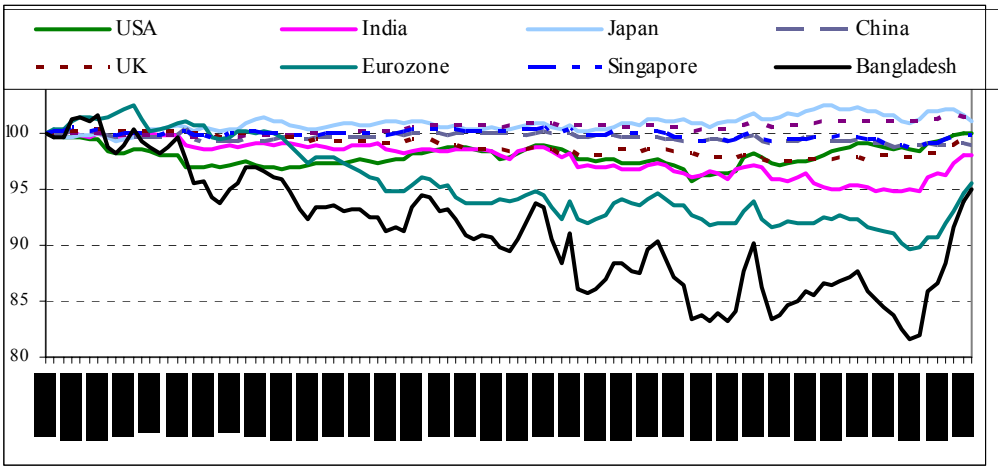
Figure 4 plots the REER and bilateral RERs. It shows that the REER depreciated around 20 percent over the years in an unstable fashion. During the fixed regime, 2000-2003, the REER moved in tandem with the price differential and the movement of US Dollar vis-à-vis major currencies. The Taka gained competitiveness during 2000-2003 because of the continued lower inflation differential as well as occasional devaluations. However, during the turbulent period of the floating regime (2004-2006), the taka remained competitive because of high depreciation as well as US dollar depreciation vis-à-vis major currencies despite high inflation differentials (with high domestic inflation). From 2006, the REER shows an appreciating trend, but for a brief period. With almost a stable nominal exchange rate of the dollar in the period 2006-2008, the REER shows slightly upward trend because of high inflation differentials and US dollar depreciation vis-à-vis major currencies. It is also observed from the trend of the REER that some periodic adjustments of taka/dollar exchange rate might have contributed to the overall trend of depreciation. Since there is a long term trend in the REER movement, it suggests that the REER might have been overvalued to some extent.

Figure 4 also shows that the bilateral real exchange rate against the euro exhibits higher volatility with an overall depreciating trend. However, all other trading partners' real exchange rates remained stable. It appears that Bangladesh competitiveness vis-à-vis the European Union is particularly unstable.

Another point is that the calculation of the REER using CPI (consumer price index) may contain measurement error because CPI may not be the right index for the purpose. Since WPI (wholesale price index) contains largely tradable goods while CPI is more heavily weighted towards non-tradable goods, this phenomenon translates into a long-term rise of CPI relative to WPI. Therefore, the REER based on CPI is likely to underestimate the economy's competitiveness to the extent that this internal price movement is significant (relative to its trading partners). If an increase in the price of nontradables relative to tradables is due to greater productivity growth in the second sector than the first, such increases lead to real appreciation in the real exchange rates. This is well-known as the Balassa-Samuelson effect. Does this effect exist in Bangladesh?

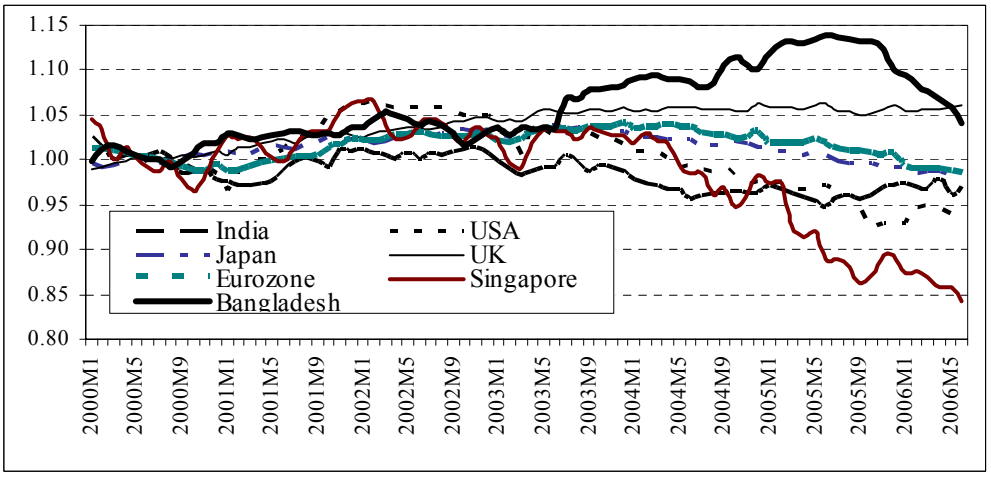
To address the issue, first we calculate the ratio of CPI to WPI, which is shown in Figure 5 and then we calculate the REER based on WPI[3] in Figure 6 using the same weights as in the case of the CPI based REER. Figure 5 shows that internal price movements are persistently higher in Bangladesh and a sharp rising trend is observed since 2003:5, however, the WPI-based REER showed slightly appreciating trend from that period that provides an indication of the Balassa-Samuelson effect in the Bangladesh economy.

Figure 4: Bangladesh's aggregate and bilateral REERs based on CPI (2000 = 100) (a rise indicates real appreciation)



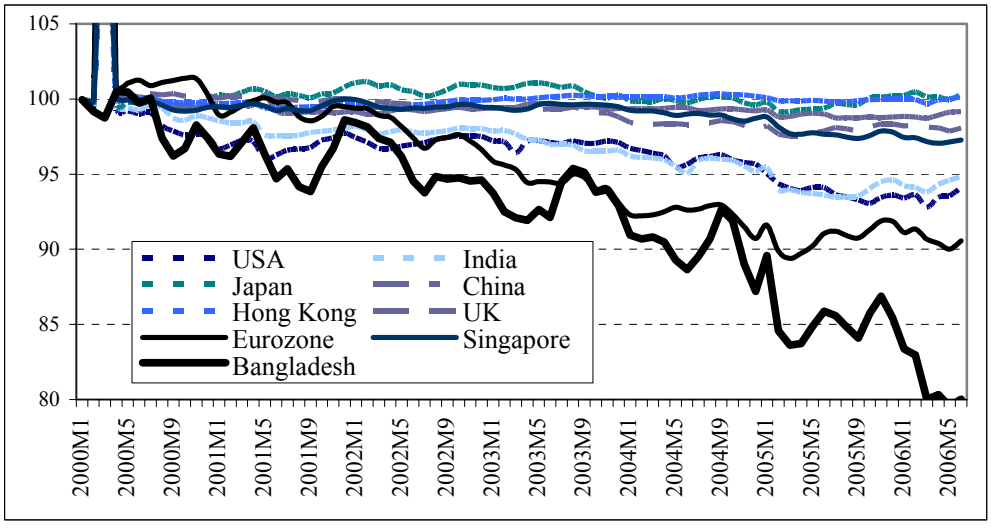
It is interesting to see that the REER (based on WPI) depreciated in line with the rising pattern of relative prices, implying that Bangladesh maintains competitiveness by offsetting price inflation (Figure 6). Comparing the patterns of the CPI-based REER and WPI-based REER, it may be concluded that WPI-based REER better predicts the competitiveness of Bangladesh. However, lack of WPI data after 2006 would be a big problem for further simulation.

Figure 5: CPI/WPI for selected countries (WPI: 2000=100)



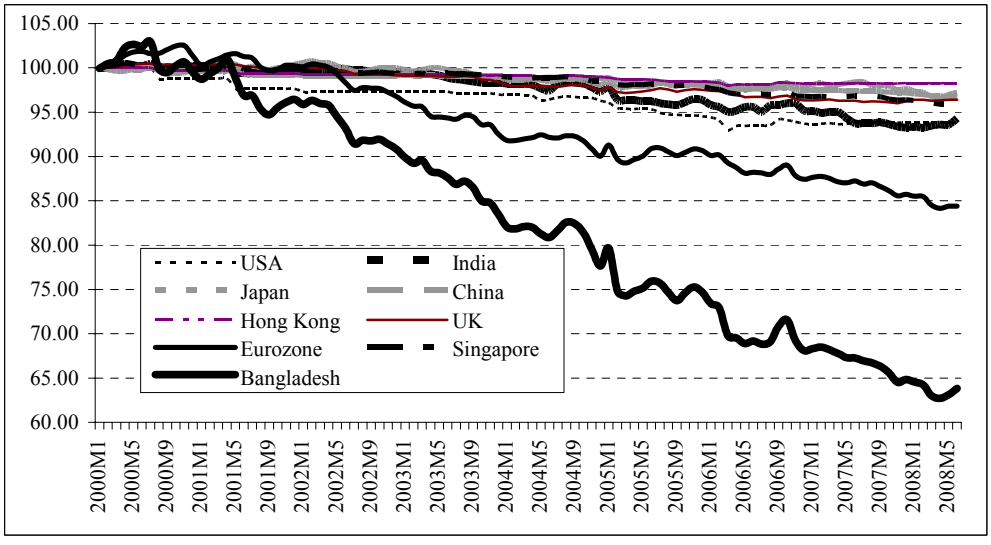
[3] WPI is available only up to May, 2006 with the base 1973. Here we calculate WPI considering the base period 2000 in order to make it consistent with the REER.

Figure 6: Bangladesh's aggregate and bilateral REERs based on WPI (a rise indicates real appreciation)



The behaviour of the nominal effective exchange rate (NEER) also shows the same depreciating but unstable trend (Figure 7). The NEER is a trade-weighted index without being adjusted for inflation. This index has particular importance in stabilizing the pace of competitiveness, especially when the currencies of the trading partners are more volatile.

Figure 7: Bangladesh's aggregate and bilateral NEERs (a rise indicates appreciation)



VIII. EQUILIBRIUM REER AND MISALIGNMENT

It is important to identify whether the actual real exchange rate is over or undervalued compared to the long-run equilibrium exchange rate[4]. We employ the behavioural equilibrium exchange rate (BEER) approach to estimate the long-run equilibrium real effective exchange rate with a view to estimating the actual over- or under valuation of exchange rate in terms of the macroeconomic fundamentals and to assess the appropriateness of current managed floating exchange rate regime in Bangladesh.

Following Clark and MacDonald (1998) and Baffes, Elbadawi and O'Connel (1999), a simple reduced form equation is examined:

$$Lreer_t = f\,(ltot_t,\ lnfa_t,\ rird_t,\ bd_t), \qquad (3)$$

where *lreer* is log of the real effective exchange rate of Bangladesh, *ltot* represents log of terms-of-trade of the country, *lnfa* represents net foreign assets to capture the effects of external resources balances on equilibrium, *rird* is the real interest rate differential with the trading partner countries, and *bd* is the budget deficit represents the fiscal balance of Bangladesh government. For the analysis, vector error correction model (VECM) has been used.

Quarterly data are used covering the period from 2000Q1 to 2008Q2. The terms-of-trade, defined as the relative price of exports to imports, has been calculated from the mirror data of trading partners using trade as weight. The net foreign assets have been taken as a proxy to capture the effect of capital account balance on the REER. Real interest rate differential has been calculated by deducting the US real interest rate from Bangladeshi real interest rate, where both real interest rates have been derived through subtracting respective inflation rate from nominal lending rate on advances. The fiscal balance of the government has been proxied by Bangladesh's fiscal deficit, expressed as a ratio of GDP. The data have been compiled from various issues of Economic Trends, Bangladesh Bank Quarterly and IMF's International Financial Statistics.

Estimation Results:

Before applying VECM, we need to confirm that all variables under consideration have to be integrated at order of one so that first difference of the variables should be stationary. To check the order of integration of the series, two well known unit-root tests, namely the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, have been employed. There seems to be a consensus in the cointegration literature that the PP test is preferable to ADF.

[4] Two approaches have been widely used to estimate equilibrium the real effective exchange rate (REER): the fundamental equilibrium exchange rate (FEER) and the behavioural equilibrium exchange rate (BEER). Generally two different sets of variables are used in estimating FEER and BEER (Clark and MacDonald, 1998). FEER models consider variables that affect the equilibrium current and capital account balances, such as real incomes of the domestic country and the partner countries. FEER also takes into account factors affecting national savings and investment. BEER, on the other hand, put emphasis on the variables of the macroeconomic fundamental such as terms-of-trade shocks, fiscal stance, real interest rate differential etc.

In Table 7 we report the ADF and PP test results to see the order of integration of the related variables[5].

Table 7: ADF and PP Tests for Unit Root[6]

Variables	ADF	PP	Variables	ADF	PP
lreer	-3.25**	-1.39	Δlreer	-6.53*	-6.93*
ltot	-2.25	-1.89	Δltot	-5.08*	-7.60*
lnfa	-3.35*	-2.20	Δlnfa	-3.52*	-3.69*
rird	-2.05	-1.97	Δrird	-3.07*	-2.88*
bd	-0.86	-1.52	Δdbd	-2.95*	-5.48*

Notes: 1. Δ implies first difference of the respective variables. 2. * and ** implies significant at 5 and 10 percent level respectively using MacKinnon critical Value.

In Table 7 the absolute values of ADF statistics on the level of variables, except *lreer* and *lnfa*, are smaller than that of the critical values implying that these variables are considered non-stationary. When first differences of these variables are considered, the test statistics on Δ*ltot*, Δrird and Δ*dbd*, exceed the critical values. Thus, *ltot*, rird, and *bd* are integrated of order one. In the case of *lreer* and *lnfa*, ADF statistics exceed the critical values implying that variables are stationary in their level. On the other hand, in case of Δ*lreer* and Δ*lnfa*, ADF statistics exceeded critical values. However, according to the PP test, all variables are found to be non-stationary at their levels and stationary at their first difference, which indicates that all variables are integrated at order one.

Table 8: Johansen Test for Cointegrating Rank

Maximum Rank	Trace Statistics	1% critical value
0	112.62	66.52
1	55.33	45.58
2	19.53	29.75
3	7.17	16.31
4	0.34	6.51

[5] A time series is integrated of order d [usually denoted as ~I(d)] with d is the number of times the series needs to be differenced in order to become stationary.

[6] ADF and PP tests for lreer, ltot, lnfa and rird are based on the inclusion of an intercept as well as a linear time trend However, since no clear trend was found for the Δrird, Δbd, Δlreer, Δltot, and Δlnfa and ADF and PP tests are performed without the trend term.

For the presence of cointegration between real effective exchange rate and the macroeconomic fundamentals, Johansen (1988) and Johansen and Juselius (1990) multivariate cointegration tests are performed. Four lags were selected for VAR following the Likelihood ratio statistic adjusted for degrees of freedom and Akaike *Information* Criterion (AIC). The result from the Johansen (1995) procedure to test for the existence and number of cointegrating equations is presented in Table 8. The Johansen's Trace test for the cointegrating rank from Table 8 evidenced that at least two significant cointegrating vectors exist in the system[7]. The presence of two cointegrating vector confirms the long-run relationship between the real effective exchange rate and macroeconomic fundamentals over the sample period 2000Q1-2008Q2.

Based on the estimated cointegrating vector, the long-run equilibrium equation can be written as:

$$lreer = 13.19 - 1.938\ ltot + 0.040\ lnfa - 0.012\ rird - 0.023\ bd - 0.006\ t \qquad (4)$$

s.e. (0.18) (0.010) (0.001) (0.002) (0.001)

where standard errors are given in parentheses. Most coefficients of the cointegrating vector are plausible in magnitude, statistically significant and correctly signed based on economic theory.

- Any improvements in terms of trade will have depreciating effect on the real effective exchange rate. A 1 percentage point increase in terms of trade is associated with 1.94 percentage point depreciation of the REER in the long-run.
- Increased net foreign assets will put pressure on the currency to appreciate and one percentage point increase in net foreign assets will cause 0.04 percentage point appreciation in the REER in the long-run.
- Real interest rate differential will worsen the exchange rate and 0.012 percentage point depreciation of REER will be associated with one percentage point improvement in real interest rate differential.
- As expected, Bangladesh's fiscal deficit as a ratio of GDP leads to depreciation of the REER and the magnitude of the depreciation in REER is 0.023 percentage point due to one percentage enhancement of budget deficit.
- As Montiel (1997) suggested, a time-trend is used to capture the impact of productivity growth, that is, the Balassa-Samuelson effect[8]. The effect contends that productivity improvements will, generally, concentrated in the tradable sector and thus lead to an appreciation. The sign of *t* is negative and significant, that is the productivity differential is negative, which implies a higher productivity for

[7] The presence of multiple cointegrating vectors makes it difficult to give an economic interpretation of the estimated relationships. Moreover, due to small sample size, we could not carry out the analysis with multiple cointegrating vectors.

[8] The Balassa-Samuelson effect can come from two sources: (1) Productivity differential between the domestic tradable and non-tradable sectors, and (ii) productivity growth differentials relative to trading partners.

tradable sectors that may contribute to the real appreciation. This confirms the Balassa-Samuelson effect.

- The estimated error correction term is found to be negative (-0.70) and significant. This implies that the speed of adjustment to the equilibrium is very high for each quarter, which is 70 percent.

Exchange Rate Misalignment

The estimated long-run relationship of the REER and macroeconomic fundamentals allow us to estimate the equilibrium REER from the VECM specifications. The long-run elasticities have been applied to the actual values of the macroeconomic fundamentals in a given period and a series of equilibrium exchange rates obtained. The overvaluation or undervaluation of the exchange rate can be assessed by deriving the equilibrium 'sustainable' real effective exchange rate and subtracting it from the actual real effective exchange rate. As sharp fluctuation in macroeconomic fundamentals is usual, equilibrium REER based on the actual values of macroeconomic fundamentals will also show sharp fluctuation. This leads us to estimate a 'sustainable' equilibrium REER, which gives an estimate of departure from actual REER in the medium-term framework. Sustainable values of the fundamentals have been derived through three quarterly moving averages.

Figure 8: Actual and equilibrium REER

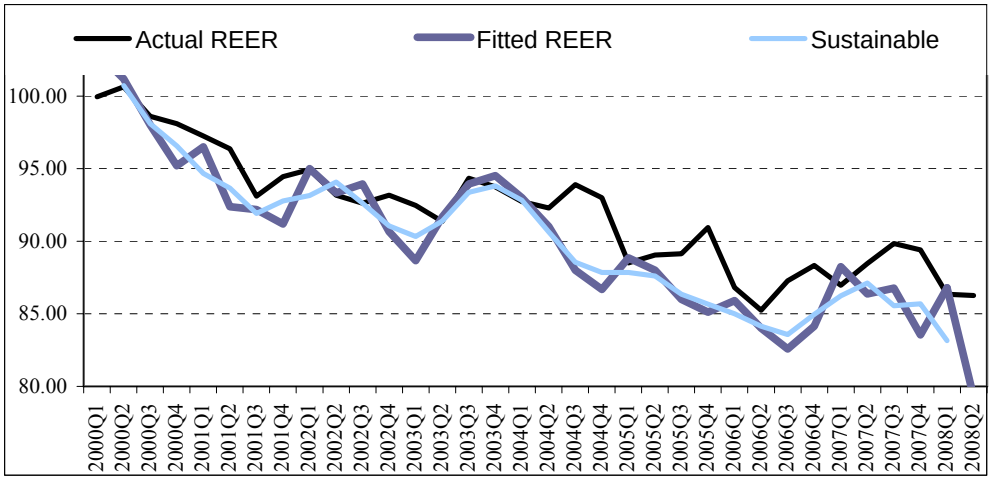


Table 9 and Figure 8 depict these real exchange rate and overvaluation of the taka. The observed real exchange rate seems to have been overvalued since 2004:Q2. For last two years from 2006, it appears that the REER remains overvalued on an average 3 percent. This indicates that the exchange rate remains very close to the equilibrium as warranted by the economic fundamentals. However, there were some scopes for depreciating the taka at around 3 percent.

Table 9: Exchange rate misalignment

Quarter	Actual REER	Fitted REER	Sustainable	Overvaluation* (%)
2000Q1	99.95	103.02		
2000Q2	100.63	101.19	100.72	-0.09
2000Q3	98.61	98.02	98.10	0.52
2000Q4	98.11	95.19	96.56	1.58
2001Q1	97.25	96.49	94.67	2.66
2001Q2	96.37	92.38	93.66	2.81
2001Q3	93.11	92.18	91.91	1.28
2001Q4	94.45	91.19	92.78	1.77
2002Q1	94.93	95.00	93.16	1.86
2002Q2	93.18	93.32	94.09	-0.97
2002Q3	92.63	93.95	92.63	0.00
2002Q4	93.17	90.65	91.06	2.26
2003Q1	92.47	88.66	90.32	2.33
2003Q2	91.37	91.67	91.40	-0.03
2003Q3	94.33	93.94	93.37	1.02
2003Q4	93.75	94.51	93.81	-0.06
2004Q1	92.72	92.99	92.82	-0.11
2004Q2	92.30	91.01	90.64	1.80
2004Q3	93.90	87.99	88.54	5.71
2004Q4	93.01	86.68	87.84	5.56
2005Q1	88.50	88.85	87.84	0.75
2005Q2	89.06	87.99	87.60	1.64
2005Q3	89.13	85.99	86.35	3.12
2005Q4	90.95	85.10	85.66	5.81
2006Q1	86.80	85.90	85.00	2.08
2006Q2	85.23	84.00	84.15	1.27
2006Q3	87.27	82.58	83.57	4.24
2006Q4	88.33	84.13	84.95	3.83
2007Q1	86.96	88.23	86.22	0.84
2007Q2	88.46	86.36	87.11	1.53
2007Q3	89.84	86.75	85.54	4.78
2007Q4	89.41	83.55	85.68	4.17
2008Q1	86.35	86.78	83.14	3.71

* Positive value represents overvaluation of the national currency

IX. REER VOLATILITY AND TRADE PERFORMANCE

In section VI we estimated the pass-through effect and found high exchange rate pass-through, implying that depreciation of taka may lead to a rise in inflation. In this section we attempt to examine the effect of real exchange rate volatility on exports. There are two primary determinants of export demand (Dornbusch, 1988; Hooper and Marquez, 1993). First, is the foreign income variable which measures the economic activity and the purchasing power of the trading partner country ("income effect"). Second, is the relative price or the terms to trade variable ("price effect"). Since real exchange rate volatility might have affected exports, exchange rate volatility is an additional factor that needs to be explicitly taken into account ("volatility effect"). Incorporating these determinants, we can derive a simple export demand function as follows:

$$x_t = \alpha_0 + \alpha_1\ y_t^{world} + \alpha_2\ p_t^{world} + \alpha_3\ V_t + \varepsilon_t \qquad (5)$$

where x_t is the natural logarithm of real export (total export is deflated by the export price index) of Bangladesh, y_t^{world} is the natural logarithm of the trade-weighted sum of the real GDP of eight key trading partners, p_t^{world} is the trade-weighted sum of terms of trade of key trade partners, V_t is the real exchange rate volatility measured as the two-quarter moving average standard deviation and ε_t is an error term. V_t is calculated as follows:

$$V_t = \left[\frac{1}{m}\sum_{i=1}^{m}\left(\ln REER_{t+i-1} - \ln REER_{t+i-2}\right)^2\right]^{1/2} \qquad (6)$$

Applying the Augmented Dickey-Fuller test, we find that all series, such as x_t, y_t, and p_t exhibit I(1) process except V_t which is I(0). Thus, we go for estimating cointegration equations considering V_t as exogenous variable. The results are shown in Table 10. To examine the impact of volatility, we estimate the short-term adjustment factors including REER volatility under the Vector Error Correction model. As apparels (Knit wear and Woven garments) constitutes major share of Bangladesh's export, we estimate separate cointegrating equations for Knit Wear and Woven for their main destinations, such as the USA and the EU (see Table A1 in the Appendix). Signs of the coefficients are consistent with the theoretical predictions. The volume of exports (imports) to a foreign country ought to increase as the real income of the trade partner (domestic country) rises, and vice-versa. So we expect $\alpha_1>0$. A rise (fall) in the terms of trade of a trade partner will cause the domestic goods to become less (more) competitive than foreign goods, therefore exports will fall (increase) and imports will rise (fall). So we expect $\alpha_2 < 0$.

Table 10 shows that overall exports from Bangladesh are inversely related to international prices and statistically significant, implying that price support is crucial for the export sector. Export of Knitwear and Woven garments constituted around 70 percent of total exports in 2007, of which 70 percent are exported to the US (23 percent) and EU market (47 percent). Estimating demand functions for knitwear and woven garments in the US and the EU market, we find significant impact of price and income on woven and knitwear exports respectively. As a result, woven exports have experienced sharper decline than knitwear in these markets in the later half of 2008 in the face of global economic recession. Although income is also found to be significant for export demand

of the USA and EU for knitwear and woven, exports of these items are expected to be less affected by the current global recession due to low income elasticity.

Although REER volatility has significantly positive effect on overall exports, the impact is very low (Table 11). The low magnitude of the coefficient of volatility indicates that the less the REER volatility, the more will be the positive impact on overall exports. This finding calls for the stabilization of the REER.

Table 10: Estimated Cointegrating Equations (quarterly data: 2000Q1-2008Q4)

A. Total export to world	$x^{total} = 49.91 + 1.69\ y^{world} - 13.32\ tot^{world}$		
	Std.error	(0.375)	(2.30)
	Chi-square	(1.69)	(9.60)***
B. USA Market	$x^{USA} = -0.07 + 0.02\ y^{USA} - 0.016\ tot^{USA}$		
	Std.error	(0.004)	(0.0008)
	Chi-square	(12.96)***	(1.20)
Knit Wear to USA	$x^{USA\text{-}knit} = -0.32 + 0.03\ y^{USA\text{-}knit} - 0.012\ tot^{USA\text{-}knit}$		
	Std.error	(0.006)	(0.01)
	Chi-square	(12.23)***	(1.20)
Woven to USA	$x^{USA\text{-}woven} = 0.05 + 0.01\ y^{USA\text{-}woven} - 0.02\ tot^{USA\text{-}woven}$		
	Std.error	(0.003)	(0.006)
	Chi-square	(9.67)***	(8.91)***
C. EU Market	$x^{EU} = 0.225 + 0.014\ y^{EU} - 0.057\ tot^{EU}$		
	Std. error	(0.0008)	(0.019)
	Chi-square	(9.88)***	(5.64)**
Knit Wear to EU	$x^{EU\text{-}knit} = -0.067 + 0.009\ y^{EU\text{-}knit} + 0.012\ tot^{EU\text{-}knit}$		
	Std.error	(0.006)	(0.016)
	Chi-square	(16.89)***	(0.53)
Woven to EU	$x^{EU\text{-}woven} = -0.22 + 0.002\ y^{EU\text{-}woven} - 0.06\ tot^{EU\text{-}woven}$		
	Std.error	(0.0008)	(0.02)
	Chi-square	(2.93)*	(6.15)***

Notes: 1. At most 1 cointegarting equation is significant at both 1% and 5 % level.

2. *, **, *** indicates 10%, 5% and 1% level of significance. Chi-square values are obtained by imposing cointegrating

restrictions on coefficients (Chi-square critical values: at 1percent = 6.63; at 5 percent

= 3.84; at 10 percent = 2.70)

Table 11: Short-term adjustment factors on export demand: Vector Error Correction Model estimates

	Total Export	EURO AREA			USA		
	Δx_t	Δx_t (Knit wear)	Δx_t (Woven)	Δx_t (Total export)	Δx_t (Knit wear)	Δx_t (Woven)	Δx_t (Total export)
Error Correction Term	-0.19 (0.22)	-0.80 (0.33)**	-0.91 (0.24)***	-0.7 (0.30)**	-2.17 (0.43)***	-1.71 (0.26)***	-1.54 (0.27)***
Δx_{t-1}	- 0.43 (0.21)**	-0.03 (0.24)	0.01 (0.21)	-0.19 (0.29)	0.90 (0.30)***	0.38 (0.23)	0.42 (0.22)*
Δx_{t-2}		-0.30 (0.24)	0.81 (0.21)***	0.20 (0.24)	0.37 (0.21)**	0.55 (0.15)***	0.43 (0.15)***
Δy_{t-1}	0.51 (3.13)	-0.18 (0.22)	-0.01 (0.004)**	-0.002 (0.005)	-0.12 (0.09)	-0.12 (0.04)***	-0.13 (0.05)**
Δy_{t-2}		-0.003 (0.006)	0.004 (0.005)	0.002 (0.005)	-0.13 (0.09)	-0.15 (0.04)***	-0.12 (0.05)**
Δtot_{t-1}	2.16 (2.44)	-0.02 (0.02)	0.007 (0.01)	0.04 (0.01)**	-0.02 (0.03)	-0.02 (0.02)	0.02 (0.02)
Δtot_{t-2}		0.06 (0.01)***	-0.02 (0.01)**	0.04 (0.01)**	0.006 (0.03)	0.05 (0.01)***	0.03 (0.02)**
Vol_reer	0.11 (0.04)**						
Vol_rer_USA					0.000006 (0.0005)	0.0002 (0.0002)	0.0003 (0.0002)
Vol_rer_EU		0.00007 (0.0001)	-0.0001 (0.0001)	0.0003 (0.0002)**			
Constant	-0.08 (0.06)	0.0002 (0.0005)	0.0002 (0.0004)	-0.0003 (0.0004)	0.001 (0.001)	0.001 (0.0002)***	0.001 (0.005)

Notes: Standard errors are in parenthesis. *, **, *** indicates 10%, 5% and 1% level of significance respectively.

X. POLICY RECOMMENDATIONS

It seems that currently exchange rates are managed on an ad-hoc basis without having clear targets or objectives. However, this management can be rated as good as the exchange rate remains very close to its equilibrium as warranted by economic fundamentals. Certainly there is scope to improve exchange rate management under a managed floating regime.

There are at least three channels identified in this study by which exchange rate instability is transmitted to the domestic economy.

(i) Pass-through (inflation) effect: A high pass-through coefficient is estimated for Bangladesh Taka. A one percent change in international prices translates almost 100 percent of that change into domestic prices. Since Bangladesh's trade is dominated by imports, a depreciation of taka easily translates inflation into the domestic economy. This high exchange rate pass-through is also likely to increase external debt burden.

(ii) Competitiveness effect: Although Bangladesh achieved average competitiveness during the period 2000-2008, it is not stable. Competitiveness against European markets is unstable, and since the overall REER moves in tandem with the real Euro, it is very likely that it would destabilize trade relations with other countries. Unstable euro already hurt exports to the European Union. Regarding the long-term determinants of the REER, an increase in net foreign assets leads to REER appreciation, that is, the loss of international price competitiveness. An improvement of terms of trade works in favor of REER depreciation because of the substitution effect due to increase in import prices.

(iii) Domestic credit effect: This is an indirect channel through which exchange rate is affected in Bangladesh. An increase in domestic credit causes the exchange rate to depreciate or the foreign reserves to deplete or some combination of the two, leading to exchange market pressure. It is observed that sterilized intervention causes extra pressure in the foreign exchange market.

Note that there is no simple formula for exchange rate management to achieve two important goals of exchange rate management, such as *competitiveness* and *price stability*, simultaneously (Ohno, 1999). In the absence of a solid consensus on the proper target of exchange rate management, we propose to adopt the following pragmatic policies:

Stabilization of REER: In normal times the exchange rate should be managed so as to stabilize overall competitiveness. For this purpose, the REER index, properly constructed to measure the average competitiveness of the tradable sectors, should be constantly monitored. Bilateral real exchange rate of Euro must be stabilized. To stabilize the REER as well as the RER of Euro, adjustments must be made against movements of other currencies as well as of inflation differentials. *This can be accomplished either by a prescribed formula or more informally through timely corrections.*

REER basket: Currently there are eight currencies in the REER basket. Since Bangladesh's commodity trade is dollar-denominated, *we propose to create a REER*

basket of four major currencies including the US dollar, the euro, the UK pound sterling and the Japanese yen with proper weights. This kind of basket would be easier to manage and monitor. Although trade with Japan is not significant, Japanese yen should be included because it matters for debt burden, official development assistance (ODA) and grants.

Crisis management: Bangladesh has not yet been faced any currency crisis, and therefore the capacity of exchange rate management has not been tested yet. With gradual economic development, shocks such as sudden shifts in FDI, export demand or the terms of trade, large business swings, significant resource discovery (or loss), major natural disasters etc. may occur. In that case *a trigger mechanism needs to be adopted for additional adjustments*. On the other hand, in the face of a currency attack or other severe financial turmoil in the region or in the global economy, REER stabilization policy may be suspended temporarily to minimize contagion, credit crunch, reversal of capital flows etc. However, *during a crisis or global economic meltdown, it is better to stabilize the NEER instead of the REER when other trading partner currencies are fluctuating against each other*.

Accumulation of Reserves: To maintain managed floats, Bangladesh needs to accumulate a sufficiently large stock of reserves. Has reserve accumulation already proceeded beyond the optimal point? The stock of international reserves stood at 7.48 billion US dollar in 2009, which can afford hardly 3.5 months' import payments. Since the standard practice is to maintain international reserve for 3-months import payments, current reserve position has met the necessary condition, but it is not sufficient. For maintaining stability in the foreign exchange market, it is necessary to accumulate additional reserves. In this context, the management of capital inflows is very important for avoiding any crisis. Since maintenance of large stocks of reserves is a costly activity, *exchange rate stabilization policies should be based on frequent and small adjustments rather than large and rare ones*.

Institutional Development: The foreign exchange market of Bangladesh is in an embryonic stage and thin in terms of daily transactions, which is USD 20 million on average. Currency forward market and other derivatives are absent. Bangladesh Bank still controls the market by following net open dollar position of commercial banks. However, if the economy embarks on a middle-income growth path, the market will need to expand and forward transactions will need to be entertained. *Therefore, to reap the maximum benefits of the managed floating regime, there is no alternative other than building institutions and bringing efficiency and depth to the foreign exchange market. Particularly, it is necessary to develop inter-bank bond markets as well as capital markets with further financial liberalization.*

XI. CONCLUDING REMARKS

This study analyzes exchange rate policies of Bangladesh under a floating rate regime in a comprehensive manner. It analyzes both the behaviour of the nominal exchange rate and the real exchange rate. Although Bangladesh was committed to maintain a freely floating regime, our findings suggest that its exchange rate policies were not consistent with the characteristics of freely floating regime. Generally speaking, Bangladesh pursues a managed floating rate regime. Given the *thin* foreign exchange market, high exchange rate pass-through and exchange rate shocks (exchange market pressure), it appears to be difficult for Bangladesh to maintain a freely floating regime.

This study finds that the REER depreciated around 20 percent from the year 2000 in an unstable fashion. One of the sources of REER instability is the real euro, which has served to destabilize trade relations with other major partners. This analysis suggests that the real exchange rate of euro should be stabilized. The estimated export demand functions reveal a positive and negligible but significant effect of REER volatility on exports, indicating that more positive impact of the REER on exports would have been achieved with a stable REER. The REER appears to have been slightly overvalued (on average 3 percent in each quarter) after 2004:Q2, which suggests that there was scope for depreciation if needed to boost the export sector.

Given the vulnerable financial system, this study suggests that it is better for Bangladesh to continue a managed floating regime with frequent and small interventions. Simultaneously, Bangladesh Bank needs to work on developing mechanisms for inflation targeting policies, ensuring efficiency in the financial system, and building necessary institutions in order to manage exchange rates efficiently. Maintaining short-term stability and medium-to-long term flexibility should be the general objective of exchange rate management policy of Bangladesh.

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Appendix:

Table A1: Exports of Bangladesh in major destinations (Percent)

Destinations	Category	2001	2002	2003	2004	2005	2006	2007
	Knit	32.35	33.65	35.04	36.42	36.75	38.27	31.49
	Woven	29.93	29.27	29.64	29.28	28.12	27.63	31.01
	Others	37.71	37.08	35.32	34.3	35.13	34.1	37.49
USA		**29.58 (100)**	**27.64 (100)**	**23.9 (100)**	**22.38 (100)**	**23.59 (100)**	**24.63 (100)**	**23.05 (100)**
	Knit	33.06	35.02	38.41	34.63	32.22	33.50	34.32
	Woven	52.43	50.65	49.54	50.00	53.84	54.20	54.14
	Others	14.54	14.33	12.09	15.42	13.95	12.30	11.50
UK		**8.48 (100)**	**9.77 (100)**	**9.7 (100)**	**11.2 (100)**	**9.36 (100)**	**9.06 (100)**	**9.13 (100)**
	Knit	38.21	39.20	37.22	38.30	42.52	38.52	41.84
	Woven	33.25	31.83	35.57	37.05	33.23	34.66	33.08
	Others	28.54	28.97	27.32	24.73	24.25	26.93	25.08
sEU		**41.58 (100)**	**43.11 (100)**	**47.19 (100)**	**51.22 (100)**	**46.83 (100)**	**46.67 (100)**	**46.55 (100)**
	Knit	43.84	46.97	48.40	51.19	53.60	55.17	56.41
	Woven	39.56	37.28	36.87	35.96	32.63	32.18	29.73
	Others	16.57	15.75	14.73	12.85	13.77	12.64	13.86
Rest of the World		**28.84 (100)**	**29.25 (100)**	**28.91 (100)**	**26.4 (100)**	**29.59 (100)**	**28.7 (100)**	**30.41 (100)**
	Knit	12.07	8.31	5.67	4.05	12.57	7.84	13.48
	Woven	0.17	0.48	0.07	0.15	4.39	0.91	4.31
	Others	87.76	92.17	94.22	95.80	83.00	91.32	82.18

Note: UK data is included in the EU figures. *Source:* Bangladesh Bank.

Table A2: Trade Weights used in the REER calculation

Country	Weights
China	0.0699
Singapore	0.085
India	0.1734
USA	0.2155
UK	0.0739
EU	0.2318
Hong Kong	0.0598
Japan	0.0906

Data Source: Bangladesh Bank; Younus (2009)