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An Empirical Analysis of the Effect of the Foreign Direct Investment and Exchange Rate on the Stock Market of Bangladesh

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Abstract

Purpose: This study aims to analyze the impact of the selected macroeconomic variables Foreign direct investment (FDI) and Exchange rate (ER) on the stock market of Bangladesh.

Methodology: Different models such as, the multivariate regression analysis, Granger causality test, Johansen cointegration test, Vector error correction (VEC) model from the econometric theory were conducted to answer the research questions of the study. Using the application software EViews 11, data had been analyzed where data covered the time series for the selected variables from 1993 to 2019.

Findings: Empirical evidence of the study leads to prove the existence of a significant causal link from the stock market toward FDI but does not indicate any significant causality with the Exchange Rate in terms of the scenario of Bangladesh.

Limitations: Findings of the study need to be interpreted cautiously since the the joint impact of the selected macroeconomic variables on the stock market in light of Bangladesh attributed an inconclusive remark.

Originality/value: Contribution of the paper reflects on the addressing of the research gap regarding the behaviour of the stock market, FDI, and ER simultaneously both in the long and short run from the perspective of Bangladesh.

Keywords: Causality, Exchange Rate, Foreign Direct Investment, Stock Market

JEL Classification: C32, C58, E44

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1. Introduction

A key aspect of the capital market is the expected behaviour of macroeconomic factors. Recently, the role of the variables of the macroeconomy on the stock exchange has received increased attention across considerable studies in finance literature. The influence of variables from the macroeconomy is reckoned as the most serious and widespread popular disturbances to volatile share value. Since the stock market of Bangladesh experienced a major crash in 1996 and again in 2010, there has been a surge of interest around the theme of influencing variables on the stock market index. Despite several preventive measures; for instance: Demutualization, Institutional investment, Floor-price mechanism, Corporate Governance Code; extended from the government, the capital market of Bangladesh could not stabilize moreover the major bourse Dhaka Stock Exchange (DSE) continuously recorded negative trend of index till March 2020 even in growing nature of economy (Alam, 2020). Exploring the findings related to the affect of the mcroeconomic variables in light of the stock market of Bangladesh is an important, but understudied, cause for concern. However, there are several studies (Chang, Ilomäki, Laurila and McAleer, 2020; Nyasha and Odhiambo, 2018; Jan and Khan, 2018; Ho and Lyke, 2017a; Tripathi and Kumar, 2016) postulate the link among various factors of the macro-environment and stock market. In Bangladesh, following Vector Autoregression (VAR) model, Nisha (2016) explains the influence of the selected variables from the macroeconomy on the DSE where the result supports the influence of money supply on return. Evidence on the stock prices are positively affected by the exchange rate (ER) has been revealed in a recent analysis of Islam, Akter and Alam (2020) based on Bangladesh. Several existing literature on DSE of Bangladesh (Nguyen, Islam and Ali, 2010; Chowdhury, Mollik and Akhter, 2006a; Muhammad and Rasheed, 2002) carried out, most are limited to the several variables such as, interest rate,

money supply, ER where causal factors leading to stock index remained precarious in few circumstances.

In the macroeconomy, if the interest rate increases, depreciation occurs in local currencies (exchange rate increases) for experiencing high inflation later, which tends to threaten foreign investment. Khan and Ullah (2015) also explained if the money supply increases, inflation will also increase which will impact to increase the ER. This leads to the enhancement of export and this will increase the foreign direct investment (FDI). FDI of an economy means the investment in equity flows directly while flows of funds affect interest rate as the supply of funds changes in an economy due to changes in funds flow. Nyongesa and Muchoki (2016) explained that the stock market is affected by the currency depreciation due to the dynamics of financial markets from the aspects of global collaboration. They suggested, in the short term, policy-makers can consider ER as a policy instrument in a country to attract the investment of foreign portfolios via the stock exchange. Sekhri and Haque (2015) supports this statement as they described that the capital inflows from foreign countries are expected to enhance the participation of investors. They added in the long run this helps develop the stock market including employment generation. Bhattacharya and Mukherjee (2005) mentioned that in some cases emerging economies may face difficulties from the perspective of setting liquidity policies as they experience increased capital inflows. The relationship between the variables capital flows, currency exchange rate, and growth in light of Nigeria has been empirically discussed by Ogbechie and Anetor (2016). By conducting the VAR approach and considering data from 1986 to 2014, their evidence addresses that the ER is negatively influenced by capital inflows. In 2019, the net foreign investment at DSE was reduced repeatedly which was reported as shares were sold by the foreign investors what worth a significant amount in Bangladeshi currency (Mahmud, 2019a). Surprisingly, empirical research regarding the FDI and DSE which is considered as a prime indicator of the

Bangladeshi stock market is yet to be closely examined. After the stock market crash in Bangladesh, investors' confidence regarding investment in shares is vacillating and in this case enhancement of foreign investment in the bourse could build stability to the market that would encourage sophisticated investors to participate in long-run. Initiatives such as; the collaboration with the Shenzhen Stock Exchange following a strategic partnership, were taken in DSE to enhance foreign investment in the stock investment of Bangladesh. (Mahmud, 2019b).

In the literature covering the stock market of Bangladesh specifically, the relative influence of FDI on DSE along with another related macroeconomic variable- exchange rate (hereafter, ER) has been subject to considerable discussion. Contrary to some published studies (Chowdhury et al., 2006a; Rahman and Uddin, 2009) regarding the stock market exposure to ER in Bangladesh, has been shown in others (Islam et al., 2020; Muhammad and Rasheed, 2002) are significantly different in key aspects. This research mainly investigates several unresolved questions that remain about the extent to which FDI and ER are causally associated with DSE. Precisely, this paper intends to fill the research gap by embarking on the following research questions:

i. What causal relationship does exist among FDI, ER, and the stock market of Bangladesh?

ii. Which factor of macro-economy between FDI and ER is comparatively more influencing on DSE in terms of the long run and short run concept?

Thus, this study includes two macroeconomic variables: FDI and ER were used for analysing the influence of variables from the macroeconomy on DSE by using multivariate regression. Furthermore, the study set out test techniques following the Granger Causality and Johansen cointegration to specify VAR approach owing to answer the research questions. To be precise; several methods identified as the Multivariate regression, Vector error correction

(VEC) had been used step by step to meet the objective which had been also followed by several researchers (Bhattacharya and Mukherjee, 2005; Hasan and Javed, 2009; Barakat, Elgazzar and Hanafy, 2016; Baffour, 2017).This paper used a total of 324 observations considering monthly data of each variable from 1993 to 2019 which was collected from an archival data source of DSE and World Bank (WB). The empirical work presented here sheds new light on FDI along with ER to explore their influence on the stock market of Bangladesh. Applying annual data on ASEAN economies, Lily, Kogid, Mulok, Sang, and Asid (2014) evaluated the shifting tendency of ER and FDI. Evidence of their study recommended that the movements of the exchange rate to attract FDI inflows are still questionable since it expresses the inconclusive nature of interpretations.

The remaining part of the paper highlights the literature review, research methodology, and empirical results and discussion in different sections consecutively. The final part also includes a discussion about the implications and limitations of the findings to develop future research into the macro-environment of Bangladesh.

2. Literature review

Different theories of finance background explains the behaviour of the macroeconomic variables in regards of its impact on the stock market. Two renowned asset pricing models are named as the Efficient market hypothesis of Fama (1970) and the Arbitrage pricing theory of Ross (1976) . The price of stocks or shares is sensitive to the changing nature of economic factors thus it is one of the main concerned issues for investors (Hasan and Javed, 2009). In an efficient form of the stock market, stock prices spontaneously fully reflect all new information that is supposed to be available. In the real world, this reflection is not equal for all economic changes and thus investigating the answer of the research questions of this study is important. Investors can efficiently assess their risk of portfolio investment based on the available information on macroeconomic variables. Over the past decade, most research

(Chowdhury and Sharmin, 2013b; Yartey, 2010) in the stock market has emerged defining the relationship of the macroeconomic variables with the stock price. Numerous analysis of different authors attempted to better understand the mechanisms of FDI, ER and its effects on the stock market and here theoretical hypotheses referring to compendium findings of previous research on these selected variables are discussed.

FDI has both benefits and costs in the home country as well as in the host country. Enhancement of foreign investments in the stock market of the host country usually generates positive feedback among sophisticated investors regarding the trading decisions of their owned investments. Foreign investment is expected to be high in the host country where the return is also expected to be high but the currency is not expected to weaken. Jeffus (2015) examined the growth of the stock market in terms of FDI from two perspectives where the first one mentions that FDI negatively affects the stock market. And the second perspective refers FDI is positively related where results support the second perspective for the selected Latin American countries. Ho (2019b); Rajapakse (2018); Malcus and Persson (2018); Soumarè and Tchana (2015); Sekhri and Haque (2015); Issahaku, Ustarz and Domanban, (2013); and Adam and Tweneboah (2009) explore how may stock market be influenced by foreign investment. By applying a regression model, Malcus and Persson (2018) found FDI and the stock market is not strongly connected in Sweden. Rajapakse (2018) showed only one direction causality of the stock market to FDI in Sri Lanka whereas, in emerging economies, a bidirectional causal relationship was found by Soumarè and Tchana (2015). The result of a survey analysis evaluated by Ho and Lyke (2017a) implies that an increasing trend of capital inflows will develop the stock market. A study of Issahaku et al. (2013) concluded by explaining that the short term association between the FDI and stock market is imaginary whilst it could indicate the existence of a long term causality. Rhee and Wang (2009) analysed the variables -liquidity and foreign equity- following the stock market of Indonesia

where findings reveal the negative influence. The positive relationship between the stock market and FDI has also found in terms of the India and Ghana following the respective studies: Sekhri and Haque, 2015; Adam and Tweneboah, 2009. Generally, it has been hypothesised as the ER negatively relates to the stock market if the import oriented companies dominate. Export is influenced positively by a weak currency value whereas import is changed oppositely. If the price appreciation or depreciation of a local currency affects the cash flows of any business activities, it will influence the share price of a firm. Foreign asset purchasing behaviour decreases where demand for an asset of a local market increases hence local currency appreciates (ER decreases). Hasan and Javed (2009) found ER negatively affects the stock market whereas Rahman and Uddin (2009) and Macfarlane (2011) reported the relation between ER and the stock market is not significant. Similarly, another finding of Vietha (2019) also supports the context. Harjito and McGowan (2007) expressed causality and cointegration between the ER and the stock market. However, unidirectional causality between these variables has been noticed in the study of Ghazali and Yasoa (2008) based on the case of Malaysia. Ali, Mukhtar, and Maniam (2015) also found a cointegration between the ER and the stock market in Malaysia. Issahaku et al. (2013) and Bhattacharya and Mukherjee (2005) found causality from the ER to the stock market in Ghana and India respectively.

Although the stock market indicators of Bangladesh have pursued significant growth, they have volatility. Chowdhury et al. (2006a) did not find the proof of causality in beteen the variables from the macroeconomy and the stock market of Bangladesh. Applying the regression model and causality test, Ali (2011) reported on the stock returns in terms of the selected variables from the microeconomy and macroeconomy. Using monthly data, the study explained the direction of the relationship in the selected variables but did not show causality.

Collectively, the capital market has been explored from the viewpoint of the influence of the macroeconomic variables where academic literature on DSE has revealed several contrasting issues. Moreover, the reviewed evidence suggests a pertinent role of FDI on several aspects of the stock market in Bangladesh about which relatively little is known and insufficient.

In summary, the explanation of the stock market in light of the changing trend of the indicators from the macroeconomy remains an open empirical question by far. Although DSE is an emerging market, a good number of studies in this field regarding the impact of FDI and ER are simply absent. This paper is expected to have a shred of strong evidence for the efficacy of measuring the long-run dynamic association between FDI, ER and the DSE market index. Thus, understanding the influential macroeconomic variables with longitudinal data which may influence the stock market of Bangladesh would be helpful for different stakeholders such as; the investors, decision-makers to encourage FDI in the stock market to be stabilized.

3. Research methodology

To date, quantitative methods for measuring the influence of the variables from the macroeconomy on the stock market have not varied much across this research arena. Estimation methods developed in econometrics on the properties of time series have advanced the investigation of the relationship among integrated macroeconomic indicators. A regression model is the main non-invasive method that is used to determine the impact of interrelated variables. More recent examples of methodologies used in empirical studies on the stock market interlinked to the economic variables foreign investment and ER is found in a study conducted by Bhattacharya and Mukherjee (2005). Following different test techniques, for instance, unit root, cointegration, Granger causality, they analyzed net foreign institutional investment, ER, and the stock returns to see the causality between them. Hasan and Javed (2009) analyzed the long run relationship between several monetary variables and

the stock market by applying different econometric models named as the Johansen and Juselius multivariate cointegration, Vector error correction (VEC) method, Granger causality, Impulse response analysis method, and Variance decomposition analysis. Following previous relevant empirical studies (Ali et al., 2015; Issahaku et al., 2013; Adam and Tweneboah, 2009; Harjito and McGowan, 2007), several econometric models were chosen to conduct this study. First, for exploring the causal link between the chosen variables, the test of Granger causality was used. Later on, to explain the overall impact of FDI and ER on DSE based on the monthly data from 1993 to 2019 the VEC model was applied. Secondary data of stock index used in this study which had been collected mainly from DSE library while FDI and ER were collected from WB data archive. DSE is the prime and oldest stock exchange of Bangladesh thus, this study selected DSE for analyzing data. The All Share Price Index (DSI), DSE general Index (DSEGEN), and board Index (DSEX) of DSE are used as a proxy since these are followed by a market value-weighted index that represents all listed companies implying the comprehensive scenario of the stock market. Daily data for each month of the DSE index had been converted into monthly using the average technique. Archival data of WB for net inflows of FDI expressed on Balance of Payment (BoP) basis in terms of current U.S. dollars whereas monthly official exchange rate presented in BDT units in terms of U.S. dollars. Annual FDI had been converted into monthly frequency using the Linear model specification of conversion low to the high frequency with EViews 11. The unit root test technique was applied to check if there is a problem of spurious regression. By examining the ADF test, first, the stationary condition of the time series data has been confirmed. Besides the Autocorrelation test method, the Heteroskedasticity test, and the Jarque–Berra normality test used for residuals diagnostics while Johansen cointegration analysis to determine VEC model, furthermore VEC stability tests, Wald test was also conducted using EViews 11 version of the software.

3.1 Multivariate regression model

Multivariate regression considering the index of DSE as a response variable and two macroeconomic variables FDI and ER as explanatory variables is developed in the following equation:

$$Log(INDEX)_t = \alpha_1 + \beta_1 Log(FDI)_t + \beta_2 Log(ER)_t + \varepsilon_{it} \quad ....(1)$$

First, all of the variables were converted into the logarithmic form and then the intercept of the logarithm of FDI, and ER were used to analyze the study.

For the test of the regression, two null hypotheses were established as,

H_1: the degree of sensitivity of FDI to the stock index is greater than zero or $\beta_1 > 0$

H_2: the degree of sensitivity of ER to the stock index is greater than zero or $\beta_2 > 0$

This regression model is valid if these hypotheses are satisfied. Furthermore, at 5% level of significance required regression diagnostic test techniques (Breusch-Pagan-Godfrey test, White test to check the issue of heteroskedasticity; Breusch-Godfrey serial correlation LM test to check the issue of autocorrelation; Jarque-Bera test to check the normal distribution condition of the dataset) were also conducted to find the assumptions regarding any misspecification in the regression model.

For avoiding the problem of spurious regression in the time series data, conducting the unit root test to check the stationary condition is important. If the dataset appears in nonstationary form then the explanation of the relationship among the variables is not worthwhile. Thus, before stepping into the regression model and Granger causality this study followed the ADF test which is one of the most used unit root test techniques for specifying the stationary issue in an autoregressive model. According to Gujrati, Portar and Gunasekar (2012), the ADF test, an extension of the Dickey-Fuller test, with constant (α) and a deterministic trend (βt) for time (t) is as follows;

$$\Delta Y_t = \alpha + \beta t + \delta Y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta Y_{t-i} + u_t \quad . \quad ....(2)$$

Here, u_t is an error term, $\Delta Y_{t-i} = (Y_{t-i} - Y_{t-i+1})$ is lagged difference to include until the error term is serially uncorrelated so that an unbiased coefficient estimate (δ) of lagged Y_{t-i} can obtain. EViews 11 automatically selects an optimum lag length according to the Schwarz Information Criteria (SIC). ADF method was applied to see whether the coefficient of lagged values is zero at a 5% level of significance and taking the first difference of each variable data were converted from nonstationary into stationary.

3.2 Granger causality test

For specifying the significant impact of one variable which is predicted by other time series variables a statistical hypothesis technique is denoted as the Granger causality test. This study followed the causality test to find if a unidirectional or bilateral lagged causal relationship from FDI and ER to a stock market index does exist or not in vice-versa. The existence of neither relationship implies that these variables are independent of each other. Following the pair of regressions to specify Granger causality where one variable is caused (Granger cause) and forecasted by the value of another variable (Gujarati et al., 2012), here, the relationship among stock Index, FDI, and ER were examined considering different lags. Furthermore, different numbers of lags in the stationary data of each selected variable had been applied and the result of Granger causality had been explained at a 5% level of significance by taking into consideration lag selection criteria because a direction of Granger causality is modified by the number of lags.

$$Y_t = \beta_0 + \sum_{i=1}^{k} \beta_i Y_{t-i} + \sum_{j=1}^{p} \alpha_j X_{t-1} + u_t \qquad ....(3)$$

$$X_t = \gamma_0 + \sum_{i=1}^{k} \gamma_i X_{t-i} + \sum_{j=1}^{p} \delta_j Y_{t-1} + v_t \qquad ....(4)$$

Where β_i, γ_i; α_j, δ_j are fixed parameters; X_{t-i} and Y_{t-i} are lagged values; u_t and v_t are error terms.

3.3 Cointegration test and specification of the VAR model

Cointegration test presents a stationary nature of the linear variables although the time series data for these variables are individually nonstationary under the assumption of the endogenous variables. This study applied the Johansen cointegration test technique for specifying the incidence of the cointegrating vectors in the selected nonstationary time series variables. Here, the Trace statistic test and the Maximum eigenvalue test, identifying as the two mostly used methods following the likelihood ratio technique, had been applied for analyzing the total number of vector's cointegration. Brooks (2008) defined the Trace statistic as a joint test which hypothesizes there are equal to or less than the total r number of vectors' coniegration in a setting of alternative hypothesis of presenting the cointegrating vectors' more than r. On the other hand, a separate test refers to the Maximum eigenvalue test statistic that hypothesizes stating at most r number of vectors' cointegtation where the alternative hypothesis presents r+1 number of cointegrating vector in total from the perspective of the long run unrestricted rank coefficients matrix of the VAR method (Brooks, 2008). Following a linear deterministic trend (T), for analyzing the Johansen cointegration test this study applied both the Trace statistic and the Maximum eigenvalue at 5% significance level where the number of lag determined by VAR lag order selection criteria.

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{k} \ln(1-\lambda_i).......(5)$$

$$\lambda_{max}(r, r+1) = -T \ln(1-\lambda_{r+1}).......(6)$$

Here, following the null hypothesis, r denotes the number of the cointegrating vector and λ denotes the eigenvalue at the order of i.

If cointegration is found, a restricted VAR model named the VEC mechanism is followed which is a method of explaining short-run behaviour along with long-run behaviour of a variable by an error correction coefficient (Gujarati et al., 2012). On the other hand, the unrestricted VAR model is used if there does not exist any cointegration among variables

where variables are shown in a linear function of the lagged values of a specific variable including other selected variables for a model. For three endogenous variables, the basic k number of lag VAR model with a specific variable Y_t has the form;

$$Y_t = C + \sum_{i=1}^{k} \Phi_i Y_{t-i} + \sum_{j=1}^{k} \Pi_j P_{t-j} + \sum_{m=1}^{k} \Psi_m Q_{t-m} + u_t \qquad ....(7)$$

Whereas, the VEC model includes an error correction term (ECT) as follows;

$$Y_t = C + \sum_{i=1}^{k} \Phi_i Y_{t-i} + \sum_{j=1}^{k} \Pi_j P_{t-j} + \sum_{m=1}^{k} \Psi_m Q_{t-m} + \Omega ECT_{t-1} + u_t \qquad ....(8)$$

Here, C presents a constant vector; Φ_i, Π_j, ψ_m are the matrices; Y_{t-i}, P_{t-j}, Q_{t-m} presents the endogenous variable's vector respectively; u_t presents shocks in the vector.

To check the VAR estimate's validity from the System equation model, Wald test; Stability condition check using Roots of the characteristic polynomial; Residual Portmanteau tests for autocorrelations; Residual heteroskedasticity tests; and Residual normality tests were applied at 5% level of significance.

4. Results and discussions

The summary of the descriptive statistics for each selected variable stands out in the output of table 1. The values of the average of all variables are positive. The standard deviation for FDI is more than others. All the selected variables are negatively skewed and follow the leptokurtic distribution. Jarque–Bera normality test at 5% significant level does not show the normal distribution pattern in the selected variables since the values of the probabilities (p) are significant for each variable respectively.

Table 1: Descriptive Statistics

	LogINDEX	LogFDI	LogER
Mean	7.523404	19.64764	4.117333
Median	7.497258	20.21506	4.226900
Maximum	9.028759	21.80175	4.441251

Minimum	5.894490	14.45545	3.652038
Standard Deviation	0.918971	1.924714	0.252353
Skewness	-0.096522	-0.886242	-0.498861
Kurtosis	1.488680	2.715015	1.893140
Jarque-Bera	31.33	43.50933	29.97795
P-value	0.00	0.00	0.00

Source: Author's calculation from time series 1993M01 to 2019M12 using EViews 11

Figure 1 illustrates the trend of the selected variables from 1993 to 2019 where the stock index, FDI, and ER are in the upward trend despite having an irregular breakdown in FDI and stock index for downward movement. The impact of seasonal factors had been tested by analyzing the Correlogram of each variable where no seasonal trend was detected.
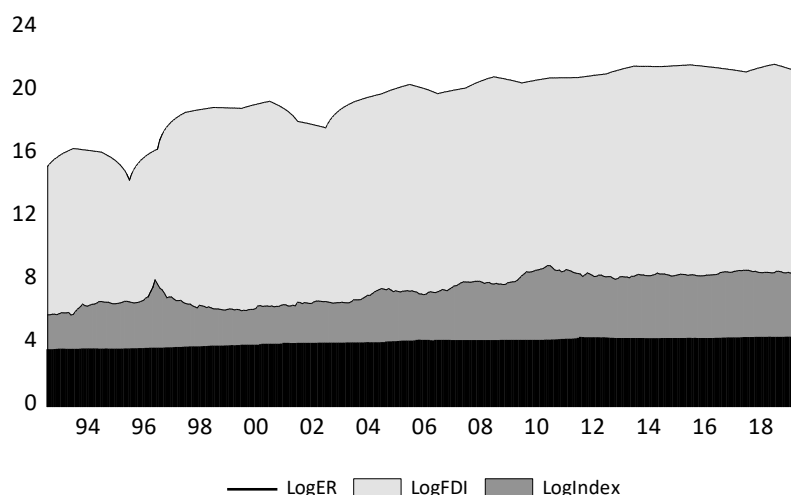

Figure 1: Trend of selected macroeconomic variables

Here, the outcome of table 2 expressed the nonstationary nature of the log values of all selected variables at level by applying the ADF test to express the stationary condition of the time series dataset. And p-value is more than 5% which implies that these variables do not reject the null hypothesis and thus these are nonstationary.

Table 2: ADF test result at the level

Variables	P-value (Constant)	P-value (Constant, Linear trend)	P-value (None)	Null hypothesis	Results
LogIndex	0.4832	0.4110	0.9226	not rejected	nonstationary

LogFDI	0.3548	0.5894	0.9301	not rejected	nonstationary
LogER	0.4633	0.9225	1.0000	not rejected	nonstationary

Source: Author's calculation from time series 1993M01 to 2019M12 using EViews 11

Later on, all selected variables turn into stationary nature based on the technique of considering the first difference at integrating order one, I(1), because the p-value is less than 5% (Table 3) rejects the null hypothesis of having a unit root.

Table 3: ADF test result at 1st difference

Variables	P-value (Constant)	P-value (Constant, Linear trend)	P-value (None)	Null hypothesis	Results
dlogIndex	0.0000	0.0000	0.0000	rejected	stationary
dlogFDI	0.0000	0.0000	0.0000	rejected	stationary
dlogER	0.0000	0.0000	0.0000	rejected	stationary

Source: Author's calculation from time series 1993M01 to 2019M12 using EViews 11

Here, table 4 presents the result of the multivariate regression model where the OLS (Ordinary Least Square) technique was used.To ensure stationary, 1st difference of all variables has been considered where all variables (both the predicted and all the predictor variables) were followed by the log-transformation technique. Here positive linkage is found in the constant term which is significant with a positive coefficient. FDI and the stock market present a negative relationship between them as it can be seen on the negative coefficient sign where the probability value is significant at 5% level of significance. This is an unexpected outcome. Moreover, the negative coefficient indicates an increase in the ER will lead to a decrease of the stock index in this scenario. But the probability value of ER is greater than 5% hence it does not indicate a significant remark on the stock market. It might be explained as the currency depreciation in Bangladesh will not cause to fall stock market. It is worth noting that the p-value of the F statistic is below 0.05 thus, it can be claimed that FDI and ER jointly influence the stock market of DSE whilst R squared value is very low which means selected macro variables do not explain DSE effectively.

Table 4: OLS regression output

Variables	Coefficient	Standard error	t-statistic	Probability
Constant	.012008	.004363	2.752572	.0063
DLOGFDI	-.144254	.049500	-2.914197	.0038
DLOGER	-.665462	.523229	-1.271837	.2044
R^2	.031291	F-statistic		5.168354
Adjusted R^2	.025237	P-value of the F-statistic		.006179

Note: Dependent Variable: DLOGINDEX, 323 observations after adjustments

Source: Author's calculation from time series 1993M01 to 2019M12 using EViews 11

The null hypothesis of not existing any serial correlation at lags 2 is rejected following the result of the autocorrelation test criteria because its p-value is 0.0000. Residuals follow the homoskedasticity nature since the two selected heteroskedasticity test values show p-value is 0.0535 and 0.2235 respectively. Furthermore, residuals of this model do not follow normal distribution because the Jarque-Bera test shows the p-value is 0.0000. Overall it can be summarized that the regression model was not the best fit based on the proof of the violation of the assumptions of a classical linear regression model. Hence, the overall output of the multivariate regression model of this study is somewhat counterintuitive for concluding the behavior of the selected variables.

The result of the Granger causality test was presented (table 5) at lags 3 to 10 where it is worth highlighting the unidirectional causal link from the stock market to FDI at a 5% level of significance. Bilateral causality found between the stock market and FDI of Bangladesh for lags 10 which is statistically significant. Moreover, results express no causality between ER and stock index; and ER with FDI. Specific lagged value of the selected macroeconomic variables was maintained following the VAR lag order criteria before conducting the Granger causality and Johansen cointegration model. The result of the Likelihood ratio (LR), Final prediction error (FPE), and Akaike information criterion (AIC) postulated that lags 3 is

suitable hence it had been selected for running the cointegration model. Previously, the first difference of each variable was considered according to the ADF test for confirming stationary data.

Table 5: Output of the Granger causality tests

Null hypothesis	Obs.	lags	F-statistic	P-value	Association
DLOGINDEX does not Granger Cause DLOGFDI	320	3	7.88605	**0.00004**	Yes
DLOGINDEX does not Granger Cause DLOGFDI	319	4	7.12500	**0.00002**	Yes
DLOGINDEX does not Granger Cause DLOGFDI	318	5	5.66104	**0.00005**	Yes
DLOGINDEX does not Granger Cause DLOGFDI	317	6	4.92611	**0.00008**	Yes
DLOGINDEX does not Granger Cause DLOGFDI	316	7	4.17812	**0.00020**	Yes
DLOGINDEX does not Granger Cause DLOGFDI	315	8	3.62458	**0.00050**	Yes
DLOGINDEX does not Granger Cause DLOGFDI	314	9	3.23515	**0.00090**	Yes
DLOGFDI does not Granger Cause DLOGINDEX	313	10	2.50272	**0.00680**	Yes
DLOGINDEX does not Granger Cause DLOGFDI	313	10	2.93962	**0.00160**	Yes

Source: Author's calculation from time series 1993M01 to 2019M12 using EViews 11

Furthermore, considering lags 3 after running the Johansen cointegration test it can be exemplified that the selected variables have at most one cointegration in the long run. Table 6 indicates that the null hypothesis of the Trace test statistic and the Maximum eigenvalue regarding at most one cointegrating vector is not rejected.

Table 6: Output of the Johansen cointegration test

Trace test statistic

Hypothesis	Eigenvalue	Trace statistic	Critical value	P-value
None	0.042	24.27	29.79	0.1892
At most 1	0.019	10.51	15.49	0.2434
At most 2[*]	0.013	4.21	3.84	0.0400

Maximum Eigenvalue test

Hypothesis	Eigenvalue	Max-Eigen statistic	Critical value	P-value
None	0.042	13.75	21.13	0.3852
At most 1	0.019	6.29	14.26	0.5756
At most 2[*]	0.013	4.21	3.84	0.0400

Note: test followed at 5% level of significance Series: LOGER, LOGFDI, and LOGINDEX ; Included observations: 320 after adjustments

Source: Author's calculation from time series 1993M01 to 2019M12 using EViews 11

The output of the Johansen cointegration test shows the presence of cointegration for both the long run and the short run. It specifies the VEC model to conduct for further identifying if cointegration is driven among selected variables. The cointegrating equation in order to address whether long-run causality exists jointly from FDI and ER towards stock index was estimated following system equation of VEC estimates which follows as;

$$D(LOGINDEX) = C(1)*(LOGINDEX(-1) + 2.87633582456*LOGFDI (-1) - 24.3814705433*LOGER (-1) + 36.3215792609)$$

Where C(1) presents the coefficient value of the cointegrating model. According to Gujarati et al. (2012) negative value of C (1) indicates a long run causality from the explanatory variables to the target variable. Here, the value of C(1) is -0.003472 where the p-value is 0.1159 (from Table 7) which implies that in the long run, the joint impact of FDI and ER on the stock market of Bangladesh is statistically not significant.

Table 7: VEC Estimates System Equation Model: Order by variable

	Coefficient	Standard error	t-statistic	P-value
C(1)	-.003472	.002202	-1.576763	.1159
C(2)	.387461	.056905	6.808919	.0000
C(3)	-.118441	.061257	-1.933503	.0541
C(4)	.077893	.058460	1.332422	.1837
C(5)	-.043891	.073039	-0.600929	.5483
C(6)	-.053553	.086006	-0.622661	.5340
C(7)	.090246	.071633	1.259846	.2087
C(8)	-.808484	.515739	-1.567623	.1180
C(9)	-.077900	.532966	-0.146164	.8839
C(10)	-.034286	.518216	-0.066162	.9473
C(11)	.007312	.004519	1.618277	.1066
F-statistic	6.181535	Prob(F-statistic)		0.000000

Source: Author's calculation from time series 1993M01 to 2019M12 using EVIEWS 11

The Wald test was applied in this study for exploring the individual influence of FDI and ER in the short term. Two hypotheses can be followed from the VEC model to specify whether FDI and ER have an influence on the stock market of Bangladesh in the short run. If the

combined value of the lagged coefficients of FDI: C(5), C(6), and C(7) is zero then it can be pointed out that FDI does not affect the stock market in the short run. Similarly, it is hypothesized that if the coefficients of lagged ER: C(8), C(9), and C(10) are in combined zero implying no relation of ER with the stock market in the short run. The output indicated that the stock market of Bangladesh does not provide a piece of evidence to influence separately by FDI or ER in the short run since the p-value was appeared as more that 0.05 and thereby null hypotheses cannot be rejected. Thus it can be summarized from VEC model estimates, there exists an insignificant long-run causality of FDI and ER towards DSE but no short-run causality exist.

Furthermore, following the Chow breakpoint test, the existence of any structural break was checked at two points of the data series.The output of this test did not support of having the structural break in the years of 2001 and 2010 since the probability value follows 0.7042 and 0.2071 respectively. Using the Roots of characteristic polynomial test and the Inverse roots of AR characteristics polynomial graph, and VEC stability condition check it can be reported that the VEC showed stability condition. Breusch-Pagan-Godfrey heteroskedasticity Test; VEC Residual White heteroskedasticity Tests; and ARCH heteroskedasticity Test examined heteroskedasticity and addressed the underlying issue is significant in this VEC model whereas, the result of VEC Residual Portmanteau Tests for Autocorrelations and the Breusch-Godfrey serial correlation LM test lead insignificant output at a 5% level of significance. Jarque-Bera Normality test of residuals for VEC estimates equation does not indicate the normal distribution. Thus, in this study VEC model does not pass all of the validity measures as there are no problems with VEC stability; autocorrelation or serial correlation but violated the assumptions of homoskedasticity and normality. Findings on significant negative regression coefficients of FDI striking a generally accepted concept regarding the impact of the FDI on the stock market does not match at DSE. Only one

direction of causal link from the stock market to the FDI was observed according to the Granger causality test result. Although differences in results exist compare to Soumarè and Tchana (2015); Issahaku et al. (2013); Bhattacharya and Mukherjee (2005); and Adam and Tweneboah (2009), there embody have some association between FDI and the stock market following; Rhee and Wang (2009); Rajapakse (2018); and Malcus and Persson (2018). Furthermore, the study of Hausmann and Fernández-Arias (2000) reflected on the countries with the less developed financial markets and institutions structure and entitled that the existence of high risk tends to attract comparatively more FDI. However, findings demonstrating a statistically significant difference overview on the causality between ER and DSE is the most unexpected hint. Unfortunately, ER appears an insignificant factor for DSE following the results of all methods used here where this study attracted conflicting interpretations from Ali et al. (2015); Issahaku et al. (2013); Hasan and Javed (2009); Harjito and McGowan (2007); Bhattacharya and Mukherjee (2005) but supports Vietha (2019); Macfarlane (2011); Rahman and Uddin (2009) and Chowdhury et al. (2006a). The findings on ER can be justified following the study of Dimitrova (2005) were summarized that the multinational or export and import oriented firm's value can be measured on the depreciation or appreciation of a currency but if the stock market index is considered; the net effect of currencies movement cannot be estimated.

Turning now to the evaluating evidence, together these results suggest a paucity regarding empirical analysis on the prevalence of joint impact of FDI and ER toward DSE because VEC estimates show an insignificant relationship. Stock Index has been identified as a contributing factor to FDI in Granger causality where regression model establishes a negative influence of FDI on DSE which is statistically significant. Despite questions about the joint impact of FDI and ER on DSE remains unclear, it can be concluded as FDI has an influence on DSE in long run. The unmeasured variables might be accountable for some aspects of the

result. Additional uncertainty arises from converting low frequency to high-frequency data of FDI therefore possible inferences of FDI cannot be ruled out. Ülkü and Demirci (2012) explained the joint relationship of the stock market and foreign exchange from the perspective of the emerging stock markets in Europe. They addressed the fact that the depth of the foreign investment as well as the stock market can express main dynamics of the stock exchange in terms of the currency. Thus, a further study with more focus on FDI and DSE is therefore suggested to confirm and validate the findings of this study.

5. Conclusion

Returning to the questions referred to as the starting point of this study, it is now possible to review in detail the influence of FDI and ER on the stock market of Bangladesh based on available information. The most obvious evidence emerges that the impact of the chosen macroeconomic indicators on the Bangladeshi stock market is not considerably significant. The output of the regression model addressed that both FDI and ER negatively affect the stock market of Bangladesh where the impact of ER was found insignificant. Although the variation of the stock market can be explained by the selected variables FDI and ER, it is only 3.12%, and the output of this multivariate regression model is jointly significant. Granger causality of DSE stock market index to FDI is satisfactory but FDI and ER made no significant cause to DSE. The long-run relationship among DSE, FDI, and ER is confirmed based on the empirical evidence of the cointegration test whilst the VEC model specifies FDI and ER jointly have an insignificant relationship with DSE. Moreover, findings does not reveal the proof of a short run relationship among the chosen variables. Synthesization of the overall test results applied in the study thereby, it can be concluded that *FDI shows its influence* on the stock market of Bangladesh in the long run. Theoretical implications of these findings are unclear as this study is subject to raising an important question about the nature of the association among the selected variables from the perspective of Bangladesh. This

paper contributes to the understanding of empirically contradictory behaviour of DSE along with FDI and ER and provides a basis for further research to develop an intense investigation about the dynamics. This study holds the key strength in the long duration based explanation regarding the consequences of the relationship between DSE and ER as it was empirically tested based on monthly data of 1993 to 2019 which appears insignificant. These findings imply the long term strategy in light of DSE considering both FDI and ER should be taken into account.

The limitation of the study belongs to the lack of a concrete explanation of the joint impact of FDI and ER on DSE. It is extremely difficult as different methods explored dissimilar explanations regarding the relationship among these selected variables. Another limitation of this study is that monthly time series of FDI are shown in conversion method from annual data which might add further caution regarding the generalization of the findings of FDI thus further experimental investigation determining the association of the selected factors is strongly recommended. For determining the shocks of FDI and ER on DSE, many possible studies such as; Impulse response function, Variance decomposition analysis using these macroeconomic variables are apparent. A future work investigating the causality between CO_2 emissions and DSE following Chang et al. (2020) would be a new aspect of macro environment analysis in Bangladesh.

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