FACTORS AFFECTING THE FLUCTUATION IN EXCHANGE RATE OF THE BANGLADESH: A CO-INTEGRATION APPROACH

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ABSTRACT

This paper adopts an econometric analysis of determinants of exchange rate for US Dollar in terms of Bangladeshi currency within the framework of monetary approach. Monthly data from January 1984 to April 2012 for Bangladesh relative to USA have been used to examine the long run and short run behavior of BDT/USD exchange rate. The paper finds that real exchange rate and the macroeconomic variables affecting real exchange rate forms a cointegrating vector. Its observes that stock of money and increase in debt service burden results in a real depreciation of currency, while increasing foreign exchange reserve results in a real appreciation of currency. Moreover, Political instability has a significant negative effect on the value of domestic currency.

Introduction

Bangladesh is said to be a country with great potentials. Though many consider it over burdened with huge population, many other consider this population as asset. Talking the positive aspects, this population can easily contribute’s economic growth(rahman et al,2006).Talking about the negative aspects, this population requires a huge amount of daily necessities that may not be possible for Bangladesh to produce and thus they fare bound to go for foreign trade. Consequently, Bangladesh falls in victim of irrational exchange rate .Exchange rate, in its simplest sense can be defined as the ratio in which one country’s monetary value is converted to others. It is known that the higher the exchange rate, the poorer will be the condition of the importing country and vice versa. In such a case, there is no doubt to say that exchange rate has a direct impact on the economic growth of any country(rizzo,1998).In the perspective of Bangladesh, there are a large number of factors held responsible for increased exchange rate.

The exchange rate is defined as the domestic price of a unit of foreign currency. The behavior of exchange rate is one of the unsolved issues of research to be dealt with. For the gigantic significance of the exchange rate in an economy, no person can refute the importance to understand the foreign exchange markets behavior .So it is very important to study about the determinants of exchange rate as well as foreign exchange markets behavior in details. The Monetary Approach which was developed in early 1970’s is very important tool to explain the exchange rate variation .this paper focus on some questions solution like: What should be equilibrium exchange rate ? How exchange rate determined? Which factors determined the exchange rate? Estimation and forecasting of exchange rate poses substantial theoretical and experimental challenge.

Changes in exchange rate have pervasive effects, with consequences for prices, wages, interest rates, production levels, and employment opportunities. Fluctuations in the value of currencies of different economies have increased after the collapse of Bretton Woods System. Especially short term
variability has dramatically increased following the shift from fixed to flexible exchange rate in early 1970’s and there after. High volatility and sudden changes in exchange rate is one of the hurdles for the success of macroeconomic policy. A model with theoretical and empirical validity needs to be developed. Forecasting nominal exchange rates is a difficult task especially in a flexible exchange rate arrangement (Rogoff, 2009). Factors affecting exchange rate can be economic, political, psychological and also the short run or long run. Behavior of exchange rate may be more appropriately studied through macro variables and/ or micro variables.

The fluctuations of exchange rate have impact on the value of the global investment portfolios, competitiveness associated with export as well as imports, internationals reserve value, debt payments currency value, and cost for tourists in respect of own currencies values. Therefore, movements in the exchange rates have significant implications for business cycle of economy of a given country flows of trade and capital, so it is important to understanding the financial developments and variations in the economic policy. Timely forecasting of the exchange rate is able to give important information to the decision makers as well as partakers in the area of the internal finance, buy and sell, and policy making. However, the experimental literature be skeptical about the likelihood of forecasting exchange rates accurately (Dua and Ranjan, 2011). The market where foreign exchange transactions are taken place is the biggest as well the most liquid financial markets. The foreign exchange rate is one of the vital economic indicators in the global monetary markets. For the giant multinational business units, an accurate forecasting of the foreign exchange rates is crucial since it improves their overall profitability (Huang, et al., 2004). In the past, the foreign exchange rates were fixed with extremely a small number of short-term variations. Now-a-days, floating foreign exchange rates are prevailed in most of the countries. The recent financial turmoil all over the world demonstrates the urgency of perfect information of the foreign exchange rates (Shim, 2000).

It can be inferred from the various approaches/models and discussions in prior studies, that the behavior of exchange rate is a complex issue having many dimensions. Research work based on balance of payment approach rests mainly on elasticity approach or absorption approach. Whereas research based on monetary approach uses purchasing power parity condition, Quantity theory of money (QTM), Interest rates parity, money demand function and cumulative current account position to examine the exchange rate behavior. In the early 1980’s, it appeared certain that empirical research has not founded support in favor of monetary approach to exchange rate. However, due to the advancement in the econometric techniques, statistical tools and model specifications, recent empirical research has provided supportive evidence for the long run validity of monetary approach (Wilson, 2009). This study has been organized as follows; Section 2 presents a brief history of Exchange rate system for Bangladeshi taka. Detailed summary of various theoretical and empirical research is given in section 3. Section 4 describes data and methodology used for empirical estimations of the factors affecting foreign exchange rates in Bangladesh. The results of the empirical estimations are presented and discussed in section 5. Section 6 concludes the study with policy recommendations and implications for further research.

2. Brief History of Exchange Rate System for Bangladeshi taka

The currency of Bangladesh is Bangladesh Taka (Tk), which was created to replace the Pakistan Rupee in January 1972. Before 1983, the Taka was linked to Pound Sterling. The exchange rates for currencies other than Sterling are based on the London market rates for the currencies concerned. Started from January 1983, however, its intervention currency was changed to the U.S. Dollar. Whatever the case may be, different countries adopt different exchange rate policies. Bangladesh, the focus of this paper, had a fixed exchange rate system in place since January, 3 1972. Bangladesh pursued a ‘fixed exchange rate’ regime upto 1979. After that, from 1979 to mid-2003, it followed a managed floating...
exchange rate system. Repeated depression of the home money, for maintaining a steady real exchange rate as well as keeping away from overvaluation of the local taka, were the prime factors for taking new system of the foreign exchange system. From May, 2003, Bangladesh took almost a new policy known as ‘clean floating’ exchange rate policy by creating fully convertible current account. But capital account convertibility is not yet done. The main reasons for all the policies that Bangladesh took were due to improve export situation, decrease import liability with the aim of improving balance of trade.

Since then. Dr. Mirza Azizul Islam, the former advisor, Ministry of Finance of the Caretaker Government of Bangladesh, presented a paper in January 2003, right before the shift from fixed to floating regime, explaining the overall performance of the fixed regime and the probable implications of the floating regime on Bangladesh economy. He suggested that the experiences of other countries in the region show that floating regime generates greater volatility in exchange rates and this sort of uncertainty is likely to affect adversely the overall trade and investment climate which is already afflicted by many unfavorable elements in Bangladesh (See Islam, 2003).

3. Literature review

Recent years, particularly in the context of globalization and currency crises have seen a main issues relating to the exchange rate regime. Which is evident in large and growing body of theoretical and empirical literature on exchange rate determination? The review of literature in the context of developing countries is related by and large to the empirical body of research devoted to testing the applicability of the purchasing power parity [PPP] concept for exchange rate determination. Recently the literature on foreign exchange rate determination emphasized a monetarist approach with most of its versions assuming strict [PPP]. Many theoretical and empirical studies have been undertaken to assess the foreign exchange rate determination.

Before exploring new phenomena, it is necessary to look into various aspects already studied. As research is a continuous process and it must have some continuity with earlier facts. The knowledge gathered in the past should be consolidated to keep it on record for future use. It is like consulting attempts to present a review of some of the important research findings relevant to the objective of present study.

MacDonald and Taylor (1984, 1993, 1994) estimated and tested the forecasting performance of unrestricted monetary model and random walk model for US Dollar and British Pound. Estimated results of study are supportive of unrestricted monetary model as compared to random walk result. Siddiqui et al (1996) estimate the determinants of real exchange rate for Bangladesh and find that increase in governmental expenditures leads to depreciation in real exchange rate. Coefficient of terms of trade (TOT) is positive and statistically insignificant. Excess domestic credit creation significantly contributes to real exchange rate appreciation. Openness has also contributed towards appreciation in exchange rate. Technological progress has negative sign but statistically insignificant. Both monetary variables and real sector variables have significant effect on the equilibrium path determination of Real Exchange Rate. Reinton and Ongen (1999) used structural exchange rate models to study the Norwegian currency market. Empirical results of flexible and sticky price monetary models show that the error correction equation incorporating long run proportionality between exchange rates and money and money growth differentials will outperform random walk currency prediction in significant manner. Monetary exchange rate models outperform the random walk model at 6 and 12 months horizons by using Norwegian Krone against four major currencies exchange rate from 1986-96. Bahmani and Kara (2000) examined the case of exchange rate overshooting in Turkey using monthly data ranging from January 1987 to December 1998 for Turkish Lira per unit of US Dollar exchange rate.

Empirical estimates support the overshooting hypothesis in the short run. Sign of change in real income is negative which indicates the relative growth in the real income in Turkey relative to USA appreciates Lira.

Several studies have attempted to analyse 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 analysing 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 nontradable. Interest rate differential and inflation differential has correct signs and are statistically significant. Papadopoulos and Zis (2000) study the determination of exchange rate by estimating Drachma/ECU rate applying co-integration technique, Impulse response and Variance decomposition analysis with monthly data from 1980 to 1991. Exchange rate variation appears to be dominated mainly by money and interest rate innovations. Fullerton et al (2001) test set of error correction model for Peso/Dollar rate based on balance of payment approach and monetary approach using annual data from 1976 to 2000. Estimated results show that an error correction technique is not an appropriate technique for Mexico when data frequency is annual. Karfakis (2003) tests the monetary model for Romanian Lei and US Dollar exchange rate and concludes that Money is positively related with the exchange rate. Increase in money is the source of depreciation in the domestic currency. Renu Kohli (2002): In her paper tests for mean-reversion in real exchange rate for India during the recent float period. She find evidence of mean-reversion in real exchange rate series constructed with the consumer price index as deflator, as well as for a series constructed using the ratio of wholesale and consumer price indexes to proxy for shares of tradable and non-tradable goods. Prior to adopting floating exchange rate regime, Islam (2003) argued 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. Estimated coefficients of rates of interest, government expenditure and deficit to GDP are negatively related with effective exchange rate. Liew et al (2009) examine the behavior of Baht (Thailand) and Yen (Japanese Currency) exchange rate with in the context of flexible price monetary model. Empirical findings of the study suggest that exchange rate is effectively determined by flexible price monetary model. Hsieh (2009) has studied the behavior of Indonesian Rupiah per unit of US Dollar. Results of extended Mundell-Fleming model of exchange rate determination indicate that relatively more real money aggregate, a relatively higher domestic interest rate, or a relatively more expected inflation rate causes real depreciation for Indonesian Rupiah. Higher ratio of governmental spending to GDP or higher stock prices lead to real appreciation in IDR/USD exchange rate. Egert (2010) examines the behavior of South African Rand against US Dollar using data from January 2001 to July 2007, finding four factors affecting South Africa's exchange rate returns in South Africa including non linear monetary equilibrium mean reversion property, changes in gold prices, general risk perception of the market and innovations in exchange rate of Dollar and Euro. Kumar (2010) examines the real exchange rate determination of India Rupee and finds the existence of long run relationship. Moura (2010) tested a model of economies of Chile, Mexico, Peru, Brazil and Colombia currencies incorporating the concept of endogenous monetary policy to forecast using Taylor rule reaction function. Rate of interest responds positively to lags of interest, the GDP gaps, and relative rate of increase in price and target inflation.

Summing up the review of literature it is obvious that international evidence in support of monetary approach has increased over time with the increase in
the availability of data, improved econometric techniques and advancement in model specifications. Despite the fact of an increasing support of monetary model, still it cannot be claimed out right superiority over other approaches to explain the behavior of exchange rates.

4. Methodology

The objective of this section is to present an overview of some of the most relevant models of real exchange rate determination. This study covers the period of managed floating or flexible exchange rate arrangement of Bangladesh, but we are using monthly time series data from January 1984 to April 2012 to examine the behavior of BDT/USD exchange rate and relationship of exchange rate behavior with relative monetary variables. Data have been obtained from International Financial Statistics (IFS), Handbook of statistics published by Bangladesh Bureau of Statistics (BBS), Government of Bangladesh, Central Bank of Bangladesh (Bangladesh Bank) and US Treasury Direct Website of Government of United States. The variables used are the stock of money, foreign exchange reserves and total debt of Bangladesh relative to United States as determinants of BDT/USD exchange rate. Moreover, a dummy variable representing Political Instability in Bangladesh as the determinant of nominal exchange rate of Bangladeshi Taka against US Dollar has also been incorporated.

\[ EX = \alpha_0 + \alpha_1 (m_s - m^*_s) + \alpha_2 (r_s - r^*_s) + \alpha_3 (d_d - d^*_d) + PI + \epsilon_t \]  

Variables with star (*) are related to United States of America and without star represent the corresponding variables relating to Bangladesh. The dependent variable is nominal bilateral exchange rate expressed as ratio of Bangladeshi Taka per unit of US Dollar. First determinant of exchange rate is the stock of relative nominal money of the respective country measured in terms of the respective country’s currency. Second explanatory variable is the natural log of relative foreign exchange reserve measured in terms of US Dollar for both countries. Third determinant of exchange rate is relative country’s total domestic and foreign debt measured in terms of the respective country’s currency. To capture the effect of non monetary factors on exchange rate, a dummy variable for political instability has been used as fourth determinant. An error term to imprison the random variation in exchange rate behavior is also used.

The classical regression model requires that the dependent and independent variables in a regression be stationary in order to avoid the problem of what Granger and Newbold (1974) called “spurious regression” characterized by a high R2, significant t-statistics but results that are without economic meaning. A stationary series exhibits mean reversion, has a finite time invariant variance and a finite covariance between two values that depends only on their distance apart in time, not on their absolute location in time. If the characteristics of the stochastic process that generated a time series change over time, i.e. if the series is nonstationary, it becomes difficult to represent it over past and future intervals of time by a simple algebraic model. Thus the first econometric exercise is to test if all the series are nonstationary or have a unit root.

To test the stationarity of variables, Augmented Dickey Fuller (ADF) test is used. Autoregressive distributive lag (ARDL) approach to co-integration has been applied to estimate the long run relationship between the nominal BDT/USD exchange rate and explanatory variables. To estimate short run dynamics relating to the macro economic variables and nominal exchange rate, error correction mechanism (ECM) has also been employed.

The variables exchange rate, relative money, relative foreign exchange reserve, relative debt and political instability in Error correction version of ARDL model is as follows:

\[ EX = \alpha_0 + \alpha_1 (m_s - m^*_s) + \alpha_2 (r_s - r^*_s) + \alpha_3 (d_d - d^*_d) + PI + \epsilon_t \]

\[ \Delta EX_t = \alpha_0 + \Sigma \beta_1 \Delta E x_{t-1} + \Sigma \beta_2 \Delta (m_s - m^*_s)_{t-1} + \Sigma \beta_3 \Delta (r_s - r^*_s)_{t-1} + \Sigma \beta_4 \Delta (d_d - d^*_d)_{t-1} + \]

Variables exchange rate, relative money, relative foreign exchange reserve, relative debt and political instability in Error correction version of ARDL model is as follows:
At first we will check the result for the existence of co-integration then we should go to next step for estimate the coefficients and testing of their significance.

\[
\begin{align*}
\partial_1Ex_{t-1} + \partial_2(m_s - m_s^*)_{t-1} + \partial_3(r_x - r_x^*)_{t-1} + \\
\partial_4(d_d-d_d^*)_{t-1} + \partial_5PI + \epsilon_t
\end{align*}
\]

(3)

\[
\begin{align*}
\Delta(m_{s} - m_{s}^*)_t = + \Sigma \beta_{1}\Delta(m_{s} - m_{s}^*)_{t-1} + \\
\Sigma \beta_{2}\Delta\Delta r_{x}(r_{x} - r_{x}^*)_t + \\
\Sigma \beta_{3}\Delta\Delta d_{d}(d_{d} - d_{d}^*)_t + \partial_1(m_{s} - m_{s}^*)_{t-1} + \partial_2Ex_{t-1} + \\
\partial_3(r_x - r_x^*)_{t-1} + \partial_4(d_d-d_d^*)_{t-1} + \partial_5PI + \epsilon_t
\end{align*}
\]

(4)

\[
\begin{align*}
\Delta(r_x - r_x^*)_t = a_0 + \Sigma \beta_{1}\Delta(m_{s} - m_{s}^*)_{t-1} + \\
\Sigma \beta_{2}\Delta\Delta r_{x}(r_{x} - r_{x}^*)_t + \\
\Sigma \beta_{3}\Delta\Delta d_{d}(d_{d} - d_{d}^*)_t + \partial_1(m_{s} - m_{s}^*)_{t-1} + \partial_2Ex_{t-1} + \\
\partial_3(r_x - r_x^*)_{t-1} + \partial_4(d_d-d_d^*)_{t-1} + \partial_5PI + \epsilon_t
\end{align*}
\]

(5)

\[
\begin{align*}
\Delta(d_d-d_d^*)_t = a_0 + \Sigma \beta_{1}\Delta(m_{s} - m_{s}^*)_{t-1} + \\
\Sigma \beta_{2}\Delta\Delta r_{x}(r_{x} - r_{x}^*)_t + \\
\Sigma \beta_{3}\Delta\Delta d_{d}(d_{d} - d_{d}^*)_t + \partial_1(m_{s} - m_{s}^*)_{t-1} + \partial_2Ex_{t-1} + \\
\partial_3(r_x - r_x^*)_{t-1} + \partial_4(d_d-d_d^*)_{t-1} + \partial_5PI + \epsilon_t
\end{align*}
\]

(6)

Hypothesis testing for non existence of long run relationship

\[
\begin{align*}
H_{0}: \partial_1 = 0, \partial_2 = 0, \partial_3 = 0, \partial_4 = 0, \partial_5 = 0 \\
H_{a}: \partial_1 \neq 0, \partial_2 \neq 0, \partial_3 \neq 0, \partial_4 \neq 0, \partial_5 \neq 0
\end{align*}
\]

At first we will check the result for the existence of co-integration then we should go to next step for estimate the coefficients and testing of their significance.

For the selecting of optimal lag order we will use AIC model selection criterion. After selecting optimal lag, long run ARDL model and error correction representation of ARDL model is estimated.

The long run ARDL \((p, q_1, q_2------qn)\) equation is as follows:

\[
\begin{align*}
EX_t = \partial_0 + \Sigma \partial_1 Ex_{t-p} + \Sigma \partial_2(m_{s} - m_{s}^*)_{t-q_1} + \\
\Sigma \partial_3(r_x - r_x^*)_{t-q_2} + \Sigma \partial_4 d_{d}(d_{d} - d_{d}^*)_{t-q_3} + \partial_5PI + \epsilon_t
\end{align*}
\]

(7)

Long run error correction model is as follows:

\[
\begin{align*}
\Delta Ex_t = a_0 + \Sigma \beta_{1}\Delta Ex_{t-1} + \Sigma \beta_{2}\Delta(m_{s} - m_{s}^*)_{t-j} + \\
\Sigma \beta_{3}\Delta(r_x - r_x^*)_{t-k} + \Sigma \beta_{4}\Delta(d_{d} - d_{d}^*)_{t-l} + \Delta PI + \epsilon_t
\end{align*}
\]

(8)

The hypotheses have tested as following way:

1. The exchange rate and increasing in relative money supply are positively related, i.e. \(H_{0} \leq 0, \ H_{a} > 0\). Relative in domestic country debt to foreign country debt is positively related to the exchange rates i.e. \(H_{0} \leq 0, \ H_{a} > 0\).
2. The exchange rates and relative increase in the balance of foreign reserves are negatively related i.e. \(H_{0} \geq 0, \ H_{a} < 0\).
3. The effect of political instability on exchange rates i.e. \(H_{0} = 0, \ H_{a} \neq 0\).
5. Results

Time Series Properties of Variables

First we present the test results to determine whether the variables in the model can be represented as stationary or non-stationary processes.

The calculated ADF test results on data series are reproduce below:

Augmented Ducky-Fullar Test result

Table 1: Results of ADF Unit root test at level

<table>
<thead>
<tr>
<th>Variables</th>
<th>Without Trend</th>
<th>With trend</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange Rate</td>
<td>-1.1280</td>
<td>-2.0543</td>
<td>Non Stationary</td>
</tr>
<tr>
<td>Relative money</td>
<td>-0.5426</td>
<td>-2.5674</td>
<td>Non Stationary</td>
</tr>
<tr>
<td>Relative Fx Reserve</td>
<td>-1.9612</td>
<td>-2.7658</td>
<td>Non Stationary</td>
</tr>
<tr>
<td>Relative Debt</td>
<td>-0.9705</td>
<td>-1.8965</td>
<td>Non Stationary</td>
</tr>
</tbody>
</table>

All the variables are non stationary at level and become stationary at the first difference. Tables 1 and 2 report the results of the time series properties of the variables. At level the calculated values of ADF test statistics with constant & without trend and with constant & with trend are less than critical value at 5% significance level.

Critical value for the ADF test statistic with constant but not a Trend = -2.8703 (At 95% confidence level)

Critical value for the ADF test statistic with constant and Trend = -3.4248 (At 95% confidence level)

Table 2: Results of ADF Unit root test at First Difference level

<table>
<thead>
<tr>
<th>Variables</th>
<th>Without Trend</th>
<th>With trend</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange Rate</td>
<td>-8.598</td>
<td>-8.77453</td>
<td>Stationary</td>
</tr>
<tr>
<td>Relative money</td>
<td>-10.0548</td>
<td>-10.0223</td>
<td>Stationary</td>
</tr>
<tr>
<td>Relative Fx Reserve</td>
<td>-11.5893</td>
<td>-11.6523</td>
<td>Stationary</td>
</tr>
<tr>
<td>Relative Debt</td>
<td>-14.5762</td>
<td>-14.5267</td>
<td>Stationary</td>
</tr>
</tbody>
</table>

Critical value for the ADF test statistic with constant but not a Trend = -2.8703 (At 95% confidence level)

Critical value for the ADF test statistic with constant and Trend = -3.4248 (At 95% confidence level).
Estimating the long-run Relationship

After identifying the unit root testing, now we can check the existence of long run relationship through the conditional F-test. The error correction version of ARDL model has been estimated for the test the presence of long run relationship between nominal exchange rate and relative stock of money, relative foreign exchange reserve and relative debt.

ARDL bound testing approach to co-integration results of the F-statistics are reported in table3. With two lags, there is an evidence for the existence of co-integration as the calculated value of F-test is 4.8506 obtained by using variable addition test which is greater than upper bound of critical value as calculated by Pesaran et al(1997). An alternative hypothesis of existence of long-run co-integration is accepted against the null hypothesis is no co-integration. ARDL bound testing approach to co-integration provides an evidence for existence of long-run relationship between the monetary variables(relative stock of money, relative foreign exchange reserve and relative debt) and nominal BDT/DOLLAR exchange rate. The results indicates in all other cases there in no long-run relationship among the variables which implies that there is no co-integrating relationship when the relative money or relative foreign exchange reserve or relative debt is used as a dependent variable.

Table3: Results of Bound Testing Approach to Co-integration

<table>
<thead>
<tr>
<th>Dependent and independent variables</th>
<th>AIC Lags</th>
<th>F-Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ F(Ex</td>
<td>m_s - m_0^<em>, r_x - r_0^</em>, d_a - d_0^*) ]</td>
<td>2</td>
</tr>
<tr>
<td>[ F(m_s - m_0^<em>, Ex, r_x - r_0^</em>, d_a - d_0^*) ]</td>
<td>2</td>
<td>2.0134</td>
</tr>
<tr>
<td>[ F(r - r_0^<em>), Ex, m_s - m_0^</em>, d_a - d_0^* ]</td>
<td>2</td>
<td>2.2315</td>
</tr>
<tr>
<td>[ F(d_a - d_0^*)</td>
<td>Ex, m_s - m_0^<em>, r_x - r_0^</em> ]</td>
<td>2</td>
</tr>
</tbody>
</table>

Critical values for F-statistic at 95% 3.219 - 4.378
Critical values for F-statistic at 90% 2.711 - 3.800

The following table 4 shows that the results of bound testing approach to co-integration when variable of political instability is added to other macro economic variables as a determinant of nominal exchange rate. Results of conditional F-test indicate that evidence of the existence of long run relationship is further improved. Co-integration between the macro economic variables and political instability with the nominal exchange rate exists in case of Bangladesh. When exchange rate is used as dependent variable with 2 lags of all the variables, the calculated value of the F-statistic is 10.3754, which is greater than upper bound critical value at 95% level of confidence, so no co-integration relationship is not accepted.
Table 4: Results of Bound Testing Approach to Co-integration with Political instability

<table>
<thead>
<tr>
<th>Dependent and Independent variables</th>
<th>AIC lags</th>
<th>F-Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>$F(Ex</td>
<td>m_s - m_s^<em>, r_x - r_x^</em>, d_d - d_d^*, PL))$</td>
<td>2</td>
</tr>
<tr>
<td>$F(m_s - m_s^<em>, Ex, r_x - r_x^</em>, d_d - d_d^*, PL)$</td>
<td>2</td>
<td>1.3753</td>
</tr>
<tr>
<td>$F(r_x - r_x^<em>, Ex, m_s - m_s^</em>, d_d - d_d^*, PL)$</td>
<td>2</td>
<td>1.96722</td>
</tr>
<tr>
<td>$F(d_d - d_d^*)</td>
<td>Ex, m_s - m_s^<em>, r_x - r_x^</em>, PL)$</td>
<td>2</td>
</tr>
</tbody>
</table>

Critical values for F-statistic at 95% 2.850 - 4.049
Critical values for F-statistic at 90% 2.425 - 3.574

After getting the evidence for the existence of long-run relationship among the variables in first stage, the estimates have been obtained in the 2nd stage. Table 5 describes the results of ARDL model (2, 1, 0, 0) based on Akaike information criterion with maximum two lag length.

Exchange rate coefficient is significant at first lag but insignificant at second lag, while the relative stock of money coefficient is positive and significant at first lag which indicates that there is a lagging effect of the increase in the money supply immediately. The relative foreign exchange reserve coefficient is negative and significant in its relation to nominal exchange rate.

Table 5: Autoregressive Distributive Lag Estimates

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficients</th>
<th>Standard error</th>
<th>T-Ratio(Prob)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.28358</td>
<td>0.04782</td>
<td>3.1967(0.002)</td>
</tr>
<tr>
<td>Ex(-1)</td>
<td>1.41053</td>
<td>0.04827</td>
<td>25.7853(0.000)</td>
</tr>
<tr>
<td>Ex(-2)</td>
<td>-0.29857</td>
<td>0.4978</td>
<td>-8.0924(0.2814)</td>
</tr>
<tr>
<td>(m_s-m_s^*)</td>
<td>-0.06783</td>
<td>0.06538</td>
<td>-1.7853(0.132)</td>
</tr>
</tbody>
</table>

Coefficient of exchange rate at first lag is significant but insignificant at second lag while Coefficient of relative stock of money at first lag is positive and significant. Which indicates that Coefficient of the relative foreign exchange reserve is negative and significant in its relation to nominal exchange rate. Coefficient of relative debt is positive and significant at 95% level of confidence while coefficient of political instability is positive and significant suggesting that with an increase in the political instability, exchange rate increases.
Results of the estimated long run coefficients using ARDL Model (2, 1, 0, 0) selected based on Akaike Information Criterion are reported in Table 6. Long run determinants of the nominal exchange rate include the relative stock of money, relative debt and relative foreign exchange reserve. The results show that 1% increase in the relative stock of money in terms of respective country currencies causes 0.5274% increase in the nominal exchange rate. Evidence for the proportionate increase in the exchange rate and money increase is not found. As per empirical estimates, 1% increase in the relative balance of foreign exchange reserve (measured in terms of US Dollar) causes a decrease of 0.0975% in the bilateral nominal exchange rate between Bangladeshi taka (BDT) and US Dollar (USD). Results confirm that there is significant association between relative foreign exchange reserve balance and value of the exchange rate. One % increase in the relative debt will cause 0.6095% increase in the nominal bilateral exchange rate which is supportive of the portfolio balance approach to exchange rate determination. Political disturbance has caused an increase in the exchange rate by 25% against the benchmark category. This is an evidence of how significantly related the political disturbances are for foreign exchange markets. Especially for a developing country like Bangladesh, non economic factors may have more significant effect on exchange rate determination. Fluctuations in both the monetary factors and non economic factors cause fluctuations in exchange rates.

TABLE 6: Estimated Long Run Coefficients using the ARDL Approach

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>T-Ratio(Prob)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>5.0275</td>
<td>0.062853</td>
<td>85.86293(0.0001)</td>
</tr>
<tr>
<td>(m_x - m^*_x)</td>
<td>0.5274</td>
<td>0.074837</td>
<td>6.876394(0.0000)</td>
</tr>
<tr>
<td>(r_x - r^*_x)</td>
<td>-0.0975</td>
<td>0.028637</td>
<td>-4.068246(0.003)</td>
</tr>
<tr>
<td>(d_a - d^*_a)</td>
<td>0.6095</td>
<td>0.165383</td>
<td>5.068326(0.0001)</td>
</tr>
<tr>
<td>PI</td>
<td>0.2538</td>
<td>0.186353</td>
<td>3.738474(0.008)</td>
</tr>
</tbody>
</table>

Summing up the empirical results, it can be inferred that there is reasonable evidence depicting both long-run and short-run relationship between the monetary variables and exchange rate in case of Bangladesh. Disequilibrium in
exchange rate converges towards equilibrium in long-run. Non-economic factors like Political Instability also negatively affect the value of Bangladeshi currency (Taka).

6. Concluding Remarks

The empirical results of present study carry the role of economic and non-economic factors in the determination of exchange rate in Bangladesh. Relative stock of money and debt are positively and significantly affect the exchange rate. Relative foreign exchange reserve is negatively and significantly correlated to exchange rate. Political instability negatively influences the value of currencies in case of Bangladesh. Empirical results show that exchange rate is strongly associated with ratio stock of nominal money of respective currencies. Increase in the relative debt is another important source affecting nominal exchange rate. Borrowing of the government from domestic and foreign sources has been one of the major causes of depreciation in the Bangladesh Taka against US Dollar. Government borrows to finance budget deficits, balance of payment deficits and development projects. All those policy measures aiming at decreasing these deficits will decrease the need for borrowing and will help in maintaining stability in the value of currency. To make best use of available limited funds for the private sector target, credit policy should be implemented in addition to increase in the availability of funds for private sector business needs. The export oriented sector should be financed on priority basis. Debt retirement should be planned out and burden of debt should be reduced. Foreign exchange reserve position is also significantly related with the behavior of exchange rate. Measures to reduce balance of trade deficit and current account deficit are required. To keep the foreign exchange rate stable, the macroeconomic environment must be conducive to maintain relatively stable price levels. Fiscal and monetary discipline is an essential precondition for price level stability. Independent and professional behavior of Central Bank of Bangladesh (Bangladesh Bank) is very vital in order to create an environment conducive for the price level and exchange rate stability. The political stability ensures commitment toward the consistent policies. To sum up the analysis, it can be concluded that exchange rate behavior significantly depends upon the macro or monetary fundamentals of the respective countries. There is a strong relation between the ratio of financial assets (money stock, foreign exchange reserves and debt) of Bangladesh relative to United States and bilateral nominal BDT/USD exchange rate. Changes in these financial assets cause changes in the exchange rate. A well thought fiscal and monetary policy along with political stability is needed to maintain the exchange rate and macroeconomic stability in Bangladesh.

Given the vulnerable financial system, we suggest 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. To conclude, maintaining short-term stability and medium-to-long term flexibility should be the general objective of exchange rate determination policies in Bangladesh.

References

22. A.K.M Atiqr Rahman, S. Real exchange rate behavior and exchange rate Misalignments in Bangladesh: A single equation Approach