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Relation between Foreign Currency Borrowings and Foreign Exchange Rate Volatility: Evidence from Bangladesh Economy

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Relation between Foreign Currency Borrowings and Foreign Exchange Rate Volatility: Evidence from Bangladesh Economy

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Abstract:

Borrowing foreign currency from sources abroad has been a relatively new concept in the private sector of Bangladesh. The major advantage of external commercial borrowing is the lower borrowing cost in the international financial markets compared with the prevailing domestic market. On the other hand, the government of Bangladesh has recently borrowed a large amount of foreign currency to finance large projects. We empirically analyze different aspects of the effect of foreign currency borrowing on exchange rate volatility in the Bangladesh economy using quarterly time series data. Since Bangladesh is an import-based country, exchange rate volatility can exert a great pressure on living standards by increasing the price of imported consumer products. Our analysis using VECM found that both government and private borrowing of foreign currency are cointegrated in the long run with the volatility of the exchange rate, but only the coefficients of government foreign currency borrowing are significant in the short run. However, in the OLS results, both government foreign debt and private foreign debt had a significant effect on exchange rate volatility. Our results suggest that measures to control government debt would be more effective in moderating foreign currency volatility than measures affecting private borrowing.

Keywords: Foreign Exchange rate; foreign currency debt; VECM.

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Introduction:

Borrowing from foreign sources is a relatively new concept in the private sector of Bangladesh. Foreign loans are extremely cost-effective for entrepreneurs. According to Younus et al. (2014), a borrower has to pay an interest rate of LIBOR plus 4.5%, which is almost one-third of the local borrowing cost. Government started to liberalize foreign borrowing in 2009 primarily for the import of capital goods for new projects and the modernization of existing projects, and for sectors defined in the country's industrial policy. Monsur (2015) suggested that the major advantages of foreign private borrowing are mainly lower borrowing cost in the international financial markets compared with the prevailing domestic market, and a typically longer maturity period of the financing. Foreign private borrowing also carries some risks, e.g., the failure of a number of firms to repay loans on time may have a negative impact on the country's overall international credit ratings. The East Asian financial crisis in 1997 and the ongoing sovereign-debt crisis in Europe underscore the importance of monitoring and regulating the external debt of a country, specifically the accumulation rate of private commercial borrowing.

Between January 2009 and July 2017, Bangladesh Bank (BB) approved 10.118 billion USD of foreign loans. The average lending rate was 10.41% in 2016 compared with 12.46% in 2014 and 13.77% in 2012. Foreign borrowing therefore introduces more competition for local banks, and those banks have to increase efficiency to stay viable. Outstanding private sector foreign loans was 1 billion USD in 2010, which increased to 9.5 billion USD at the end of 2016. Unfortunately, no analysis has been performed by the Bangladesh government or the central bank regarding the rate of accumulation of private foreign loans. If increasing pressure for the repayment of external

debt influences the exchange rate volatility, there is a risk of a sharp depreciation, which would be very detrimental for the Bangladesh economy. This study aims to determine whether there is any relation between exchange rate movement and foreign currency borrowing.

The International Monetary Fund's Debt Sustainability Analysis (2017), which analyzes the foreign currency debt situation of the government of Bangladesh, observed that sustainable debt management is essential for steady economic growth of Bangladesh. If the government spends a large amount on debt service payments, the funds available for essential government spending can be limited. In addition, the country becomes vulnerable to a financial crisis in the event that foreign aid ceases.

In countries such as Bangladesh, where the export and production base is very limited, this problem could be serious. Bangladesh has already seen an economic recession in its major export markets, namely, the EU and United States. In addition, the remittance flow from the Middle East is decreasing for various reasons. If all these elements are combined, they could severely affect the balance of payment and result in a deteriorating debt ratio.

To date, the government foreign currency debt of Bangladesh has been moderate, so there may be some scope to use these loans to support this year's fiscal budget deficit, which is 5 percent of GDP. Until 2016, the government external debt stock was USD 26 billion, which is 13 percent of GDP or 77 percent of total exports. The two largest creditors for the government foreign debt are the World Bank and the Asian Development Bank, with outstanding loans of USD 12.1 and USD 7.8 billion, respectively. The largest bilateral creditor is Japan, with outstanding loans of USD 2.9 billion.

With the next general election to be held in December 2018, the current government is trying to spend on some large infrastructure projects to make people happy. To finance these projects, the government did not impose new taxes, in hopes of gaining support from the business community as well. Furthermore, the domestic banks are now facing a major liquidity crisis, such that the central bank recently lowered the CRR by one percent to inject more liquidity into the banking sector. Thus, the only financing option left for the government now may be a loan from foreign sources. However, if these projects are not economically viable, the government may be unable to service the debt. In that case, the government may be forced to agree to conditions imposed by the government of the creditor country that are not in the interest of the Bangladesh people. Recently, the Sri Lankan government had to make this type of agreement with China after their newly constructed deep-sea port turned out not to be an economic success. Below are graphs that show the relationship and trends between exchange rate volatility and government and private foreign currency borrowing.

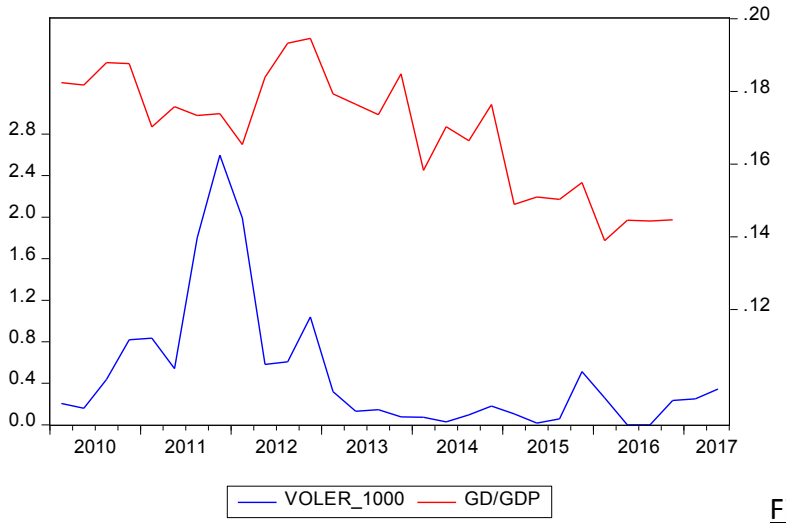

Figure-1.1: Voler and GD/GDP

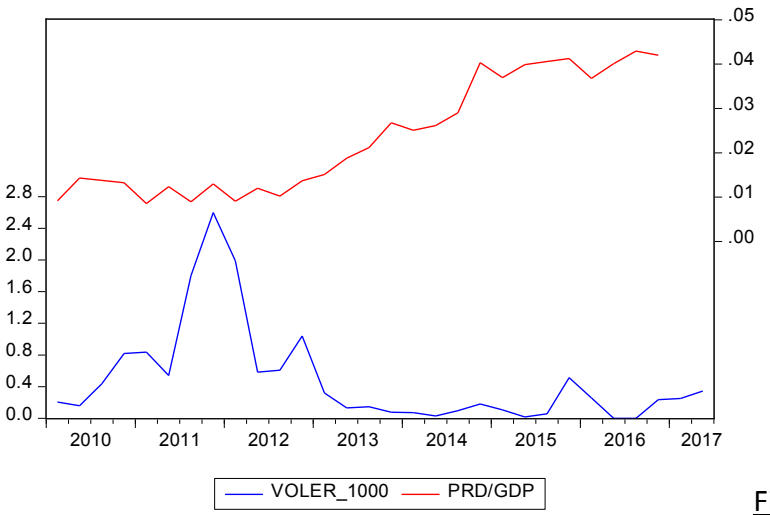

Figure-1.2: Voler and PD/GDP

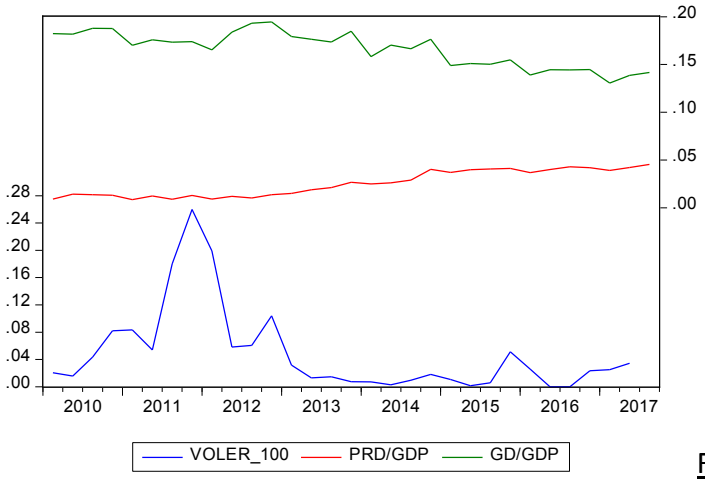

Figure-1.3: Voler, GD/GDP and PD/GDP

Literature Review:

Eichengreen and Hausmann (1999) showed that a principal reason for the Asian and Latin American currency crisis was foreign currency borrowing from external sources. Bordo et al. (2010) also suggested that foreign currency borrowing could expedite a currency crisis.

Radelet and Sachs (1998) and Rodrik and Velasco (1999) focused on short-term debt during a currency crisis. As new economies try to liberalize the capital account along with shifting the exchange rate regime from fixed to floating, they are extremely vulnerable if a currency crisis

occurs. Sung et al. (2014) examined Korean quarterly data during 1994-2009 and found that short-term foreign debt has a significant effect on foreign currency volatility and that a positive relationship exists between them.

However, if we want to investigate the main determinants of exchange rate volatility, the literature offers a variety of explanatory variables. Although one of the first papers by Meese and Rogoff (1983) suggested that the determinants of exchange rate volatility are largely unpredictable, this is true in most cases.

The main objective of this research was to examine the determinants of foreign currency rate volatility and, more specifically, to evaluate the relation among foreign exchange rate volatility, government foreign currency debt and private foreign currency debt, in the context of Bangladesh.

Some existing research has attempted to investigate the relation between foreign capital flows and financial crisis. However, there are limited research papers that specifically investigate the relation between exchange rate volatility and foreign currency debt. Based on a review of the literature, Cady and Gonzalez-Garcia (2007), Devereux and Lane (2003), and Sung et al. (2014) previously tried to investigate the effect of external debt on foreign exchange rate volatility. The first two of these studies used panel data and the last one used time series data for their empirical analysis. The main difference in our current study is that we use time series data for the Bangladesh economy only. To the best of our knowledge, no other study uses time series data for Bangladesh to analyze the relation between foreign currency debt and foreign exchange rate volatility.

While other studies tried to determine the best explanatory variables to explain FX rate volatility, including foreign currency debt, we focused mainly on the relation between foreign currency debt (both government and private) and FX rate volatility. However, we used other variables as independent variables along with government foreign currency debt and private foreign currency debt.

Since Devereux and Lane (2003) used cross-sectional data, their results mainly showed differences between developed and developing countries. On the other hand, Sung et al. (2014) used time series analysis to explain FX rate volatility in the Korean economy using OLS and the two-stage least squares method along with ARCH and GARCH models. However, we used the time series analysis with VECM mainly to explain long run co-integration among the variables. The main reason for the difference in approach is that our data were found non-stationary while they used stationary data for their analysis. Our results therefore would be from a different perspective than that of the previous authors.

Cady and Gonzalez-Garcia (2007) and Devereux and Lane (2003) in their research used foreign exchange rate volatility as the dependent variable and examined the determinants of volatility using some independent variables. We also tried to explain volatility of exchange rate using some explanatory variables but mainly focusing on foreign currency borrowing as the targeted independent variable.

Devereux and Lane (2003) made their research about bilateral exchange rate volatility. Their OLS equation includes variables such as the sum of exports and imports in trade, GDP growth differential and GDP size, liquid liability of the domestic market, and external financing or the external debt variable. They concluded that the external debt variable is significant for

developing countries but not for developed countries. Devereux and Lane (2003) found a negative relationship between external debt and FX rate volatility, which also conforms to the results we obtained with these variables. However, their research differed slightly from ours in that they used panel data to determine the effect on FX rate volatility whereas we used time series data based on the data of Bangladesh only.

Whereas Cady and Gonzalez-Garcia (2007) and Devereux and Lane (2003) tried to investigate the effect of different variables on FX rate volatility in cross-sectional data, Sung et al. (2014) focused mainly on the impact that short-term private foreign currency debt and stock trading of external investors have on FX rate volatility in the Korean market using time series data of South Korea only. Kim et al. (2012) researched the effect of capital account liberalization on the exchange rate floating regime, which could potentially cause new economies to fall into crisis.

Data & Methodology:

The estimation period for our analysis is from 2010Q1 to 2017Q2. Since the short-run and long-run effect on VECM is better captured by quarterly rather than annual data, we used quarterly data even though the sample size is small. The data came from the Statistics department of Bangladesh Bank. We primarily used VECM for our analysis to determine both short-run and long-run relation, and we used OLS as a reference. This section defines key terms used in our analysis and describes potential problems associated with the data.

Model for OLS:

$$\mathbf{DVOLER_t = \alpha + \beta_1 DGD\_GDP_t + \beta_2 DPRD\_GDP_t + \beta_3 DX + \varepsilon_t}$$

Data Description:

$VOLER_t$ = log difference of the daily nominal U.S. dollar/BD Taka rate (DTB_t), which is converted in the quarterly standard deviation; VOL = STDEV[d(log(DTB_t))].

GD_GDP_t = Government External Debt/GDP ratio.

PRD_GDP_t = Private External Debt/GDP ratio.

$STD\_Reserve_t$ = Ratio of short-term external debt to foreign exchange reserves.

$Trade\_volume_t$ = Log of the sum of exports and imports.

$Yield\_spread_t$ = Long-term yield (20-year government treasury bond rate) minus short-term yield (5-year government treasury bond rate).

M2/GDP = Ratio of broad money (M2) over GDP to measure domestic liquid liabilities.

Radelet and Sachs (1998) showed if there is a low short-term external debt to foreign exchange reserve ratio, foreign investors could be skeptical about the possibility of repayment. They also suggested that a low reserve adequacy ratio indicates the economy is prone to crisis.

Sung et al. (2014) suggested that if the yield spread is high, companies borrow from abroad and deposit in domestic banks. This phenomenon is common in Bangladesh also. Since the foreign loan's interest rate is low, companies and government institutions use a portion of the loan for business capital and deposit the rest in domestic banks or use it to buy government treasury bonds with higher yields. Thus, they are able to repay the money they borrowed and make a

profit from the spread. This profit potential promotes external borrowing, which in the long run increases FX rate volatility.

We use the 2nd and 4th lag of our main targeted variables in our OLS models for a robustness check. Given the possibility that the semi-annual monetary policy or annual fiscal budget could affect these variables, we use these lag variables to determine whether there is any difference with level data.

Finally, we use VECM to determine whether the variables are co-integrated in the long run or not. If there is a co-integration, we want to understand the long-run relation as well as the short-run relation among them. This information will determine the percentage of correction needed to return to the long-run equilibrium.

Table-2.1: OLS result (With level data)

Variable Name	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
C	0.000418	-0.002690*	0.001701**	0.000677***	0.005986**	0.002918*	0.004204**	0.000369	0.004159*
GOVDebt/GDP	0.006131	0.015861**			-0.020244**	-0.011350	-0.014507*	-0.014651	-0.019605
PRDebt/ GDP			-0.023769***	-0.038225***	-0.044718***	-0.049853***	-0.049792***	-0.046349***	-0.051357**
STD/ Reserve	-0.004135		-0.002720		-0.004406		-0.003062		
Yield Spread		0.000335*		0.000477***		0.000439***	0.000406***		
Log Trade Volume								0.000381	
M2/GDP									0.001717

Table-2.2: OLS Result (lag 2) for GD_GDP and PRD_GDP

Variable Name	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
C	**0.000531**	**-0.002631**	**0.001330**	**0.000673**	**0.004937****	**0.003452***	**0.003248***	**0.008937**	**0.008974*****
GOVDebt/GDP_2	0.005900	0.015651*			-0.019621*	-0.014198	-0.014677	-0.018870*	-0.017183*
PRDebt/ GDP_2			-0.025217***	-0.040900***	-0.046065***	-0.053802***	-0.056581***	-0.041481**	-0.031180**
STD/ Reserve	-0.004493		-0.001014		-0.000127		0.001445		
Yield Spread		0.000306		0.000499***		0.000453	0.000466***		
Log Trade Volume								-0.000437	
M2/GDP									-0.009505**

Table-2.3: OLS Result (lag 4) for GD_GDP and PRD_GDP

Variable Name	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
C	0.000127	-0.002355	0.001485	0.000577**	0.001876	0.003524	0.003587	0.051810	0.004475*
GOVDebt/GDP_4	0.007770	0.014924*			-0.001872	-0.015875	-0.015975	-0.002540	0.018591
PRDebt/ GDP_4			-0.018432	-0.040545***	-0.019909	-0.059596***	-0.059234***	0.015878	0.010774
STD/ Reserve	-0.004269		-0.002587		-0.002757		-0.000223		
Yield Spread		0.000185		0.000507***		0.000624***	0.000622***		
Log Trade Volume								-0.005240***	
M2/GDP									-0.014534***

We use different combinations of variables in our model to obtain results. Due to the degree of freedom we cannot use many independent variables at a time. In all the OLS models we found a negative relation between the volatility of exchange rate and the foreign currency debt, both government and private. However, in some models their coefficients are not significant. We included 2^{nd} lag and 4^{th} lag variables for a robustness check. Since we obtained similar results with level data, we were able to show that our results are robust.

Unit root test:

Unit Root tests can be used to determine the stationarity of data. In the table below, the stationarity property of the seven variables we used were verified using the Augmented Dickey Fuller (ADF) and Phillips-Perron (1988) tests of unit root. The most common test for unit root is the ADF test. In addition, the Phillips-Perron (1988) test for unit root can address the serial correlation and heteroskedasticity problem of the Dickey-Fuller test equation. Engle and Granger (1987) suggests that if a time series needs to be differenced with d number of times we can say it is integrated of order d, which can be denoted as I(d).

Table-2.4: Unit Root test results

Variable Name	ADF Test			PP Test		
Variable Name	**Trend**	**Trend & Intercept**	**None**	**Trend**	**Trend & Intercept**	**None**
VOLER	I (1) ***	I (1) ***	I (1) ***	I (1) ***	I (1) ***	I (1) ***
GOVDebt/GDP	I (2) ***	I (1) *	I (1) *	I (1) ***	I (1) ***	I (1) ***
PRDebt/GDP	I (1) ***	I (1) ***	I (2) ***	I (1) ***	I (1) ***	I (1) ***
STD/Reserve	I (0) **	I (1) ***	I (1) ***	I (0) **	I (1) ***	I (1) ***
Yield Spread	I (1) ***	I (1) ***	I (1) ***	I (1) ***	I (1) ***	I (1) ***
Log Trade Volume	I (1) ***	I (0) ***	I (1) ***	I (1) ***	I (0) ***	I (1) ***
M2/GDP	I (2) ***	I (1) **	I (1) **	I (1) ***	I (1) ***	I (1) ***
***,** & * respectively indicates 1%, 5% & 10% significance level.						

The results from both the ADF and PP tests indicate that the first difference variables are stationary. Therefore, to ensure stationarity, variables should be used in the first-differenced form.

Model for Johansen co-integration:

We use the Johansen (1991) cointegration test to investigate whether there is a cointegrating relationship among the variables of our models. The Johansen procedure estimates the vector of autoregression (VAR) to determine cointegrating vectors:

$$\mathbf{\Delta X_t = \alpha + \sum_{k=1}^{k-1} \Pi_k \Delta X_{t-1} + \Pi X_{t-k} + \mu_t}$$

where X_t is a column vector of n endogenous variables, Π and Π_k are n by n matrices of unknown parameters, $\mathbf{\Pi X_{t-k}}$ is the error correction term and μ_t is an error term. The matrix Π contains all

long-run relation information. If it is full rank, all the variables will be stationary. If it is zero, there will be no long-run elements in the particular VAR. If the rank of Π is between 0 to full rank, some cointegrating vectors exist.

As a first step, the lag order of the VAR needs to be selected. In accordance with the Schwarz Bayesian criterion (SBC), the optimal lag length was selected as 1 among the VAR order 1, 2 and 3 for the VECM. Since the SBC is more parsimonious and generally chooses fewer lags than the Akaike information criterion (AIK) or other lag selection criteria, we chose SBC. It is the best choice given our small sample size and the lack of degree of freedom. We also used only one or two other explanatory variables along with our two main targeted independent variables for the sake of degree of freedom.

In all three models, one cointegrating equation was found by both trace and maximum eigenvalue tests at the 0.05 level. In addition, the null hypothesis of no cointegration is strongly rejected in both tests.

Juselius (2006) indicated that to formulate a VAR model one should test for long-run exclusion of a variable. If the result is accepted, that particular variable can be excluded from the long-run relations and is not needed in the cointegration.

Model for VECM:

$$\mathbf{D}\boldsymbol{Voler}_t = \boldsymbol{\alpha}_0 + \sum_{i=1}^{p} \boldsymbol{\alpha}_i \boldsymbol{DVoler}_{t-i} + \sum_{i=1}^{p} \boldsymbol{\beta}_i \boldsymbol{DGD\_GDP}_{t-i} + \sum_{i=1}^{p} \boldsymbol{\eta}_i \boldsymbol{DPRD\_GDP}_{t-i} + \sum_{i=1}^{p} \boldsymbol{\gamma}_i \boldsymbol{DX}_{t-i} + \boldsymbol{\Phi}\, \boldsymbol{ECT}_{t-i} + \boldsymbol{\mu}_t$$

Table-2.5: Result for VECM Long Run relation:

VOLER(-1)	GD_GDP(-1)	PRD_GDP(-1)	Yield_Spread(-1)	STD_Reserve(-1)
1.00	-0.037965	-0.064742		-0.005348
1.00	-0.043300	-0.068402	-0.000314	
1.00	-0.041850	-0.062148	-0.000205	-0.006433

From the table, we can see that there is a negative long-run relationship between exchange rate volatility and government foreign currency debt to GDP, private foreign currency debt to GDP, and yield spread and short-term debt to foreign currency reserve ratio.

Table-2.6: Result for VECM Short Run:

Variable Name	Model 1	Model 2	Model 3
ECT	-0.957035***	-0.628206***	-0.810913***
C	6.91E-05	1.44E-05	6.91E-05
Dvoler(-1)	0.772369***	0.606903**	0.763828***
DGOVDebt/GDP(-1)	0.034931***	0.020492**	0.032825***
DPRDebt/GDP(-1)	0.015878	0.021822	0.032825
DYield Spread(-1)		0.000134	9.27E-05
DSTD_Reserve(-1)	0.007943		0.007640***

Short-run dynamics are estimated by using one period lag variable for the first differenced data. Surprisingly, all the variables in the short run have positive coefficients. Unfortunately, only the government portion of foreign currency borrowing is significant in all the models. The error correction term is rightly signed and significant at the 1% level. This means that there would be an adjustment towards long-run equilibrium if any deviation occurs in the short-run dynamics.

The VECM analysis thus shows a negative influence of government and private foreign currency borrowing in the long run. However, only the government portion of the debt showed a positive and significant relation with exchange rate volatility. Since the coefficient for the private portion of the debt in the short run is not statistically significant, we cannot comment on this.

Interpretation of results:

Devereux & Lane (2003) found that external debt has a positive and significant relation with FX volatility for developing countries, which is similar to the finding of our study. Developing countries place more importance on FX volatility than industrialized countries. They also have to face various constraints in their borrowing. Hence, as their dependence on external debt increases, they try to minimize volatility. They understand that if their domestic currency is depreciated they will have to pay significantly more for repayment. In addition, most of these countries manage a floating exchange rate regime. This means that the central banks try to intervene whenever there is a possibility of sharp appreciation or depreciation. This is the actual

situation in the Bangladesh economy where Bangladesh Bank regularly buys and sells dollars and other currencies with domestic banks to stabilize the rate of exchange.

John Cady and Jesus Gonzalez-Garcia (2007) have suggested that trade volume, which is denoted as the sum of all exports and imports, affects exchange rate levels. Exporting significant foreign currency earnings will help to minimize exchange rate volatility. On the other hand, Khatoon and Rahman (2009) found that there is a positive relationship between trade and the devaluation of the foreign exchange rate in Bangladesh.

According to Sung et al. (2014), if the yield spread is high, different government organizations and companies collect external debt and operate over the long term in the domestic bond market to generate more profit. This behavior indicates a positive relationship between yield spread and FX volatility.

The long run and short run results in VECM for our main targeted explanatory variables show different signs. Influence of government and private foreign currency borrowing is negative in the long run but their coefficients are positive in the short run. One possible explanation for this could be that, in short run positive influence of government and private foreign currency borrowing is like a shock. In one quarter it could essentially increase the volatility of exchange rate. On the other hand as the central bank tries to intervene in the long run so that this increase of external debt would decrease exchange rate volatility. In managed floating system like in Bangladesh it is quite common for the central bank to try for stabilizing the exchange rate.

We can observe another behavior from the VECM and OLS results. If there is high volatility of foreign exchange, there would be some difficulty to borrow money from foreign sources. In this

situation, there is a possibility of “crowding out” effect. This effect will imply that if government tries to borrow foreign currency, private entrepreneurs will not be able to get much fund. Also real interest rate from foreign sources will be also higher, which will discourage private investors to borrow from foreign sources. In this sense, the government part of the foreign currency debt becomes more important part than the private part.

We used only 30 observations in this study. Since private foreign currency debt only started in Bangladesh in late 2009, it is impossible to find long-time series data. From 2010, Bangladesh Bank started to collect external debt data quarterly. Before that, only annual data were available. Perhaps in the near future we will be able to include more observations in the models we used and obtain better results.

Most of the variables in the previous study of Sung et al. (2014) were found to be I(0), so they used OLS with level data. However, we found all of the variables to be I(1), which means that if we showed OLS with level data, it could indicate spurious regression. Therefore, we used cointegration and the VECM method to address the nonstationary time series issue.

Some of the independent variables used by previous studies may not be particularly helpful in explaining VOLER in the Bangladesh economy. There is also a data scaling problem among some of the variables. We therefore have to carefully choose the best variables among all of them to understand the relation between VOLER and foreign currency debt.

Conclusion:

According to the VECM results, it can be inferred that government foreign currency debt is more important for explaining exchange rate volatility than private foreign currency debt in the Bangladesh economy because VECM indicated a long-run relation with volatility for both types of debt, but showed that only the government portion of that debt was significant in the short run. Furthermore, the negative error correction term showed there will be an adjustment in the event of a deviation from the long-run relationship among these variables. However, analyses using the OLS and ML methods showed that the private portion of the debt also had a significant negative relationship with exchange rate volatility.

Since the private portion is still relatively small in comparison with the government portion of foreign currency debt, our results suggest that government debt controlling measures would be more effective in maintaining foreign currency volatility compared with measures affecting private borrowing. Nonetheless, it is hard to determine what the threshold point for external debt should be to not affect exchange rate movement. With the government external debt mainly dependent on the actions of the ruling political part, there is sometimes a risk of over borrowing, which could have a negative impact in the long run. The central bank will need to carefully analyze the macroeconomic conditions on an ongoing basis and advise the government accordingly on foreign currency borrowing.

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