

# Impact of Foreign Exchange Reserve on Stock Market Development: Evidence from Dhaka Stock Exchange

Md. Tanvir Hasan\*

**Abstract:** *This paper investigates the linkage between foreign exchange reserve and stock market development in Bangladesh for a period of 1995 to 2014. This study uses linear regression model, unit root test using ADF test, Johansen co-integration test, granger causality test to measure the relationship between foreign exchange reserves of Bangladesh and stock market capitalization. This study employs multivariate framework incorporating inflation and interest rates. The results show that there exists a unidirectional causal relationship between market capitalization and foreign exchange reserve, inflation and market capitalization but no relationship between interest rate and market capitalization.*

**Keywords:** *Foreign exchange reserve, market capitalization, Co integration test, unit root.*

**JEL classification:** *C01, F31, E31, E22*

## I. Introduction

It has always been a debate whether there exists any association between foreign exchange reserve and stock market capitalization. The debate lies on whether foreign exchange reserves cause stock market growth or stock market growth causes foreign reserves; or whether there exists a bi-directional relationship between foreign exchange reserve and stock market development. According to Disyatat and Galati (2005) the empirical evidence on the effectiveness of intervention in advanced countries remains mixed. Where as foreign exchange intervention to ensure a control over reserve has been found to be effective, the magnitudes differ substantially across countries. In contrast to the established acumen for larger economies with a very high integration of their financial markets with global capital markets, there is some evidence that untainted intervention is more effective in influencing the foreign exchange reserve that influences the exchange rate in emerging market economies along with the capital market development.

Foreign exchange reserves are foreign currency assets held by the central banks of countries. These assets include foreign marketable securities, monetary gold, special drawing rights (SDRs) and reserve position in the IMF. The main purpose of holding

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\*Lecturer, Department of Finance, University of Dhaka

foreign exchange reserves is to make international payments and hedge against exchange rate risks.

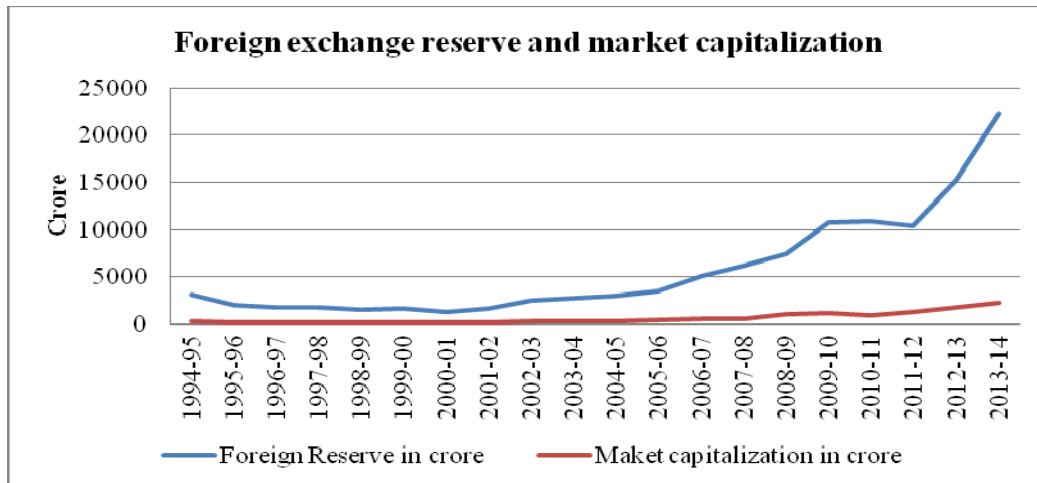
On the other hand, Market capitalization is the aggregate valuation of the company based on its current share price and the total number of outstanding stocks. It is calculated by multiplying the current market price of the company's share with the total outstanding shares of the company.

Dhaka Stock Exchange (DSE) is the major and earliest stock exchange of Bangladesh, which is situated at the main area of the Dhaka city. On 28<sup>th</sup> April 1954, DSE was formed. It is a public company established and regulated under Company Act 1994, Security and Exchange Commission Act 1993, Security and Exchange Commission Regulation 1994, Security Exchange (Inside Trading) Regulation 1994. Presently, DSE has 195 members.

On August 10, 1998 DSE introduced screen-based state-of-the-art automated online real-time trading through local area network (LAN) and wide area network (WAN). On January 24, 2004 Central Depository System (CDS) for electronic settlement of share trading was introduced in the DSE. The Dhaka Stock Exchange has become a full Depository Participant (DP) of CDBL to facilitate the non-DP members. It has 536 listed securities with Tk. 1,032.1 billion issued capital and Tk. 2,943.2 billion market capital till the fiscal year 2014.

Historically, the Bangladesh Stock Market (DSE General) reached an all time high of 8918.51 in December of 2010 and a record low of 282.43 in October of 1991.

Figure 1 shows that both stock market capitalization and foreign exchange reserve experienced significant growth over the years in Bangladesh. In the year 1994-95 the market CAP was Tk. 3,496.51 crore and in 2013-14 Tk. 238,626.3 crore. Here total market CAP is increased by Tk. 235,130 crore within these 20 years.



**Figure 1:** Foreign exchange reserve and market capitalization

At the same time we see there was a significant growth on foreign exchange reserves over the years. Though there was a decreasing trend from the year 1994-95 to 2000-01 i.e. Tk. 3,069.6 crore in 1994-95 to Tk. 1,306.7 crore in 2000-01, but from 2001 it was advanced in increasing trend. It was increased from Tk. 1,582.9 crore in 2001-02 to Tk. 22,309.8 crore in 2013-14. Increasing remittances from expatriates abroad and rising export incomes have boosted these reserves over the years. Dropping costs of imports, especially food and fuel have also helped restrict forex outgo and boosted reserves.

Rest of the study has been split into follows: Section 2 describes the literature review, Section 3 illustrates the research methodology, Section 4 shows the analytical findings and section 5 ends the study with some concluding remarks scope of further research.

## **II. Literature review**

An increasing amount of empirical research has examined the relationship between the macroeconomic variables and stock market growth. From the recent study, Akinlo. O (2015) has done an investigation on the relationship between foreign exchange reserves and stock market development in Nigeria over the period of 1981-2011. The results showed that foreign exchange reserves have positive effect on stock market growth.

By using unit root test, co integration and error correction model on quarterly data from January 1995 to December 2008, Pal and Mittal (2011) evaluated the relationship between two Indian capital markets with interest rates, inflation, exchange rate and gross domestic savings. They showed that interest rate and foreign exchange rate have impact on one capital market but both capital markets are influenced by inflation rate and no significant effects of gross domestic saving in either of these markets.

Liu and Shrestha (2008) examined the relationship of Chinese stock market with industrial production, exchange rate, inflation, money supply and interest rate using secondary data of those variables from January 1992 to December 2001 using heteroscedastic cointegration test. They found a positive relationship between industrial production and money supply with Chinese stock indices where inflation, interest rate and exchange rate have a negative effect on share prices.

Alagidede et al., (2002) examines the link between exchange rates and stock prices in Australia, Canada, Japan, Switzerland, and UK using data from January 1992 to December 2005. They find the causal linkage from exchange rate to stock prices.

Without incorporating Foreign exchange reserve, Nishat and Shaheen (2004) examined the impact of industrial product index, consumer price index and money supply on the Karachi Stock Market by using Johansen's (1991 and 1995) vector error-correction model (VECM) with a data set of Quarterly period of 1973:1 to 2002:4. They found that those variables were cointegrated and industrial production was the largest positive determinant of Pakistani stock prices, while largest negative determinant was inflation.

Ahmed & Imam (2007) investigates the relationship between different macroeconomic variables and stock market growth. By the analysis from different tests like co integration, unit roots and vector error correction models and using monthly data from July 1997 to June 2005 they found that there is no long run relationship between macroeconomic variables i.e. money supply, Treasury bill rate, interest rate, GDP, industrial production index. But the market return is somewhat influenced by interest rate change or T-bill growth rate

By using simple linear regression model, unit root test, granger causality test with the data set from the year 1990-91 to 2010-11 Ray (2013) found that foreign exchange reserves of India has positive impact on BSE stock market capitalization. Moreover, the results showed that there was unidirectional causality from foreign exchange reserves to stock market capitalization.

By using ordinary least-square (OLS) regression method Ologunde et al., (2006) investigated the relationships between interest rate and stock market capitalization rate in Nigeria. They found that stock market capitalization rate were positively influenced by the prevailing interest rate and negatively influenced by government development stock rate.

By applying multivariate model with a data set from 1990 to 2004 of United States and the United Kingdom, Dimitrova (2005) developed a relationship between the foreign exchange and stock market. He analyzed it with a hypothesis that there is a link between the foreign exchange and stock markets. He asserted this link is positive when stock prices are the lead variable and negative when exchange rates are the lead variable.

By applying the cointegration analysis with data set from the period of January 1965 until June 2005 in US and Japan, they analyze the relationship between stock prices and key macroeconomic factors. They found that there is a single co integrating vector exists in the USA and two cointegrating vectors exists in Japan. In US stock prices were influenced positively by industrial production and negatively by inflation and interest rate. However, they found that money supply had an insignificant influence over the stock price. In Japan, one vector normalized on the stock price provided evidence that stock prices are positively related to industrial production but negatively related to the money supply. And in second vector, normalized on industrial production, industrial production was negatively related to the interest rate and the rate of inflation.

An empirical result of the short-run and long-run relationship between selected macroeconomic variables, trading volume, stock returns and Athens stock exchange with period of 1990 to 1999 came from Patra and Poshakwale (2006). No short run or long run equilibrium relationship is found between the exchange rates and stock prices.

There are few studies those mainly focus on the relationship between foreign exchange reserve and share market capitalization. Specially in our country no one has done this job on this specific topic yet. Hence this study focuses on that particular arena which focuses on the causality relation between foreign exchange reserve and stock market development.

### III. Data analysis and research methodology

#### Research Design

With a view to exploring the link between foreign exchange reserves and stock market development a function has been developed in which stock market development depends on foreign reserves. The stated equation for the analysis is

$$SMD = f(FER) \dots (1)$$

However, it is relevant to consider other variables which many have influential effects on stock market development of a particular country. The exclusion of these variables could bias the direction of relationship between foreign exchange and stock market development. Consequently, to conduct this study two supporting macroeconomic variables, inflation and interest rate have been considered. Therefore the equation becomes as follows:

$$SMD = f(FER, INF, INT) \dots (2)$$

Taking the log results in

$$\ln SMD = \alpha + \beta_1 \ln FER + \beta_2 \ln INT + \beta_3 \ln INF + \varepsilon \dots (3)$$

Where *SMD* is stock market development measured by stock market capitalization, *FER* is foreign exchange reserves, *INT* is the interest rate, and *INF* is the inflation rate.

To conduct the study both descriptive and econometric analyses have been done. For the purpose of descriptive statistics mean and standard deviations have been calculated of the countries concerned of the selected variables during the study period of 1995-2014. Therefore, first part of this study describes descriptive statistics, graphical analysis, stationarity test, and co-integration test to identify the relationship and trend of the variables used in the study.

The study deals with some important macroeconomic variables. For that purpose Stationarity test, Cointegration test along with Granger Causality test of the variables have been done.

#### Model Specification

##### Unit Root Test

For the purpose of the study some macroeconomic variables have been chosen. Past studies showed that macroeconomic variables are non-stationary (Nelson and Plosser,

1982) and may be conducive to spurious regression. So, stationarity of the series has to be examined. For this reason, an Augmented Dickey- Fuller (ADF) test has been conducted.

### **Cointegration Test**

With a view to conducting this study Johansen (1998) and Johansen and Juselius (1990) maximum likelihood cointegration technique is used, which tests both the existence and the number of cointegrating vectors.

### **Model on Granger Causality**

To examine the causal relationship among the selected variables a trivariate Granger Causality Model is utilized. The apposite design of the model depends on the status of the unit roots of the variables of interest and on the existence of co-integration between the variables. If variables are cointegrated, then there exists causal relationship between variables (either unidirectional or bidirectional).

## **IV. Analytical Findings**

### **Descriptive statistics:**

Data analyzed to this study have been collected covering the period of 1995-2014. Table 1 demonstrates the summary statistics of the study. Data are collected from central bank of Bangladesh. All variables are in logarithm form.

**Table 1: Descriptive statistics**

	FER	MCAP	INF	INT
Mean	57258.6	712302.7	6.24	8.61
Standard Error	12574.1	203463.9	0.62	0.3
Median	29998	172676.5	6.92	8.46
Standard Deviation	56232.9	909918.4	2.79	1.34
Sample Variance	3.16 X 10 <sup>8</sup>	8.28E+09	7.82	1.81
Kurtosis	2.83	-0.66	-0.12	0.81
Skewness	1.71	1.06	-0.63	0.58
Range	210031	2351298	10.64	5.65
Minimum	13067	34965.1	-0.02	6.04
Maximum	223098	2386263	10.62	11.69
Sum	1.14 x 10 <sup>6</sup>	1.14 x 10 <sup>6</sup>	124.89	172.11
Count	20	20	20	20

Note: FER and MCAP are expressed in millions BDT and INF and INT are expressed in %

**Source:** Author's estimation

The summary statistics disclose that all the series exhibit a high level of reliability and the standard deviations are relatively low except for market capitalization.

### Stationarity Test

For the stationarity test of the variables Augmented Dickey Fuller (ADF) Unit Root Tests has been conducted. The null hypothesis is that the variable is non stationary and the alternative hypothesis is that there exists stationarity. A stationary time series data is one whose statistical properties such as mean, variance, autocorrelation, etc. are all constant over time. Most statistical analysis is based on the assumption that the time series can be stationary.

**Table 2: Augmented Dickey Fuller (ADF) Unit Root Tests**

Variables	Test statistic		Critical values at 5% level	Stationarity status	
	Level	1 <sup>st</sup> difference		Level	1 <sup>st</sup> difference
MCAP	-0.320	-3.536	-3.000	Non stationary	Stationary
FER	1.426	-3.193	-3.000	Non stationary	Stationary
INF	2.982	-7.028	-3.000	Non stationary	Stationary
IR	-2.918	-3.132	-3.000	Non stationary	Stationary

**Source:** Author's estimation

From the Table 2 it is evident that all the variables are non stationary at level as their test statistics are less than the critical values. Hence the null hypothesis of non stationarity is not rejected in that case. It is also apparent that the variables are stationary after taking the 1<sup>st</sup> difference even though they are non stationary at levels.

### Cointegration Test

The presence and the number of co-integrating relationships among the underlying variables are tested through a vector error correction model applying the Johansen co-integration test. To test for cointegration it should be specified how many lags to be included. If there exists a stationary linear combination of nonstationary random variables, the variables combined are said to be cointegrated. Since it is unknown what appropriate lag structure to be used therefore lag length selection test<sup>1</sup> have been carried out.

<sup>1</sup>In the process of determining lag length fixed maximum lag length of two has been selected as sample size is too small.

**Table 3: Cointegration test**

Lag	LL	LR	Df	P	AIC	HQIC	SBIC
0	37.6627				-3.7403	-3.71302	-3.54244
1	83.8805	92.436	16	0.000	-7.09783	-6.96142	-6.10853*
2	106.762	45.764*	16	0.000	-7.86249*	-7.61695*	-6.08174

**Source:** Author's estimation

From Table 3 it is perceived that Hannan–Quinn information criterion (HQIC) method selects two lags, Schwarz Bayesian information criterion (SBIC) method selects one lag, sequential likelihood-ratio (LR) selects two lags as indicated by the “\*” in the output. Since the variables are stationary at 1<sup>st</sup> difference Johansen tests of cointegration has been applied as shown in Table 4.

**Table 4: Johansen tests for cointegration**

Maximum Rank	LL	Eigen value	Trace Statistics	5% critical value
0	74.183171		65.1584	47.21
1	90.855013	0.84314	31.8148	29.68
2	101.88776	0.70649	9.7493*	15.41
3	106.7622	0.41819	0.0004	3.76
4	106.76239	0.00002		

**Source:** Author's estimation

Johansen's method has been used. Test statistics are based on a model with two lags and a constant trend. Table 4 presents test statistics and their critical values of the null hypotheses of no cointegration and one or fewer cointegrating equations. The eigenvalue shown on the last line is used to compute the statistic in the line above it. Johansen's testing procedure starts with the test for zero cointegrating equations (a maximum rank of zero) and then accepts the first null hypothesis that is not rejected. Johansen's testing procedure starts with the test for zero cointegrating equations and then accepts the first null hypothesis that is accepted. In the output above, the null hypothesis of no cointegration has been rejected and the null hypothesis of two cointegrating equations are not rejected.

Thus, the null hypothesis that there are maximum two cointegrating equations in the model is accepted. Hence the variables are cointegrated meaning that they have association in the long run.



**Table 5: VECM**

	<b>Ln MCAP</b>	<b>Ln FER</b>	<b>Ln INF</b>	<b>Ln IR</b>
Constant	.0608128 (.184)	.0409069 (0.164)	-.0028395 (0.948)	.0025009 (0.881)
ECT	-.1500633 (.462)	-.0584253 (0.656)	-.7327823 (0.000)	-.7508265 (0.010)

**Source:** Author's estimation

There always exists an error correction representation of the form as represented by

$$\Delta X_t = \pi X_{t-1} + \sum_{i=1}^{p-1} \theta_i \Delta X_{t-i} + \varepsilon_t \quad \dots \quad (4)$$

Where  $\Pi$  and the  $\Phi$ - are functions of the  $\Phi$ 's.

From Table 5 it is apparent that there is no long run causality running from market capitalization to foreign exchange reserve. However, there are long run causality in case of inflation and interest rate as indicated by negative error correction term and statistically significant p-value.

To test for serial correlation in the residuals, Lagrange-multiplier test for residual autocorrelation has been conducted. From Table 6 it is apparent that there is no residual autocorrelations up to two lag lengths at 5% level of significance.

**Table 6: Lagrange-multiplier test for residual autocorrelation**

<b>Lag</b>	<b>chi2</b>	<b>df</b>	<b>Prob &gt; chi2</b>
1	12.2321	16	0.72785
2	24.7495	16	0.07436

**Source:** Author's estimation

To check whether the residuals are normally distributed Jarque-Bera test has been conducted and here the null hypothesis is that the residuals or variances are normally distributed. It is apparent from Table 7 that for the first model of interest rate the null hypothesis is not rejected at 5% level of significance. This is true for rest of the models of inflation, market capitalization, and foreign exchange reserve.

**Table 7: Jarque-Bera test**

<b>Equation</b>	<b>chi2</b>	<b>df</b>	<b>Prob &gt; chi2</b>
Ln IR	1.333	2	0.51343
Ln INF	0.850	2	0.65388
Ln MCR	0.260	2	0.87817
Ln FER	0.112	2	0.94552
ALL	2.555	8	0.95912

**Source:** Author's estimation

### Granger Causality Model

After fitting the cointegration test, it should be verified whether one variable “Granger-causes” another (Granger 1969). Following table shows the variables under consideration along with their respective Prob>chi<sup>2</sup>.

**Table 8: Granger Causality Wald tests**

Equation	Excluded	chi2	df	Prob>chi2
Market capitalization	Foreign exchange reserve	8.4105	2	0.015
Market capitalization	Inflation	6.3649	2	0.041
Market capitalization	Interest rate	.21062	2	0.900
Market capitalization	All	28.7	6	0.000
Foreign exchange reserve	Market capitalization	.69678	2	0.706
Foreign exchange reserve	Inflation	.70588	2	0.703
Foreign exchange reserve	Interest rate	4.2302	2	0.121
Foreign exchange reserve	All	8.349	6	0.214
Inflation	Market capitalization	1.9201	2	0.383
Inflation	Foreign exchange reserve	7.9843	2	0.018
Inflation	Interest rate	10.096	2	0.006
Inflation	All	50.086	6	0.000
Interest rate	Market capitalization	2.5013	2	0.286
Interest rate	Foreign exchange reserve	1.4476	2	0.485
Interest rate	Inflation	1.6275	2	0.443
Interest rate	All	13.363	6	0.038

**Source:** Author’s estimation

Consider the results of the three tests for the first equation. For that test the null hypothesis is that foreign exchange reserve does not granger cause market capitalization. In that case the null hypothesis is rejected (Prob>chi<sup>2</sup>=0.015<.05) that means foreign exchange reserve has a causal linkage with market capitalization for Bangladesh. The same conclusion can be made in case of inflation and market capitalization. The last test is with respect to the null hypothesis of all variables. In that case the null hypothesis is rejected. The bottom line for that equation of market capitalization is that all the variables jointly granger causes market capitalization for Bangladesh. Following the same process for second equation the null hypothesis of no causal relationship between market capitalization and foreign exchange reserve is not rejected which means market capitalization did not granger cause foreign exchange reserve. Same conclusion can be drawn for both inflation and interest. In case of the equation of inflation the null

hypothesis that market capitalization does not have any causal relationship with inflation is not rejected. Which means market capitalization does not cause inflation. But for foreign exchange reserve and interest rate the null hypotheses are rejected which means both of these macroeconomic variables have causal relationship with inflation. However, all of the variables jointly cause inflation. From the last equation of interest rate it is apparent that null hypothesis of no causal relationship is not rejected. But all of the variables (market capitalization, inflation, foreign exchange reserve) jointly cause interest rate.

#### **V. Concluding remarks**

This study analyzes the relationship between foreign exchange reserve and stock market development taking interest rate and inflation as supporting variables. To figure out the relationship a series of econometric models have been applied. This study employs Augmented Dickey-Fuller (ADF) unit root test to pinpoint the stationarity of the data set and Johansen Juselius Cointegration test. The study shows that foreign exchange reserve and interest rate positively and significantly affect the stock market development measured in the form of market capitalization. The results demonstrate a unidirectional causal relationship between market capitalization and foreign exchange reserve, between inflation and market capitalization but no causal relationship between interest rate and market capitalization.

Under the light of above results it is highlighted that there is a need of well managed macroeconomic policies in order to obtain the benefits from the capital market. In order to take the full advantage of stock market and carry on with the international markets well managed macroeconomic policies are necessary in which interest rates and inflation rate are thoroughly monitor and try to control as much as possible. It gives the confidence to the investors as well as the industries.

The possibility for future research is to further evaluate what are the other determinants that affect the stock market capitalization and where fluctuations in that case are coming from. Even though this study reveals the interconnection between some selected macroeconomic variables and stock market development but other variables can determine the stock market development, but how?

However, the limitations of the study should not be over looked. The present study is limited to only three selected macroeconomic variables. Inclusion of more variables with a longer time period may improve the results.

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