The relation of Foreign Exchange Reserve with its determinates in Bangladesh: A Time Series Analysis

Seminar Paper

Submitted by

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Abstract:

Foreign exchange reserve is now an utmost discoursed issue in developing countries of the world. Thus, this study has been undertaken an economic analysis of the determinants of foreign exchange reserve and their influence on foreign reserve. The 38 years of secondary data from 1984 to 2021 are used in this paper to work out the determinants of foreign exchange reserve and their relation with foreign reserve. These determinants are examined by using Augmented Dicky Fuller (ADF) and Phillips Perron unit root test whether the determinants are stationary or non-stationary. Similarly, Granger cointegration approach is used to display the cointegrating relationship among the variables. Additionally, ARDL model is used to see whether there is long-run or short-run relationship among foreign exchange reserve, current account balance, external debt and exchange rate. Besides, Kusum and squre kusum seasonality tests are taken to check the model whether it lie within 5% level of significance or not. The experimental results confirm that there exits a strong relationship among foreign exchange reserve, current account balance, export, import, remittance and exchange rate. On the contrary, there no significant influence of external debts on foreign exchange reserve. Drawing inferences from these finding, it can be suggested that exchange rate, strong remittance related initiatives, expansion of export, limited import of luxurious goods can play a sustainable role to make up a healthy amount of foreign exchange reserves in Bangladesh.

Kew words: Foreign exchange reserve, ARDL model, export, import, remittance.

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1.1 Introduction:

Foreign exchange reserve is vital for the advancement of the developing countries. Moreover, it is normally managed by central monetary authority of a nation to influence exchange rate and to stalize the economy to achieve broader economic objectives (IMF 2000). Similarly, foreign exchange reserve is used to increase investment and to achieve higher economic growth (Chigbu & Promise 2015). Besides, increased foreign exchange reserve decreases cost of liquidity risk (Fukuda & Kon 2008). Foreign reserve surges due to rise in the export, remittances (Dooley et. al. 2003). Furthermore, exports, exchange rate, remittance are significant determinants of foreign exchange reserve in the long-run, however exchange rate is not significant determinants of reserve in the short-run (Sanusi, 2019). Thus, the understanding of the determinants of foreign exchange reserve and their relation with foreign reserve is vital for researcher, government officials and sponsors.

Bangladesh is a developing country with inadequate infrastructure. As a result, the country needs to import more raw materials & machineries, and advance technology which require more foreign currencies. Bangladesh earns foreign currencies in various ways. It has a massive potential to achieve foreign currencies from export, remittances, FDI's and so on. Research demonstrations that exports, exchange rate, remittance are significant determinant of foreign exchange reserve. There is limited research in Bangladesh to see the determinants of foreign exchange reserves and their relation with foreign reserve. This fact encourages researcher to see the relation of foreign exchange reserve with its determinants to ensure the optimum level of foreign reserves.

1.2 Background of the study:

 In the globalization era, no developing country can advance without international trade, foreign debt and so on. Optimum level of foreign exchange reserve maintains the stability of financial sector of a country. On the contrary, less foreign exchange reserve volatiles the financial stability of the developing country. Recently, the economic crisis of Sri Lanka is becoming alarming. According to the World Development Indicators, Sri Lanka's national debt was around 70 percent of the country's GDP. In 2021, the figure shot up to above 100 percent as the economic crisis deepened (Rahman 2022). It faces a growing shortage of foreign exchange reserves, limiting its capability to import basic requirements like food and fuel, to repayment the foreign debt (Notezai 2022). Thus, the study of the determinants of foreign exchange reserve is vital to policy makers, government officials to stabilise the exchange rate.

1.3 Justification of research:

Developing countries require more foreign exchange reserve to enhance their economic growth but they have inadequate access to it (Kaphle, 2021). To get foreign exchange reserve, they obtain foreign currencies, involve in international trade, send manpower to earn remittance and manage foreign debt (Mackinnon 1973). Each developing country needs to import more raw materials, construction materials, expert services and advanced technology which are very expensive. To satisfy these expenses, they need more foreign currencies (Krugman 1984).

Russia Ukraine war largely affects the international reserves of Bangladesh like other develop and developing countries. It's foreign exchange reserve fell to below $40 billion in August 2022 for the first time in two years due to the Russia Ukraine war. Among the COVID-19 pandemic, international reserves topped the $48 billion mark in August 2021 which is the highest of the Bangladesh's history. It has been decreased after that. Global inflation has been also affecting Bangladesh's reserve too. Similarly, Bangladesh is the seventh highest remittance receiver country in the world. Now its remittance inflows decrease from $24.77 billion to $21.03 billion. Bangladesh has currently over $90 billion in foreign debt due to implementation of mega infrastructure projects. Moreover, the cost of the U. S. dollar against the Bangladeshi taka has risen

from around 85 taka in May to 112 taka in the curb market in August, 2022(Mostofa, 2022).

Though, the contribution of the determinants of foreign exchange reserve for the development of a country has increased in these days, literature and research are limited in this area. To make ensure the credibility of external sector, more researches are needed to understand the challenges which occurring from the shortage of foreign exchange reserves.

1.4 **Research Objectives:**

To find the aim of this research, following objectives are taken:

1. To study the existing literature of the determinants of foreign exchange reserve.
2. To check whether there is long run and short run relationship among foreign exchange reserve, current account balance, external debt and exchange rate.
3. To evaluate the causal relationship among foreign reserve, import and export of Bangladesh.
4. To figure out the relationship between remittance and foreign exchange reserve.
5. To suggest policy recommendation.

1.5 **Research Questions:**

In this context, this study attempts to answer the following questions in order to determine the actual situation:

1. Is there any long run and short run relationship among foreign exchange reserve, current account balance, external debt and exchange rate?
2. Is there the causal relationship among foreign reserve, import and export of Bangladesh?
3. Is there a bidirectional causal relationship between remittance and foreign reserve?

2.0 Review of Literature:

Literature review is very essential to describe the research problems based on the past research findings. Basically, this chapter provides the overview the determinants of foreign exchange reserve. After that, it has discussed the relationship between foreign exchange reserve, current account balance, external debt and exchange rate.

### 2.1 The overview of determinants of foreign exchange reserve:

A few notable empirical studies are carried out to see the determinants of foreign exchange reserve. Foreign reserve surges due to rise in the export, remittances (Dooley et. al. 2003). Moreover, exports, exchange rate, remittance are significant determinants of foreign exchange reserve in the long-run, however exchange rate is not significant determinants of reserve in the short-run (Sanusi, 2019). Furthermore, worker Remittances play a significant role to accumulate foreign exchange reserve, which will help to promote national economic growth (Giuliano & Arranz, 2009).

Medhekar (2010) has found in his study that foreign reserve directly linked with export, import and remittance of the economy of Bangladesh. Moreover, Rezaulk(2011) stated that Bangladesh can sustain its reserve level in the near future with her swelling trend of remittance earnings, export earnings and foreign direct investment flows.

Based on the above discussion, it can be said that export, import, remittance, external debt and exchange rate are main determinants of foreign exchange reserve. Moreover, current account balance comprises of export, import, remittance and so on. These variables are discussed below:
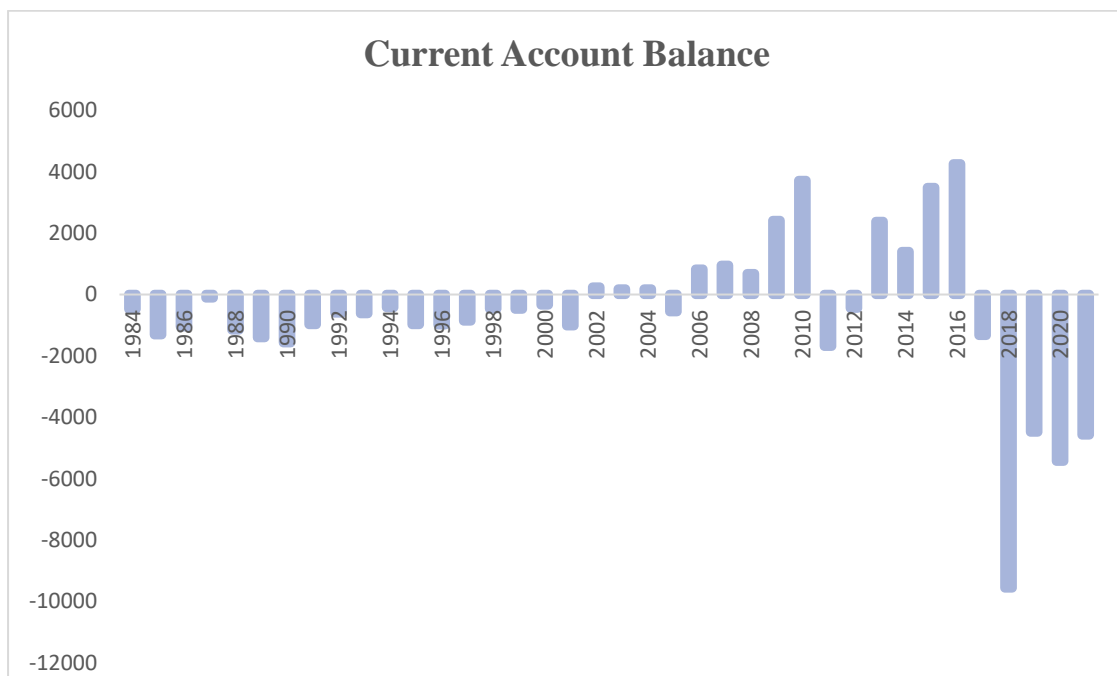
Foreign Exchange Reserve:

Foreign exchange reserve was below 10000 million dollars before 2012. After that, it increased sharply up to 2021.
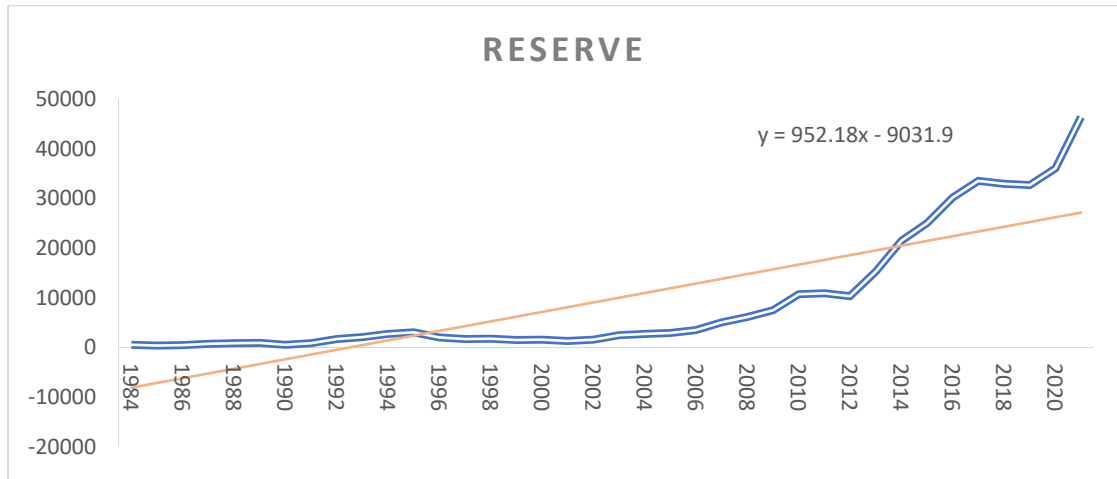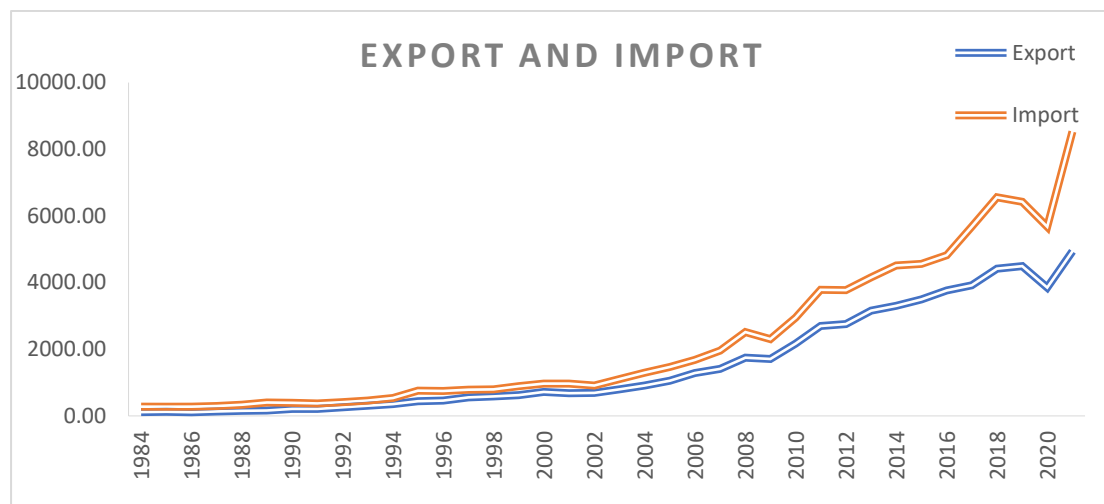

Graph-1:

Current Account Balance:

Current Account Balance was volatile from 1984 to 2021. After the year of 2016, it was negative amount up to 2021.
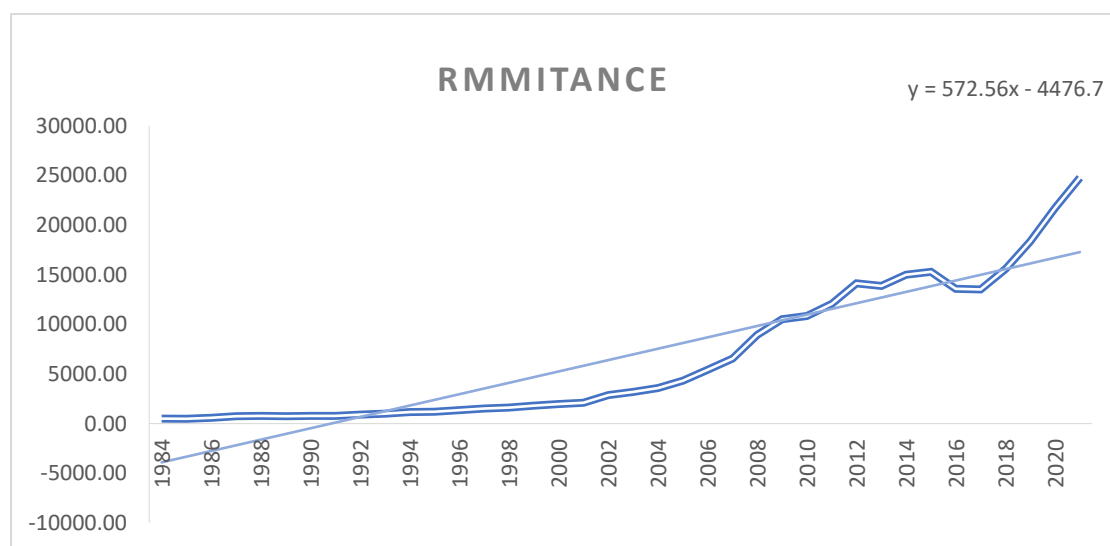

Graph-2:

Export and Import:

Export and import were increased up to 2021.In 2020, both export and import were decreased. After that, they were rose.

EXPORT AND IMPORT
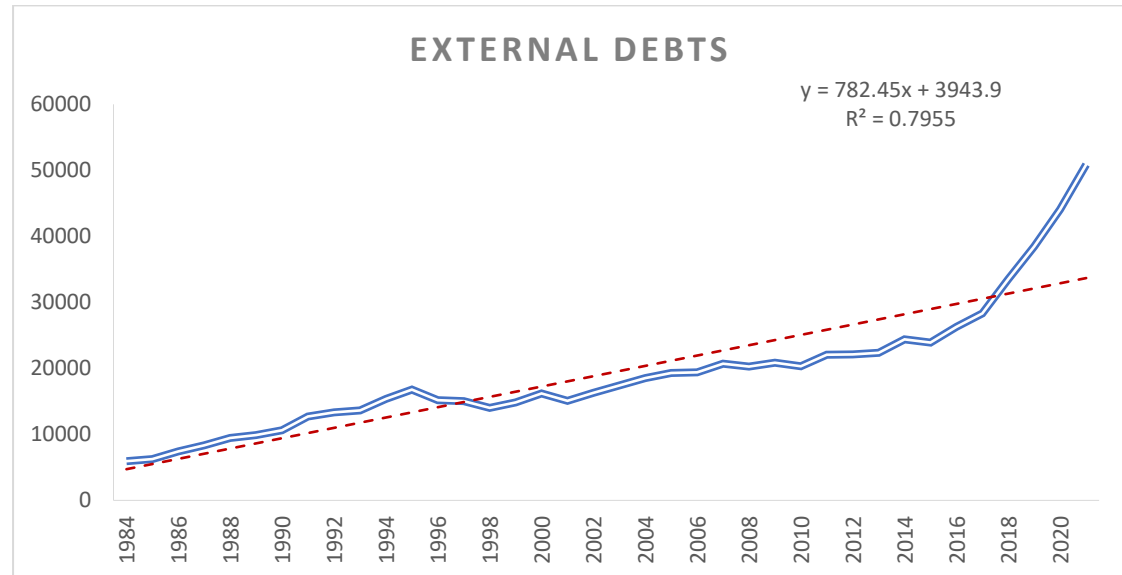

Graph-3:

Remittance:

Remittance was below 15000 million dollars before 2017. After that, it increased sharply up to 2021

RMMITANCE

$y = 572.56x - 4476.7$

Graph-4:

External Debts:

External debt was below 20000 million dollars before 2015. After that, it increased sharply up to 2021.

EXTERNAL DEBTS

y = 782.45x + 3943.9
R² = 0.7955

Graph-5:

2.2 Relation of foreign exchange reserve with its determinants:

Kashif et. al. (2017) showed that foreign exchange reserve has both short-run and long-run association with current account balance and exchange rate. Moreover, import has a negative influence on foreign exchange reserve (Kruskovic & Maricic, 2015). Similarly, there is a strong unidirectional causality between foreign support and foreign reserve (Regmi 2009). Additionally, there is bilateral causality between gross investment, export and foreign reserve (Ahmad & Ghanbarzadeh, 2011). Furthermore, inflow of foreign currencies produces positive relation to the balance of payment of a nation in the long-run (Ray 2012).

Prabhesh et. a. (2007) found that India's long-run foreign reserve is a function of current account vulnerability, capital account vulnerability, exchange rate flexibility and opportunity cost of holding reserve. Similarly, Schgal & Sharman (2008) fond that the risky capital flows and the exchange rate volatility have positive impact on foreign reserves holdings. Moreover, Delatte and Fouquau (2009) identified the misalignment

of the real exchange rate and the level of the US real interest rate may influence the acceleration of foreign exchange reserve. Furthermore, earning of foreign currency from remittance and export is positively related to foreign exchange reserve of a country (Kaphle, 2021).

It is clear from the above discussion that foreign exchange reserve has both short-run and long-run association with current account balance and exchange rate. Moreover, export, exchange rate and remittance have positive relation with foreign reserve while import has negative relation. A few relations among variables is given below:
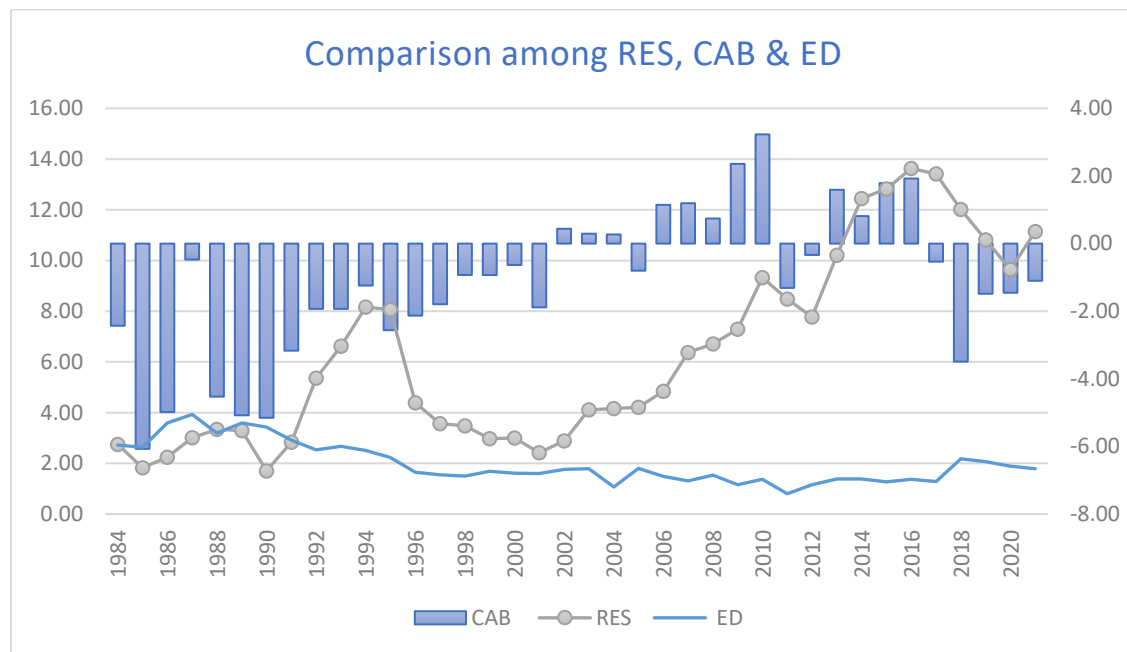
Graph-6:

From the graph it is seen that CAB has causal effect on reserve in the long-run however, external debt does not have significant influence on reserve.

3.The Model, Data and Methodology of the Study

3.1 Empirical Framework

RES= F (CAB, ED, ER)

RES= F (EXP, IMP)

Where, RES= Foreign Exchange Reserve, ED= External Debt, ER= Exchange Rate, EXP=Export, IMP=Import.

3.2 The Data

The data was collected from secondary sources. The analysis includes the data from 1984 to 2021, which spans 38 years. The econometrics analysis had certain limitations due to the small data range. The secondary data is used to address the study question, which comprises foreign exchange reserve, current account balance, external debt, export, import and exchange rate.

3.3 Econometric Methodology

In this study, a suitable model was selected using EViews software. Granger causality model are used to determine whether foreign exchange reserve, current account balance, external debt and exchange rate.

ARDL Model:

Multi-variable regression can be employed in ARDL model. The following is how to write regression model with more than one independent variable:

$RES= \alpha_0 + \beta_1 CAB + \beta_2 ED + \beta_3 ER + u_i$ …………………………… (1)

Here,

RES= Foreign Exchange Reserve

CAB= Current Account Balance

ED= External Debts

ER= Exchange Rate

RES= Dependent variable,

CAB, ED & ER= Independent variables,

$\alpha 0$ =intercept,

$\beta 1, \beta 2, \beta 3$ = regression coefficients

The ARDL model is a step by step procedure. Equation 1 can be written in the ARDL framework as follow:

$\Delta RES = \alpha_0 + \beta_1(CAB)_{t-i} + \beta_2(ED)_{t-i} + \beta_3(ER)_{t-i} + \sum \beta_4 \Delta (CAB)_{t-i} + \sum \beta_5 \Delta (ED)_{t-i} + \sum \beta_6 \Delta (ER)_{t-i} + U_i$ ……………………………………….. (2)

The term with difference operators captures short-run dynamics, while the coefficients attached with first lagged terms measure long-run relationships. The null hypothesis of no long-run relationship ($\beta_1 = \beta_2 = \beta_3 = 0$) shall be tested against the alternative hypothesis of the presence of long-run relationship($\beta_1 \neq \beta_2 \neq \beta_3 \neq 0$). The exitance of long-run relationship shall be recognized if the null hypothesis is rejected. Other coefficients like β_4 , β_5 , β_6 capture short-run dynamics.

ARDL Model shall be estimated in order to identify the short-run and long-run relationships. Duasa(2007) has said different optimal lag order is applicable in the ARDL approach.

The next step is to create an error correction model to observe the short-run dynamics to check the stability of the parameters of the long-run. From the equation (2), an error correction model is generated as :

$\Delta RES_t = \alpha_0 + \sum \beta_4 \Delta (CAB)_{t-1} + \sum \beta_5 \Delta (ED)_{t-1} + \sum \beta_6 \Delta (ER)_{t-1} + \emptyset (ECM)_{t-1} + U_i$ ……………………. (3)

Where ECM stands for the error correction term. We expect a negative relationship and the depended variable. The ECM shall be calculated from the long-run coefficient based on equation (2). The error correction model(ECM) demonstrations the speed of adjustment required to reinstate the long-run equilibrium subsequent a short-run shock. The $\emptyset$ is the coefficient of ECM which indicates the speed of adjustment.

Secondly, the researcher applied causality dynamics among foreign reserve, import and export. The causal relationships of Import and Export are as follows:

$RES_t = \alpha_1 + \beta_{11}RES_{t-1} + \beta_{12}RES_{t-2} + \beta_{13}IMP_{t-1} + \beta_{14}IMP_{t-2}\beta_{15}EXP_{t-1}\beta_{16}EXP_{t-2} + \varepsilon_1$ ……..(4)

Finally, the causality dynamics between the variables, foreign reserve and remittance is examined by applying Granger Causality tests (Granger, 1986). Granger method can describe the bi-directional causal relationship in the short run among the variables in the model. The bi-directional causal relationships of foreign reserve and remittance are as follows:

$RES_t = \alpha_1 + \beta_{11}RES_{t-1} + \lambda_{11}REM_{t-1} + \varepsilon_1$ …...……..(5)

$REM_t = \alpha_2 + \lambda_{21}REM_{t-1} + \beta_{21}RES_{t-1} + \varepsilon_2$ ………....(6)

4.0 Examination and analysis:

4.1 Long-run and short-run relationship among foreign exchange reserve, current account balance, external debts and Exchange rate.

4.1.1 Unit Root Test:

In the first step, the non-stationary problem is checked through Augmented Dickey Fuller (ADF) and Phillips Perron (PP) test. The results for the ADF and the PP test are reported in table-1.

Table-1:

Parameter	ADF		PP	
	Level	difference	Level	difference
RES	-0.85	-4.32***	-0.85	-4.23***
CAB	-2.69*	-7.35***	-2.69	-11.93***
ED	-0.24	-5,19***	-o.37	-5.20***
ER	-o.36	-5.63***	-1.08	-5.45***

*** indicates 1% level of significance, ** indicates 5% level of significance, * indicates 10% level of significance

Result: The results have shown that all of the comprised variables are non-stationary at level. But, all of the variable become stationary at first difference.

Table-2: Lag Selection:

Number of lags	AIC	SBC	LM test for serial correlation
1	3.11	3.51	0.26(0.61)
2	3.16	3.37	0.68(0.51)
3	2.38	3.14	0.12(0.94)
4	2.41	3.37	0.23(0.91)
5	1.85	2.90	0.13(0.97)

Result: In order to check the long-run relationship, we need to decide the leg length criteria. We use Akaike (AIC), Schwarz (BIC) criteria and LM test of serial correlation to select appropriate lag. It can be found from table-2 that AIC and BIC values are lowest at lag 5. The LM test shows that there is no serial correlation at lag 5.

Table-3: Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
CAB does not Granger Cause RES	33	3.62230	0.0153
RES does not Granger Cause CAB		2.06233	0.1091
ED does not Granger Cause RES	33	1.30614	0.2975
RES does not Granger Cause ED		0.47316	0.7922
ER does not Granger Cause RES	33	1.33606	0.2861
RES does not Granger Cause ER		3.18752	0.0259
ED does not Granger Cause CAB	33	0.69485	0.6329
CAB does not Granger Cause ED		1.12500	0.3763
ER does not Granger Cause CAB	33	3.90280	0.0110
CAB does not Granger Cause ER		2.18665	0.0926
ER does not Granger Cause ED	33	0.67246	0.6486
ED does not Granger Cause ER		1.64839	0.1891

Result: From table-7, it is found that current account balance granger causes foreign exchange reserve at 5% level of significance while the foreign reserve does not hold. Moreover, we similarly observe that there is bi-directional causality running from current account balance to exchange rate. Furthermore, foreign exchange reserve has positive impact on exchange rate. However, there is no granger causal relationship among external debt, exchange rate and current account balance.

4.1.2 Estimation of ARDL Model:

The ARDL model is to estimate the long-run relationship between the independent variables and dependent variable. Using lag 5, the following ARDL (3, 5,5,5) model is estimated:

Table-4

Dependent Variable: D(RES)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.088060	3.433190	-0.608198	0.5581
D(RES(-3))	0.635558	0.249765	2.544622	0.0315
D(RES(-4))	0.161204	0.352796	0.456934	0.6585
D(RES(-5))	0.173216	0.237592	0.729046	0.4845
D(CAB(-1))	0.258001	0.418939	0.615844	0.5533
D(CAB(-2))	-0.012899	0.367406	-0.035109	0.9728
D(CAB(-3))	-0.554416	0.383128	-1.447077	0.1818
D(CAB(-4))	-0.343432	0.499250	-0.687896	0.5089
D(CAB(-5))	-0.051440	0.364930	-0.140959	0.8910
D(ED(-1))	-0.730877	0.745327	-0.980613	0.3524
D(ED(-2))	-1.379799	0.746629	-1.848037	0.0977
D(ED(-3))	-1.432278	0.919986	-1.556847	0.1539
D(ED(-4))	0.839721	1.027665	0.817116	0.4350
D(ED(-5))	1.090366	0.423519	2.574540	0.0300
D(ER(-1))	0.301537	0.112040	2.691325	0.0247
D(ER(-2))	-0.053218	0.149971	-0.354854	0.7309
D(ER(-3))	0.144508	0.107518	1.344038	0.2118
D(ER(-4))	0.110496	0.145258	0.760690	0.4663
D(ER(-5))	-0.182599	0.170467	-1.071172	0.3120
RES(-1)	-0.553155	0.379937	-1.455912	0.1794
CAB(-1)	-0.040081	0.549924	-0.072885	0.9435
ED(-1)	0.048877	1.082308	0.045160	0.9650
ER(-1)	0.032455	0.038927	0.833732	0.4260

R-squared	0.957210	Mean dependent var		0.071296
Adjusted R-squared	0.852614	S.D. dependent var		1.457635
F-statistic	9.151440	Durbin-Watson stat		1.837813
Prob(F-statistic)	0.000858			

Table-5: Long-run relationship:

Dependent Variable: RES

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.850353	1.138402	-1.625396	0.1133
CAB	0.473567	0.105183	4.502326	0.0001
ED	1.045274	0.325084	3.215394	0.0029
ER	0.019997	0.011924	1.677046	0.1027
R-squared	0.472786	Mean dependent var		0.819480
Adjusted R-squared	0.426267	S.D. dependent var		1.258139
F-statistic	10.16330	Durbin-Watson stat		1.686714
Prob(F-statistic)	0.000063			

Result: The long-run results revealed that 1% change of CAB affect foreign reserve by 0.47% at 1 % level of significance. Similarly, 1 percent increase of external debt would result in 1.05 percent increase of reserve of Bangladesh at 1 % level of significance.

4.1.3 Seasonality Test:
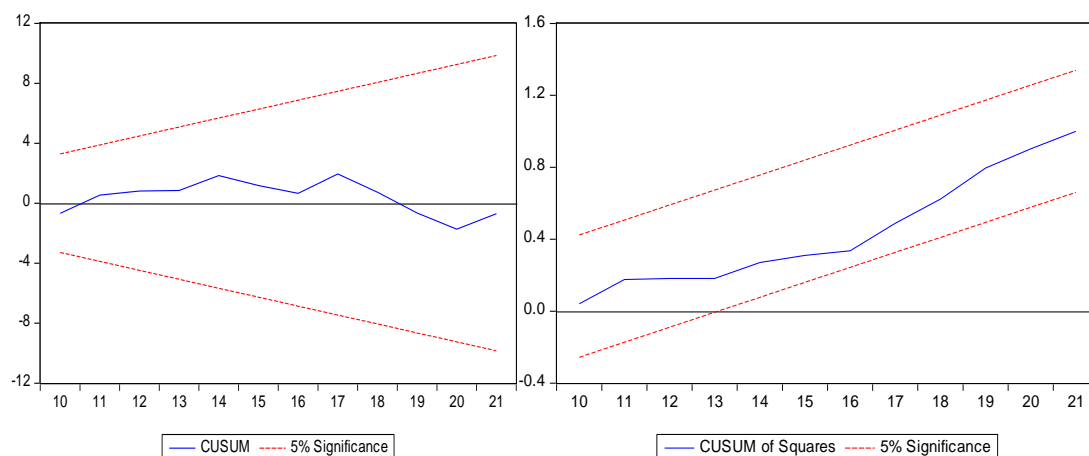
Result: CUSUM and CUSUM square tests are used to see where the model is appropriate or not at 5% level of significance. Both CUSUM and CUSUM square tests indicate that our model is stable at 5% level of significance.

Table-6: Error Correction Model:

Dependent Variable: D(FR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.522871	0.420705	-1.242845	0.2377
D(FR (-3))	0.762141	0.157810	4.829475	0.0004
D(FR (-4))	0.391676	0.225227	1.739029	0.1076
D(FR (-5))	0.305314	0.159880	1.909641	0.0804
D(CAB (-1))	-0.065533	0.149088	-0.439557	0.6681
D(CAB (-2))	-0.261758	0.197361	-1.326289	0.2094
D(CAB (-3))	-0.831141	0.159847	-5.199600	0.0002
D(CAB (-4))	-0.721237	0.268574	-2.685432	0.0198
D(CAB (-5))	-0.313945	0.211445	-1.484759	0.1634
D(ED (-1))	-0.753184	0.368341	-2.044799	0.0635
D(ED (-2))	-1.369453	0.413877	-3.308842	0.0062
D(ED (-3))	-1.832803	0.627761	-2.919588	0.0129
D(ED (-4))	0.283506	0.703123	0.403210	0.6939
D(ED (-5))	0.926545	0.336918	2.750059	0.0176
D(ER(-1))	0.282356	0.098213	2.874926	0.0140
D(ER(-2))	-0.005553	0.119497	-0.046466	0.9637
D(ER(-3))	0.137709	0.096739	1.423506	0.1801
D(ER(-4))	0.095646	0.108111	0.884698	0.3937
D(ER(-5))	-0.155117	0.135881	-1.141560	0.2759
ECM3(-1)	**-0.809360**	0.240119	-3.370660	**0.0056**

R-squared	0.952605	Mean dependent var		0.071296
F-statistic	12.69418	Durbin-Watson stat		1.552273
Prob(F-statistic)	0.000031			

Result: Table-6 provides short-run coefficients and error correction term attained from the ARDL model. From the table, it is found that the coefficient of ECM has a negative value, demonstrating that the tendency of model is reverting by the value of 0.80 percent. Similarly, we also found that this finding is statistically significant at 1% level of significance, indicating a strong long-run relationship among the variables. With this, we discard the null hypothesis of our study and can accept the alternative hypothesis.

4.1.4 Seasonality Test:
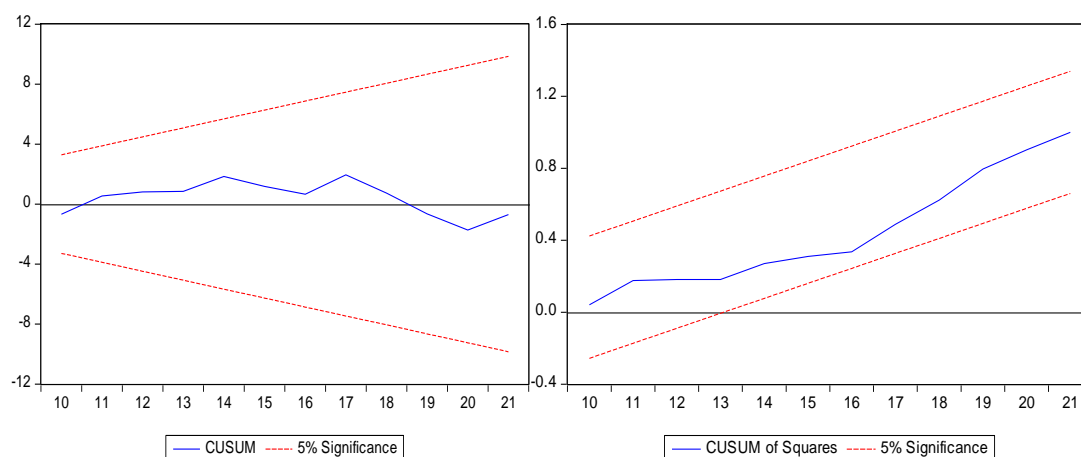
Result: CUSUM and CUSUM square tests are used to see where the model is appropriate or not at 5% level of significance. Both CUSUM and CUSUM square tests indicate that our model is stable at 5% level of significance.

4.2 Causal Relationship among Foreign Exchange Reserve, Import and Export of Bangladesh.

Table-7: Unit Root Test

Parameter	ADF		PP	
	Level	difference	Level	difference
RES	-0.89	-4.3***	-0.85	-4.23***
EXP	-1.48	-5.86***	-1.49	-5.90***
IMP	-1.57	-6.44***	-1.42	-6.53***

*** indicates 1% level of significance, ** indicates 5% level of significance,* indicates 10% level of significance

Result: The result has shown that all of the comprised variables are non-stationary at level. But, all of the variables become stationary at first difference level.

Table-8: Cointegration equation estimation

Dependent Variable: D(FRS)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.072096	0.171733	0.419816	0.6778
D(FRS(-1))	0.508779	0.193062	2.635314	0.0135
D(FRS(-2))	-0.115846	0.180271	-0.642621	0.5257
D(E(-1))	5.348254	2.256223	2.370446	0.0249
D(E(-2))	2.564303	2.572036	0.996993	0.3273
D(I(-1))	-5.961237	1.501719	-3.969609	0.0005
D(I(-2))	0.002278	1.834188	0.001242	0.9990

R-squared	0.550751	Mean dependent var		0.254165
F-statistic	5.721044	Durbin-Watson stat		2.098897
Prob(F-statistic)	0.000553			

Results: According to the findings, export has a significant positive influence on foreign reserve, whereas import has negative effect on foreign reserve. 1 % increase in export raise 5.35 percent of reserve at existing situation. Similarly, 1% upsurge of import decrease 5.96 % of reserve.

Table-9: LM Test for serial correlation

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.033701	Prob. F(2,26)	0.3698
Obs*R-squared	2.578046	Prob. Chi-Square(2)	0.2755

Result: Table-9 shows that the probability of F-statistic is 0.3698 which is more than 5% level of significance. This indicates that there is no serial correlation in the regression model.

Table-10: Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
Export does not Granger Cause FRS	36	4.79919	0.0153
RES does not Granger Cause Export		2.77495	0.0779
Import does not Granger Cause FRS	36	16.0452	0.0000
RES does not Granger Cause Import		2.00706	0.1515
Import does not Granger Cause Export	36	1.44506	0.2512
Export does not Granger Cause Import		3.89878	0.0309

Result: The test result shows that export has causal effect on reserve, while reserve does not have causal effect on export. Similarly, import has causal influence on reserve, whereas reserve has no causal effect on import. Moreover, export has granger causality on import at 5% level of significance. On the contrary, import does not have causal effect on export.

4.3 Causal relationship between foreign reserve and remittance.

Table-11: Unit Root Test

Parameter	ADF		PP	
	Level	difference	Level	difference
RES	-0.89	-4.3***	-0.85	-4.23***
REM	-1.45	-4.07***	-1.34	-4.12***

*** indicates 1% level of significance, ** indicates 5% level of significance, * indicates 10% level of significance.

Results: The results have shown that all of the included variables are non-stationary at level. But, all of the variables convert stationary at first difference.

Table-12: Cointegration equation estimation

$RES_t = \alpha_1 + \beta_{11}RES_{t-1} + \lambda_{11}REM_{t-1}$ $REM_t = \alpha_2 + \lambda_{21}REM_{t-1} + \beta_{21}RES_{t-1}$				
Depandant Variable	**RES**		**REM**	
Regressor	**Coefficient**	**P-value**	**Coefficient**	**P-value**
RES(-1)	0.32	0.05	-0.05	0.55
REM(-1)	0.52	0.08	0.33	0.04
Constant	0.15	0.48	0.08	0.48

Result: The cointegration equation estimation indicates that remittance has positive influence on reserve with lag 1.

Table-13: Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
H_1: REM does not Granger Cause RES	37	8.22434	0.0071
H_2: RES does not Granger Cause REM		5.70820	0.0226

Result: The Granger Causality test reveals that null hypothesis H_1 and H_2 can be rejected at a 5% level. This suggests that reserve and remittance have a bi-directional granger cause relationship.

5.0 Findings, Policy Recommendations and Conclusion

5.1 Findings:

Current account balance (CAB), external debt (ED) and exchange rate (ER) are the important determinants of foreign exchange reserve. The long-run model revealed that foreign exchange reserve is positively influenced by CAB, ED & ER. This model indicates that 1% change of CAB, ED & ER affect foreign reserve by 0.47%, 1.05% and 0.02% respectively. The ECM of ARDL has a negative value at 1% percent level of significant. This indicates that there is strong a long-run relationship among foreign exchange reserve, CAB, ED and ER. If there perceives any short-run shock, it will return in long-run equilibrium position by the rate of 0.80 percent. Moreover, it is found that current account balance granger causes foreign exchange reserve at 5% level of significance while the foreign reserve does not hold. Likewise, we observe that there is bi-directional causality running from current account balance to exchange rate. Furthermore, foreign exchange reserve has positive impact on exchange rate. However, there is no granger causal relationship among external debt, exchange rate and current account balance.

The study endeavored to establish a causal relation among foreign exchange reserve, import and export. According to the findings, export has a significant positive influence on foreign reserve, whereas import has negative effect on foreign reserve. 1 % increase in export raise 5.35 percent of reserve at existing situation. Similarly, 1% upsurge of import decrease 5.96 % of reserve. Moreover, export has granger causal effect on import, while import has no causal effect on export.

In addition, the study looks at whether or not there is a bidirectional causality between reserve and remittance. The analysis shows that remittance has positive impact on reserve, but that reserves have no causal effect on remittances at a 5% level of significance.

5.2 Policy Recommendations:

Foreign exchange reserve is crucial for the advancement of the developing countries like Bangladesh. Recently, Sri-Lanka is facing tough situations due to shortage of foreign exchange reserve. The country does not have enough foreign currency to fuel for essential services like buses, trains and medical vehicles. Failure to pay the interest of debt can harm a country's reputation. This can also damage the confidence in its currency and economy. (Perera, 2022). Thus, positive effects of the determinants of foreign exchange reserve are indispensable for the development of Bangladesh.

5.2.1 Increase export:

The analysis demonstrations that export has positive influence on reserve. Thus, the government should take several initiatives to increase export. The garments sector has contributed around 85 % export earning in Bangladesh during last two decades. The demand of garments has reduced in most of the develop countries due to Ukraine-Russia war. Thus, the export of jute products, tea, footwear, frozen food, leather should increase all over the world by building up bilateral and multilateral relationship to increase foreign exchange reserves.

5.2.2 Rationality of the import on the basis of export:

Imports lead to an outflow of foreign exchange reserve from the country whereas export leads to inflow of foreign exchange reserve into the country. Therefore, the country should increase the import amount on the basis of export. The study shows that export has positive effect on reserve on the contrary, import has negative relation with reserves. It we should not increase export; we should not go for import luxurious goods anymore which makes the shortage of foreign exchange reserve.

5.2.3 Upsurge remittances:

As per the findings, remittances impact positively on the foreign reserves. Similarly, it improves the balance of payments in the developing countries (Meyer 2017). Thus, ministry of expatriate's welfare and oversees employment should take numerous

initiatives with collaboration of ministry foreign affears to send more skill worker to foreign countries.

5.2.4 External Debts:

Bangladesh still gets external debts at very low interest rate as a least developing country. It will graduate to developing countries in 2026. After 2026, Bangladesh will not get external loan with very low interest rate. Thus, the loan with less interest rate and favorable terms and reference can be received to improve the reserve.

5.2.5 Exchange Rate:

Exchange rate has negative effect on current account balance. If the exchange rate of a country increases relative to another countries, the prices of its goods and services increases. This can decrease the country's exports and increase imports. As a result, it affects negatively on foreign exchange reserves. Thus, low exchange rate should be maintained.

5.3 Implementation Action-Log:

Actions	Responsibility	Timeframe	KPI
To increase export	Export Promotion Burau, Ministry of Commerce Ministry of Finance	Short-term, Medium-term	- to increase in reserve. - to increase in GDP growth.
To reduce import of luxurious goods	Ministry of Commerce Bangladesh Bank	Short-term	-to maintain an optimum reserve.
Upsurge remittance	Ministry of Expatriates Welfare and Overseas Employments, Ministry of Labour	Short-term	-to increase in reserve. - to increase in GDP growth.
To receive external debts	External Resource Division, Finance Division	Short-term	-to increase in reserve
To maintain low exchange rate	Bangladesh Bank	Short-term	-to maintain an optimum reserve.

5.4 Conclusion:

An optimum level of foreign reserves shows how much strong of external sector of a country. Mostly, a country should keep sufficient amount of foreign exchange reserve if the government want to have the currency stable and to evade fluctuation of exchange rate. In the absence of optimum level of foreign reserves, speculation devaluates currency forcefully. Much research has been conducted on the topic of determination of foreign reserve by Asian countries. However, there is no in-dept study on the determinants of foreign exchange reserves in Bangladesh which seems to be consistent with the finding of previous work. Thus, this study has been taken to identify the determinants of foreign exchange reserve and the relation with its determinants in Bangladesh by using econometrics tools and techniques.

This study examinations the current empirical literature on determinants of foreign exchange reserves. We found that the long-run relationship exists among foreign exchange reserve, current account, external debt and exchange rate. This finding has been attained using the empirically robust Autoregressive Distributed Lag (ARDL) Model. Similarly, these findings of the study are supported by earlier studies like Lizondo and Mathieson (1987). Moreover, the variables also indicate a short-run relationship through granger causal test. The results indicate that current account balance granger causes foreign exchange reserves while the reserve does not hold. Moreover, we also observe that there is uni-directional causality running from current account balance to exchange rate. Furthermore, foreign exchange reserve has positive impact on exchange rate. Drawing inferences from these finding, it can be suggested that exchange rate, strong remittance related initiatives, expansion of export, limited import of luxurious goods can play a sustainable role to make up a healthy amount of foreign exchange reserves in Bangladesh.

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