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Influential macroeconomic factors of stock price: A study on Dhaka stock exchange

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ABSTRACT

This research aims to find out the impacts of macroeconomic factors on the stock market performance of Bangladesh. It has focused on finding out the short-run and long-run impacts of the variables. Call money rate (CMR), foreign borrowing (FB), import payment (IMPMT), and GDP growth rate (GDPGR) variables are used as independent variables, and stock price is used as the dependent variable. Monthly data from 2013 to 2022 are used for the analysis. The augmented distributed lag (ARDL) model is used for analysis. In addition, Granger causality and the error correction in short-run disequilibrium to long-run equilibrium are measured. All the macroeconomic variables except IMPMT at the first lag have an impact on the stock price. CMR has a negative relation with stock price, and all other variables have a positive relation. In the long run, all the variables are also impacting the stock price significantly. Short-run disequilibrium is being equilibrated in the long run by 32.35 percent each month. Granger causality analysis shows that except for FB, the other three variables, i.e., CMR, IMPMT, and GDPGR, have a causal relationship with the stock price in different forms. The research has found significant influential macroeconomic factors of stock price, and by using the findings, policymakers will be able to take appropriate measures.

Contribution/Originality: This particular study aimed to contribute by identifying influential macroeconomic factors affecting stock prices, including some variables that have not been extensively studied in the context of the Dhaka Stock Exchange.

1. INTRODUCTION

In shaping an economy, the stock market plays a pivotal role. It has captured the imagination of investors, analysts, and ordinary people for centuries. The world is going through ups and downs, bulls and bears, booms and busts, and fortunes made and lost. The capital market opens the door to investors and traders of securities. One of the pioneering theories that helps to understand this phenomenon is the Arbitrage Pricing Theory. Yield from an investment can be anticipated by the systematic risk of that particular investment. This theory was developed in Ross (1976). Economic indicators play an important role in that situation. It has been a crucial phenomenon to be researched in different markets globally. The US stock market return is linearly related to the macroeconomic factors of the US market (Chen, Roll, & Ross, 1986). Some other pioneering studies have stated that the fluctuations of the microenvironment are strongly connected to the volatility of stock returns (Schwert, 1989). This research focuses on Bangladesh, an emerging country of this era. It aims to explore the complex relationship between the microenvironment and the stock market prices. The primary objectives are twofold: first, to identify the key

macroeconomic factors that significantly influence market behavior, and second, to determine the directional impact, whether positive or negative of these variables on market performance. Understanding these relationships is essential for developing a comprehensive framework of market dynamics in Bangladesh's emerging economy.

Research has been conducted so far to identify significant variables in Bangladesh and has primarily focused on isolated factors, often overlooking the comprehensive interaction between various macroeconomic variables. However, the macroeconomic environment in Bangladesh is constantly changing, so up-to-date research can provide better insights into the current economic situation and its impact on stock prices. The combination of variables under consideration has never been studied before. Additionally, this research examines four macroeconomic variables, including foreign borrowing, which has not been considered in previous studies. Furthermore, limited research has addressed import payments as a macroeconomic factor, as recommended for further research by Kaur, Singh, and Gupta (2016) for an economy like Bangladesh. This study will contribute to informed decision-making for policymakers regarding future policies. In particular, foreign borrowing and import payments are crucial indicators for the economy. It is essential for authorities to maintain market stability, and these variables play a vital role in that process. These variables are directly related to the balance of payments and can significantly impact the economy. Therefore, this research identifies a gap in existing studies by including these two critical macroeconomic variables, which will assist policymakers in taking accurate measures. Moreover, the study can contribute to the broader literature on emerging markets, helping to bridge the gap between research on developed and emerging economies.

This investigation aims to define the long- and short-term influences on DSE in Bangladesh, based on macroeconomic parameters. The contribution of the study is to expand the current literature on the effect of macro factors on the stock market and to assist respective parties such as investors and policymakers in making more informed decisions.

After the introduction, an overall literature review is conducted that identifies numerous journals. A detailed methodology for completing this paper is provided afterward. The findings from the analysis are presented to meet the objectives of this research. The study concludes in chapter 5 with concluding remarks and future directions for research.

2. LITERATURE REVIEW

A large number of articles from different sources have been identified, and the author has conducted a broad literature review to develop the hypothesis of the research. Stock market performance has been crucial for any country for a long time. There has always been a relationship between the macro variables of an economy and the stock market of that particular economy. Developed countries are well aware of this situation, and daily research has been conducted on this concern.

One of the first researches conducted on this idea was by Roll, Chen, and Ross (1986). Stock market returns depend on the industrial production of that economy. The economic issue (inflation) interacts with real returns and investment capital (Fama & Gibbons, 1982). A similar kind of result is found in another research where they found an inverse relation between real yields on bills and the predicted inflation rate (Mundell, 1963). They have found out that the real anticipated returns on financial assets and economic activity correlate with each other. Another research that has been done on the London Stock Exchange has found no meaningful connection between stock market returns and macro variables, which were the main concern (Taylor & Poon, 1991).

Studies that have been conducted on the UK capital market have found no significant link between macroeconomic factors and microeconomic factors (Cheng, 1995). However, in another study, they discovered that the microenvironment has a meaningful response on the FTSE 100, but they added that the significance of the variables varies depending on the sector of the economy studied (Gunsel & Çukur, 2007). A similar result has been found by Mukherjee and Naka (1995). They have studied six macro variables that they found significant.

Macroeconomic variables of an economy can impact the stock price based on the size of the firm (Menike, 2006). The return of different markets is significantly impacted by global determinants (Abugri, 2008).

Global research on the interaction between macroeconomic variables and stock market dynamics has revealed intriguing disparities across different economies. Advanced markets demonstrate varying sensitivities: New Zealand shows minimal responsiveness to traditional economic indicators, while the U.S. market exhibits a nuanced relationship displaying weak positive correlations with the money supply but inverse relationships with the consumer price index and long-term interest rates (Humpe & Macmillan, 2009). Japan presents a distinct case, where the money supply negatively influences stock prices. The landscape of emerging markets presents even more diverse patterns. The BRIC (Brazil, Russia, India, and China) nations show remarkable resilience, with stock prices remaining largely unaffected by fluctuations in exchange rates and oil prices (Gay Jr, 2011). In contrast, Pakistan's market demonstrates sector-specific sensitivities, particularly in the oil and gas, automobile, and electronics industries (Saeed, 2012). Nigeria's market exhibits broad vulnerability to various economic indicators (Osamwonyi & Evbayiro-Osagie, 2012) while Egypt's market shows consistent correlations with multiple macroeconomic factors (Barakat, Elgazzar, & Hanafy, 2016). Interestingly, contradictory findings emerge even within the same market, as evidenced by divergent results from different studies of the Karachi Stock Exchange (Rafay, Naz, & Rubab, 2014; Saeed, 2012). These variations propose that stock market responses to economic variables are not uniform but are rather shaped by complex interactions between market maturity, regulatory frameworks, and economic development stages unique to each country.

Further analysis of emerging market indices reveals interesting regional variations. In the Indonesian Stock Exchange, researchers documented that both the Dow Jones index and crude oil prices exerted significant positive influences on the Jakarta Composite Index (JCI). However, the US dollar's strength relative to the Indonesian rupiah demonstrated a significant negative impact on the index (Robiyanto, Santoso, Atahau, & Harijono, 2019). The Ghanaian stock market presents a particularly nuanced case, as revealed through Autoregressive Distributed Lag (ARDL) modelling. Research found that multiple factors, including the monetary base (in logarithmic terms), inflation rate, and investments in equipment, buildings, and human capital, negatively impacted stock market growth. Conversely, foreign direct investment (FDI) and interest rates showed positive correlations with market performance (Asravor & Fonu, 2021).

Talking about Bangladesh's economy and stock market, several studies have been conducted by different authors from time to time. Yet, it is necessary to find the latest situation to understand the phenomenon. In emerging countries like Bangladesh, the impact of macro factors is being considered. A comprehensive study comparing sixteen developed and sixteen emerging markets revealed significant causal relationships between macroeconomic factors and stock prices in both categories. However, established markets demonstrated stronger correlations, with the notable exceptions of exchange rates and money supply. Research specific to Bangladesh's stock market has produced mixed results. The interest rate has an inverse connection with stock prices (Uddin & Alam, 2010). However, Macroeconomic factors e.g., interest rates, money supply, and crude oil prices, positively influenced stock prices (Khan & Yousuf, 2013). Another study by Quadir (2012) also supported a positive correlation between finance charges and stock returns. An interesting cross-market analysis by Hasan and Zaman (2017) examined the influence of exchange rates and the Bombay Stock Market return on Bangladesh's stock market. Their findings revealed substantial cross-market effects: a one percent increase in exchange rates could influence DSE returns by nineteen percent, while volatility in the Bombay Stock Exchange also showed a significant impact on Bangladesh's market performance. However, some studies found limited or no causality between certain macroeconomic variables and the Dhaka Stock Exchange (DSE). Ali (2011) found no Granger causality between the DSE and various macro indicators, including GDP, CPI, export receipts, investment, lending interest rate, industrial output index, deposit interest rate and the national income. More recent research by Hasan (2015) suggested that while various macroeconomic variables can

explain Bangladesh's stock market behavior, both interest rates and inflation demonstrated inverse relationships with market performance.

A comprehensive analysis of SAARC (South Asian Association for Regional Cooperation) nations' stock markets revealed an absence of correlation between market performance and key economic indicators, specifically inflation and money supply (Ullah, Islam, Alam, & Khan, 2017). In Bangladesh's secondary stock exchange, the Chittagong Stock Exchange (CSE), research indicated only weak correlations between macroeconomic variables and market performance (Chowdhury, 2017). However, more nuanced findings emerged from a recent analysis of Bangladesh's primary indices. Using Granger causality tests between DS30 and DSEX, researchers identified unidirectional causal relationships with interest rates, exchange rates, and inflation. This study also revealed a causal connection between stock prices and both CPI and foreign remittances, while import payments demonstrated a unique bi-directional relationship with stock prices (Ali, 2023).

Call money rate has served as a short-term interest rate indicator for an economy. Numerous studies have been conducted to understand the relationship between stock prices and interest rates, and they have found a causal relationship between them. Such studies are (Ajaz, Nain, Kamaiah, & Sharma, 2017; Andrieş, Ihnatov, & Tiwari, 2014; Gan, Lee, Yong, & Zhang, 2006; Hasan & Zaman, 2017; Hossain, Hossain, & Amin, 2016; Md & Alam, 2019; Mukherjee & Naka, 1995; Paramati & Gupta, 2013; Ratanapakorn & Sharma, 2007; Seltzer & Horner, 1922).

External debt has been a crucial factor for an emerging country like Bangladesh. It can boost economic activity and impact firm performance, which eventually results in economic growth.. Agyapong and Bedjabeng (2020) have found some positive relations, some negative relations, and some insignificant impacts. Considerable absolute influence can be exerted on economic growth by using external debt for specific economic reasons rather than to meet political agendas (Oke & Sulaiman, 2012). Debt inflow may stimulate growth in developing economies, as Sulaiman and Azeez's (2012) empirical research showed in their research. It is also supported by some other research (Melnyk, Kubatko, & Pysarenko, 2014; Osinubi & Amaghionyeodiwe, 2010). Financial development is significantly related to external debt, which is found by Agyapong and Bedjabeng (2020) who has taken data from 2002 to 2015, and the analysis was conducted on African economies. However, foreign debt has a negative influence on economic growth (Frimpong & Oteng-Abayie, 2006). Research has found that there is an inverse association between economic growth and external debt. Some other research also supports this finding (Adegbite, Ayadi, & Felix Ayadi, 2008; Arshad, Aslam, Fatima, & Muzaffar, 2015; Azeez, Oladapo, & Aluko, 2015).

The connection between stock return and financial development has been found by Dellas and Hess (2005). In another research, they have taken 49 emerging and mature markets in their study. Liu and Sinclair (2008) conducted an analysis to determine the relationship between economic development and stock market prices by following the VECM framework and found that stock prices can be determined by economic growth. Another study on emerging stock market performance by Oskooe (2010) concluded that the same long-term causation exists between stock price variation and economic growth, as well as short-term bilateral causality between share prices and economic development. This study also employed the Vector Error Correction Model (VECM) in their analysis. Numerous studies argue that economic growth has the power to influence a firm's performance, ultimately helping firms earn more and offer higher dividends per share, which can lead to stock price fluctuations (Cheung & Ng, 1998; Fama, 1990; Ritter, 2005; Shahbaz, Ahmed, & Ali, 2008). On the other hand, Takyi and Obeng (2013) have found that there is no relation between government borrowing and financial development in both the short run and long run in their ARDL method of analysis.

Trade balance is often used by numerous studies, which is the difference between import payments and export payments. Practically, there are not many studies that use import payments and export payments. Bodurtha Jr, Cho, and Senbet (1989) have said that changes in trade balances may indicate alterations in cash flows and a degree of financial uncertainty, both of which have an effect on stock returns. These accounts are handled as pertinent economic indicators that affect the stock market. Kwon and Shin (1999) in a study on the Korean stock market found co-

integration between macro factors and stock prices, where one of the components was trade balance. A study on Iran by Mehrara (2006) has found that trade balance Granger causes the stock price at a 5 % significance level. Chang, Bhutto, Turi, Hashmi, and Gohar (2021) have found a significant effect on the trade balance. However, according to Abdullah and Hayworth (1993), a growing trade imbalance causes stock values to drop. No causal connection has been found between stock price and macro factors in Pakistan (Ali, Rehman, Yilmaz, Khan, & Afzal, 2010). Ali (2023) observes that import payment (IMPMT) affects the change in stock prices negatively and a bi-directional causality between import payment and with DSE all-share price index.

GDP is a primary measure that can represent a country's total economic activity. Thus, it has the power to influence the future cash flow of an organization, which ultimately can impact stock values. Various renowned researchers have acknowledged that significant proportions of yearly stock-return variations are attributable to projections of factors that are significant drivers of cash flows to enterprises (Barro, 1990; Fama, 1981; Geske & Roll, 1983; Kaul, 1987).

The stock price is significantly impacted by composite determinants such as financing costs, currency exchange rates, inflation rates, and GDP growth rates (Simbolon & Purwanto, 2018). The findings of Huy, Dat, and Anh (2020) study of Vietcom Bank (VCB) in Vietnam from 2014 to 2019 indicate that GDP growth has a considerable contact with the stock price of VCB. Huy et al. (2020) analyzed Sacombank (STB) in Vietnam between 2014 and 2019 and discovered that a rise in GDP growth had an absolute influence on the stock price. In research on the Bangladesh stock market, Chowdhury, Mollik, and Akhter (2006) could not find evidence of cointegration between macro variables and the Bangladesh capital market. Ali (2014) finds that in both the long term and the short term, GDP has a considerable inverse association with the stock market. Alam, Miah, and Karim (2016), who include the GDP growth rate in their study, say that these factors have a considerable role in exploring share values on the Bangladesh stock market. Hossain (2020) has detected that the growth rate of GDP has no significant influence on the performance of manufacturing firms in Bangladesh. Islam, Mostofa, and Tithi (2017) discovered that the microenvironment had a crucial influence on the capital market performance of Bangladesh. Hasan, Islam, and Wahid (2018) discovered that the growth rate of GDP has no statistically significant effect on the performance of Bangladeshi non-life insurance firms. Research that used data from 1993 to 2019 from five South Asian nations found that there is a cause-and-effect relationship between the GDP growth rate and the stock market (Alam, 2020). There are a lot of studies that have been done so far that tried to find out some selected macro variables that are influential to the stock price and stock return (Afzal & Hossain, 2011; Al-Jafari, Salameh, & Habbash, 2011; Alam & Uddin, 2019; Ali, 2011, 2014, 2023; Chowdhury, 2017; Haque, 2016; Hasan & Zaman, 2017; Hasan et al., 2018; Hossain, 2020; Islam et al., 2017; Jamaludin, Ismail, & Ab Manaf, 2017; Kabeer, 2017; Khan & Yousuf, 2013; Mahzabeen, 2016; Md & Alam, 2019; Muktadir-al-Mukit, 2012; Quadir, 2012; Rifat, 2015). Our research is different in the sense that the combination of the variables under consideration has never been studied before in the context of Bangladesh and merits further investigation. This research is the first to use foreign borrowing and import payments as factors in the context of Bangladesh to explore their connection with the economy and stock market.

3. METHODOLOGY

For the analysis purpose, the DSE Broad Index (DSEX) prices were taken as the dependent variable, and selected macroeconomic independent variables, namely, the call money rate (CMR), import payments (IMPMT), foreign borrowing (FB), and GDP growth rate (GDPGR). Macroeconomic variables data are collected from the Bangladesh Bank Monthly Economic Trends publication (Bangladesh Bank, 2023). DSEX price data is collected from Bangladesh Dhaka Stock Exchange Commission (BSEC) (Sec.gov.bd, 2023). At the beginning of the study, the author collected several macroeconomic variables for analysis, but after testing for multicollinearity among them, most variables were removed. A VIF value exceeding 10 indicates a multicollinearity problem. Monthly data from March 2013 to

December 2022 (118 observations for each variable) was used for the analysis. The sample range was determined based on data availability for each variable at the time of the research.

The definition of variables is given Table 1.

Table 1. Variables.

Name	Definition	Unit of measurement	Acronyms
Call money rate	Call Money rate is the interest rate charged on short-term advances among banks and other financial institutions to meet immediate funding needs. These loans, often made overnight, provide liquidity for daily operations and are usually unsecured. The rate is highly sensitive to demand and supply conditions in the money market and is a key indicator of short-term monetary policy trends.	As percentage	CMR
Foreign borrowing	Foreign borrowing is the act of a country, its businesses, and financial institutions obtaining loans or credit from foreign lenders, which can include international banks, governments, or financial organizations. It is typically used to finance domestic projects, boost economic development, or manage deficits, with repayment obligations in the currency of the lending country or institution (Agyapong & Bedjabeng, 2020).	TK in crore	FB
Import payment	Import payment refers to the payment made by an importer to a foreign supplier or seller for goods or services that are being imported into the importer's country. It is the amount of money that an importer pays to the exporter or foreign seller for the goods or services received (Ali, 2014).	Million USD	IMPMT
GDP growth rate	GDP growth rate is the rate at which a country's GDP increases or decreases over a specific period, usually expressed as a percentage. It reflects the economic health and expansion of a country, showing how much the economy has grown compared to the previous period (Alam et al., 2016).	As percentage	GDPGR

The analysis begins with descriptive statistics. It aims to understand the fundamental characteristics of the data used in this analysis. In time series analysis, understanding data characteristics is essential for selecting appropriate analytical models. The Augmented Dickey-Fuller test serves as the primary tool for examining data stationarity a critical property where statistical characteristics like mean, variance, and autocorrelation structure maintain consistency over time (Shrestha & Bhatta, 2018). Non-stationary data, in contrast, shows systematic variations such as trends or cycles across different periods. Given the mixed stationarity observed in the variables, the Autoregressive Distributed Lag (ARDL) model emerges as the most suitable analytical approach. This model offers two key advantages: it captures immediate variable relationships through short-run dynamics while simultaneously accounting for extended effects through its distributed lag component, providing a comprehensive understanding of both immediate and long-term relationships among the studied variables. Some variables are stationary at level and some are stationary at first difference. The equation form of the ARDL model is.

$$y_t = \alpha + \sum_{i=1}^{p} y_i y_{t-1} + \sum_{j=1}^{k} \sum_{i=0}^{q_j} X_{j,t-1} \beta_{i,j} + \epsilon_t$$

Where:

- y_t is the dependent variable at time t.
- α is a constant (Intercept).

- $\sum_{i=1}^{p} y_i y_{t-1}$ represents the autoregressive (AR) terms, i.e., lags of the dependent variable.
- $\sum_{j=1}^{k} \sum_{i=0}^{q_j} X_{j,t-1} \beta_{i,j} + \in_t$represents the distributed lag (DL) terms, i.e., lags of the independent variables.
- $\in_t$ is the error term at time t.

The model allows for different orders of integration between the variables. It allows for both short-run and long-run dynamics between the variables It means that the variables may have different degrees of persistence or trend (Shrestha & Bhatta, 2018). ARDL model is the best to use when the variables are mixed in nature. This model is used mostly to analyze the long-term influence of economic variables that can be used to forecast future trends and assist in making new policies. Data show a mixed nature of stationarity where some are stationary at level, and some are at 1st difference. GDPGR is stationary at this level. CMR, IMPMT, and FB are stationary at 1st difference. Due to this mixed nature of data, the ARDL method is chosen for analysis because it is the most suitable one in this scenario.

By using the bound test of the ARDL model, it can be determined whether the variables are cointegrated or not, which means identifying the long-run equilibrium relationship between two or more time series variables. The equation of the bound test is as follows.

$$\Delta y_t = -\sum_{i=1}^{p-1} y_i^* \Delta y_{t-i} + \sum_{j=1}^{k} \sum_{i=0}^{q_{j-1}} \Delta X_{j,t-1} \beta_{i,j,i^*} - \rho y_{t-1} - \alpha - \sum_{j=1}^{k} X_{j,t-1} \delta_j + \in_t$$

Where

$$\rho = 0$$

$$\delta = \delta_2 = \cdots = \delta_k = 0$$

The bound test helps the user to identify the co-integration between the variables used in the model i.e., they have different levels of trend or seasonality (Pesaran, Shin, & Smith, 2001). The research used the ARDL model to evaluate the variables' long-run relationship. To use the ARDL model, the following assumptions are made.

- Variables subject to the analysis must be stationary at the level, or first difference, or both. The model will be ineffective if any variables are stationary at the second difference; the ARDL method is deemed ineffective (Pesaran et al., 2001).
- Error terms shouldn't be serially correlated with one another.
- The dataset shouldn't have any heteroscedasticity.
- A normal distribution should be seen in the dataset.

To find out the joint significance, the Wald test is used. This model is named after economist Abraham Wald. It is commonly used in linear regression, logistic regression, and other types of generalized linear models. The null hypothesis states that "The coefficient of macroeconomic factors in the regression model is zero," while the alternative hypothesis posits that "The coefficient of macroeconomic factors is not zero." Should the p-value fall below the significance threshold, the null hypothesis is rejected (Nkoro & Uko, 2016).

To monitor variable movement, an error correction term is applied, allowing for an assessment of how variables revert to their long-term equilibrium (Shrestha & Bhatta, 2018). This term combines the residual from the ARDL model's short-term dynamics with the coefficient of the lagged levels of the dependent variable. In the ARDL framework, the error correction mechanism (ECM) serves to reveal whether a long-term relationship exists between the variables and to estimate the speed at which they return to equilibrium. The error correction term's coefficient indicates the adjustment rate (Nkoro & Uko, 2016).

To uncover causal links between variables, the Granger causality test is utilized. This test relies on the principle that if X causes Y, then fluctuations in X will precede those in Y (Shrestha & Bhatta, 2018). This test uses a method where a set of regressions is used for each variable, then compares the explanatory power of these equations with and without the lagged values of the other variable(s).

$$X_t = \alpha_0 + \sum_{j=1}^{k} \alpha_{1s} X_{t-1} + \sum_{i=1}^{m} \alpha_{2i} Y_{t-m} + \in_{1t}$$

$$y_t = \beta_0 + \sum_{j=1}^{n} \beta_{1j} Y_{t-1} + \sum_{h-1}^{p} \beta_{2h} Y_{t-h} + \in_{2t}$$

Where ε_{1t} and ε_{2t} are assumed to be uncorrelated and E (ε_{1t} *and* ε_{2t}) = 0 = E(ε_{2t} *and* ε_{2s} 2s) for all s ≠ t. These equations illustrate the unidirectional causality between the variables X and Y, which will represent the stock price index and macroeconomic variable, If.α_{2i} is statistically significant meaning that y Granger-causes the variable x. Alternatively, if β_{2h} is statistically significant, then it means Y Granger causes X (Nkoro & Uko, 2016). If both are significant, then there is a bi-directional relationship, meaning that both are mutually dependent. On the other hand, if both are not significant, then there is no causal relationship between them. It is important to note that the Granger causality test does not establish causality in a strict sense, but rather it identifies the direction of causality and the extent to which one variable may influence the other variable over time. It is also subject to limitations such as omitted variable bias, reverse causality, and spurious regression. Therefore, it should be used in conjunction with other empirical and theoretical evidence to draw meaningful conclusions about causality.

Model specification, reliability of long-term coefficients, and assumptions of normality, serial correlation, and heteroscedasticity are all examined by diagnostic tests. To check the normality of the data, this research used a test named the Jarque-Bera test (Khatun, 2021). Data need to be normally distributed, for which the null hypothesis must be accepted. It will be true if the p-value generated in the test is higher than the significance level. In that research, the significance level is chosen as 5% for the analysis.

Correlation matrix and variance inflation factor (VIF) are two related statistical tools used in analysis to gain insight into multicollinearity. For this purpose, the author has chosen to include VIF, as it is also a measure of multicollinearity calculated for each predictor variable in a regression model (Schroeder, Lander, & Levine-Silverman, 1990). If the correlation value is greater than 0.80 then there might be a multicollinearity issue (Bohrnstedt & Carter, 1971). At the same time, if the VIF value is greater than 10, it also indicates multicollinearity (Schroeder et al., 1990).

To test heteroscedasticity, the Breusch-Pagan-Godfrey test has been used. It occurs when the variance of the error terms is not constant across observations (White, 1980). The test works by examining whether the squared residuals from the regression model are related to the independent variables. If they are, this suggests heteroscedasticity (King, 2018). This test is used in this research.

A stability test is done to find out the functional form of omitted variables in a regression model, which in that research is the Ramsey RESET test. The test was invented in Ramsey (1969) and Volkova and Pankina (2013). Another test used in this research is the Cumulative Sum of Squares test, which helps the researcher to identify changes in the mean of a time series data (Turner, 2010). If the data is stationary with a constant mean, the cumulative sum should fluctuate randomly around zero. However, if there is a shift in the mean, the cumulative sum will deviate from zero and continue to accumulate over time (Turner, 2010).

4. EMPIRICAL RESULTS

A descriptive analysis of variables used in this analysis is presented to understand the nature of the data. In total, 118 observations for five variables are used for the analysis. These are the Call Money Rate (CMR), DSEX Price (DSEX), Import Payment (IMPMT), Foreign Borrowing (FB), and GDP Growth Rate (GDPGR). Table 2 summarizes the results. The variable with the highest variability is Foreign Borrowing (FB), as indicated by its relatively high standard deviation (24497) compared to its mean. Similarly, IMPMT also has a high degree of variability. All the variables have shown high variability, with the exception of the GDP growth rate. The data for GDPGR is negatively skewed, while most other variables show mild positive skewness, indicating that those variables

have a few higher values that are pulling the distribution to the right. The GDP growth rate in 2019 (3.45%) is notably lower than the other values, which are mostly in the 5.78–7.88% range. This low growth rate pulls the distribution towards the left, creating a negative skew. IMPMT and FB in particular exhibit more pronounced skewness. GDP Growth Rate has the highest kurtosis (5.04), suggesting the distribution has heavier tails or more extreme outliers compared to a normal distribution. FB has the lowest kurtosis (1.996), which suggests a relatively more uniform distribution.

Table 2. Descriptive statistics.

Statistics	CMR	DSEX	IMPMT (Million dollars)	FB (TK in crore)	GDPGR
Mean	4.65	5177	4307	41072	6.51
Median	4.27	5055	3975	41643	6.72
Maximum	8.41	7329	7706	93921	7.88
Minimum	1.67	3438	2489	12021	3.45
Std. dev.	1.77	859	1239	24497	0.887
Skewness	0.37	0.397	1.12	0.489	-1.38
Kurtosis	2.24	2.35	3.47	1.996	5.04
Observations	118	118	118	118	118

Then it provides a correlation matrix to get an insight into the multicollinearity issue. Table 3 shows the correlation between the variables used in the analysis. DSEX price is correlated with all the independent variables at a 1% significance level, except for FB, which is significant at 10%. Among the independent variables, there is no significant correlation with each other, except between CMR with GDPGR and IMPMT. However, the correlation values are not substantially higher.

Table 3. Correlation matrix.

Correlation Probability	LOG DSEX	D LOG FB	LOG CMR	LOG GDPGR	LOG IMPMT
LOG DSEX	1				
D LOG FB	0.200**	1			
LOG CMR	-0.535***	-0.029	1		
LOG GDPGR	0.430***	-0.048	-0.292***	1	
LOG IMPMT	0.809***	-0.087	-0.452***	0.160*	1

Note: ***, **, and * indicates statistically significant at 1%, 5%, and 10% level.

Table 4 represents the unit root test of the variables. The data have shown a mixed nature of stationarity, where some are stationary at the level, and some are stationary at the first difference. GDPGR is stationary at the level. CMR, IMPMT, and FB are stationary at the first difference. Due to this mixed nature of data, the ARDL method is chosen for analysis.

Table 4. Unit root test.

Variables	t-stat at level	t-stat at first difference
LOG CMR	-2.01	-12.0***
LOG IMPMT	-1.15	-12.0***
LOG DSEX	-2.10	-10.2***
LOG FB	-2.75	-5.93***
LOG GDPGR	-3.86***	

Note: *** indicates statistically significant at 1%level.

The short-run co-integration is measured is presented in Table 5 by using the selected ARDL model. For that analysis, the lag length criteria were set to '1' (Appendix Table: A) (Nkoro & Uko, 2016). GDPGR has a significant impact on the stock price at a 1% significance level. On the contrary, CMR, the first lag of IMPMT, and the first difference of foreign borrowing have an impact on the stock price at a 5% significance level. The four macroeconomic

variables possess substantial explanatory power for Bangladesh's stock prices, as indicated by an adjusted R-squared value of 93.01% in the short-run model with a p-value of 0. To ensure the robustness of the data, several econometric tests have been conducted. The multicollinearity test, presented in Appendix Table B, uses the Variance Inflation Factor (VIF) and confirms no multicollinearity issues, as all variables have VIF values below 10. Results from the Serial Correlation LM Test, shown in Appendix Table C, reveal no significant serial correlation in the residuals at the 5% significance level, supporting the assumption of no serial correlation and validating the model's fit for the data. Appendix Table D demonstrates that the data in the model exhibit homoscedasticity, meaning the residual variance is consistent. Additionally, Appendix Figure A illustrates the normality of the error term, where the null hypothesis suggests a normal distribution for the error term. With a Jarque-Bera p-value exceeding the 0.05 threshold, this result indicates that the data are normally distributed.

Table 5. Short run cointegration.

Variable	Coefficient
LOG DSEX (-1)	0.676***
LOG CMR	- 0.026**
D LOG FB	1.20**
LOG GDPGR	0.111***
LOG IPMT	0.047
LOG IMPMT (-1)	0.09**
C	1.44***

Note: ***, ** indicates statistically significant at 1% and 10% level.

Table 6 presents the Wald test for ARDL. It is conducted to understand the nature of the joint significance of the independent variables. The F-statistic is 5.462259 with a p-value of 0.0005, and the chi-square statistic p-value is 0.0002. These results confirm the joint significance of the group of coefficients.

Table 6. WALD test for ARDL model.

Test statistic	Value
F-statistic	5.46***
Chi-square	21.8***

Note: *** indicates statistically significant at 1%level.

Appendix Figure B in the supplementary materials illustrates the CUSUM square test. Here, the CUSUM square line falls within the 5% significance threshold. The CUSUM square test concludes that the ARDL model is generally robust to random variation. There is no specification error in the model since the T and F values are larger than the 5% significance threshold (Table E).

According to the bound test, long-run co-integration is observed. It has identified a relationship between macro factors and the stock market of Bangladesh. As from Table 7 it can be seen that the test statistic value is 5.07 and the crucial value at 5% threshold is 3.49 which is lower.

Table 7. Bound test between DSEX and Macro variables.

Test statistic	Value
F-statistic	**5.07**
K	4

To understand CMR, FB, GDPGR, and IMPMT's continuous impact on stock market returns, the study used the bound test coefficient. All variables significantly influence stock prices. In this study, all macroeconomic variables are significant at the 1% level, except for LOG CMR, which is significant at the 5% level. Since each independent variable plays a substantial role in explaining stock market behavior, these findings suggest a long-term relationship

between stock prices and macroeconomic factors. Specifically, at the 1% significance level, the positive coefficient of D LOG FB indicates that external financing has a favorable impact on the log of stock prices over the long term. Furthermore, GDP growth rate and import payments exhibit a positive and statistically significant long-term effect, as evidenced by the coefficients of LOG GDPGR and LOG IPMT at the 1% level. Conversely, the negative and statistically significant coefficient for the log call money rate (CMR) demonstrates that the call money rate has a long-term negative impact on the dependent variable. Table 8 represents the long-run cointegration of the variables.

Table 8. Long-run cointegration.

Variable	Coefficient
LOG CMR	-0.079**
D LOG FB	3.708***
LOG GDPGR	0.342***
LOG IPMT	0.423***
C	4.447***

Note: ***, ** indicates statistically significant at 1% and 10% level.

The equation that can be drawn from the above analysis.

LOG DSEX = 4.447 - 0.079(LOG CMR) + 3.708 (D LOG FB) + 0.342 (LOG GDPGR) + 0.423 (LOG IPMT).

The error correction model with the coefficient of CointEq (-1)* = -0.324 and a corresponding p-value of 0.000 is shown in Table 9. Since the p-value is less than 0.01, we may conclude that the coefficient is significant at the 1% level of probability. The ECM regression's error correction term, denoted by CointEq (-1)*, reflects the rebalancing process that returns the dependent variable to long-run equilibrium with the other variables. The coefficient of -0.324 suggests that about 32.36% of the disequilibrium from the previous period will be corrected in the current period. In other words, the dependent variable moves 32.36% of the way back to equilibrium every period when there is a shock, and this process continues until long-run equilibrium is restored. A larger negative value of CointEq (-1)* indicates a quicker rate of adjustment towards the equilibrium level.

Table 9. Error correction model (ECM) results.

Variable	Coefficient
D(IPMT)	0.047
CointEq (-1)*	-0.324***

Note: *** and * indicates statistically significant at 1% and 10% level.

Table 10 displays the pair-wise Granger causality test findings between DSEX and all other chosen macro variables. The data suggests a statistically significant bi-directional causal relationship between trade LOG GDPGR and LOG DSEX, contradicting the null hypothesis that there is no causal association between DSEX and other macro variables. Nonetheless, at the 1% level of significance, a unidirectional causal relationship between LOG DSEX and LOG IMPMT was discovered. Borrowing from outside by the government has no causal effect on the DSEX.

Table 10. Test of granger causality.

Direction of causality			F-statistics
LOG CMR	→	LOG DSEX	8.55***
LOG DSEX	~	LOG CMR	1.39
D LOG FB	~	LOG DSEX	0.04
LOG DSEX	~	D LOG FB	0.03
LOG GDPGR	→	LOG DSEX	3.33*
LOG DSEX	→	LOG GDPGR	5.89**
LOG IPMT	~	LOG DSEX	2.12
LOG DSEX	→	LOG IPMT	26.2***

Note: ***, **, and * indicates statistically significant at 1%, 5%, and 10% level.

Call money rate is impacting the stock price both in the short run and long run. There is a significant causal relationship between CMR and stock price. The coefficient in the short run is -0.026, and in the long run, it is -0.079. Both are significant, which ultimately means that the average monthly call money rate negatively impacts the stock price of the Dhaka Stock Exchange.

This result aligns with the research (Ajaz et al., 2017; Hasan & Zaman, 2017; Hossain et al., 2016; Md & Alam, 2019; Mukherjee & Naka, 1995; Ratanapakorn & Sharma, 2007). When the interest rate increases, the cost of borrowing for businesses and investors reduces liquidity in the financial system. It ultimately decreases the profitability of the business firm and eventually lowers the stock price.

The first difference of foreign borrowing impacts the stock price both in the short run and long run. There is no causal relationship between the two, but the relation is significantly positive. The coefficient in the short run is 1.20, and in the long run, it is 3.708. Several reasons may explain this. It is argued that if foreign borrowing is used for investment in infrastructure projects such as roads, bridges, ports, and power plants, it leads to economic growth and development, which can increase investor confidence and lead to higher stock prices. The government of Bangladesh manages its foreign borrowing levels effectively and uses the funds productively, resulting in positive impacts on the economy and the stock market. This increases investor confidence, attracts foreign investment, and potentially leads to higher stock prices on the Dhaka Stock Exchange.

Bangladesh, as a heavily import-oriented nation, experiences a positive impact of import payments on stock prices in both the short and long run. However, in the short run, it is the first difference in import payments that influences stock prices. Additionally, a bi-directional causal relationship exists between import payments and stock prices on the Dhaka Stock Exchange, with a short-run coefficient of 0.09 and a long-run coefficient of 0.423. Limited research has examined the direct impact of import balance on stock prices; however, Ali (2014) found similar results to this study. Import payments, an integral component of the trade balance, have been identified as significant in explaining stock prices in prior studies, such as those by Kwon and Shin (1999), Mehrara (2006), and Chang et al. (2021). Increased imports, particularly of capital goods and raw materials, can boost industrial production and business growth, driving corporate profits and, in turn, elevating stock prices.

The GDP growth rate positively influences stock prices in both the short and long run, with a bi-directional relationship observed between these two variables. The short-run coefficient is 0.112, while the long-run coefficient is 0.342, indicating that Bangladesh's GDP growth has a sustained positive effect on Dhaka Stock Exchange prices. This finding aligns with previous studies by Huy et al. (2020), Alam et al. (2016), and Alam (2020). The results highlight the interconnected nature of economic growth and stock market performance, which is particularly significant in an emerging economy like Bangladesh, where the stock market plays a crucial role in capital formation and supports broader economic development.

5. CONCLUSION

The research has employed the ARDL method to determine the influence of macroeconomic variables on the stock market performance of the Dhaka Stock Exchange. The macroeconomic variables chosen for this research are called money rate, foreign borrowing, import payments, and GDP growth rate, and it observes that there is a significant relationship between the variables and the stock price. The findings not only align with prior studies in different markets but also address the gap in research specific to Bangladesh, an emerging economy with unique financial and economic characteristics.

From the theoretical perspective, the research provides evidence that not only the developed country's stock market is affected by macroeconomic variables but also true for the emerging economy such as Bangladesh. The negative impact of the call money rate on stock prices is consistent with established financial theories that emphasize the tightening of liquidity during periods of higher borrowing costs. Alongside that, the positive relation of GDPGR IMPMT and FB with the stock market supports the view that economic expansion and effective use of external

resources contribute to improved stock market performance. Bi-directional causal relationships between variables suggest a more intricate and dynamic relationship between macroeconomic factors and stock market performance than previously recognized in studies of the Bangladeshi market. The feedback loop developed by that analysis between economic growth and stock market activity may lead to more refined models in future research.

During periods of tight liquidity, investors, policymakers, and finance managers may understand the importance of more cautious investment strategies. The government may implement policies to improve the portfolio, as foreign borrowing and import payments have positive impacts. This can be achieved through proper channeling into productive infrastructure projects, as seen in Bangladesh, which can stimulate long-term economic growth and foster investor confidence.

The gap that this research has introduced is the use of variables as independent variables that are not well addressed by the literature that has been published till now. Foreign borrowing and import payments are those crucial variables. While previous studies have largely focused on broader trade balances, this research specifically isolates the impact of import payments and demonstrates their substantial role in shaping stock market outcomes. For further study, comparative studies between Bangladesh and other emerging markets to identify common patterns and differences can be done.

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Appendix

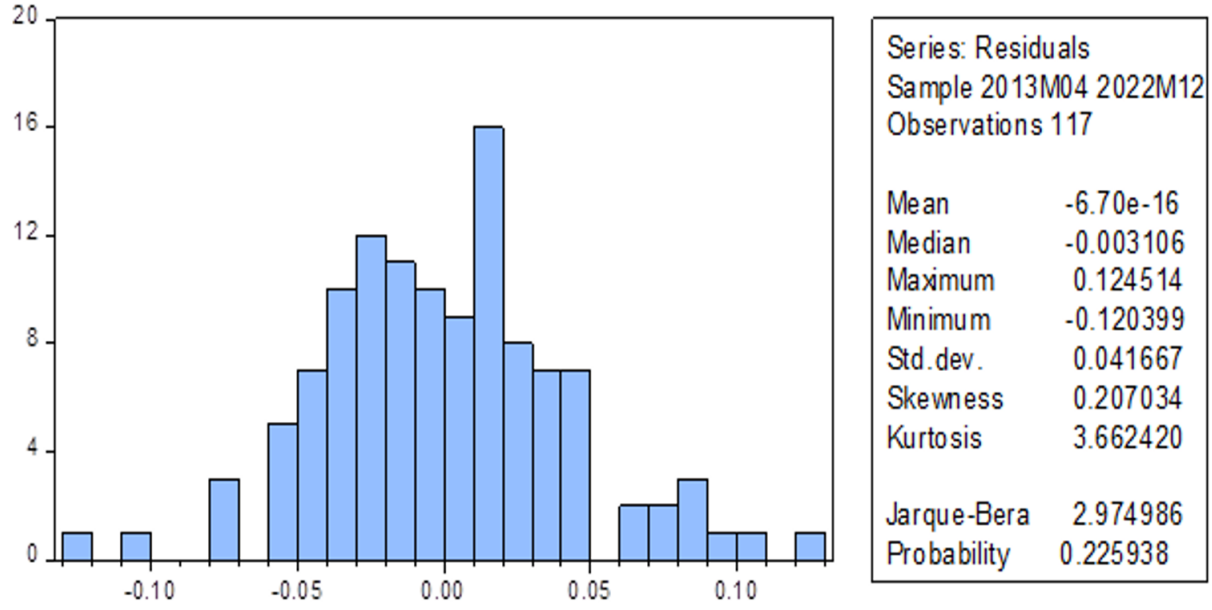
Appendix Table A. VAR lag length criteria.

Lag	LogL	LR	FPE	AIC
0	503	NA	0.000	-8.52
1	1083	1099*	0.000*	18.0*

Note: * indicates statistically significant at 10% level.

Appendix Table B. VIF.

Variable	Coefficient variance
DSEX(-1)	0.005
CALLL	0.000
DFB	0.211
GDPGR	0.001
IPMT	0.001
IPMT(-1)	0.001



Appendix Figure A. Normality test.

Appendix Table C. Breusch-Godfrey test.

Statistic	Value	Probability	Value
F- statistic	1.01	Prob. F(1,109)	0.318
Obs*R-squared	1.07	Prob. Chi-Square(1)	0.301

Appendix Table D. BPG test.

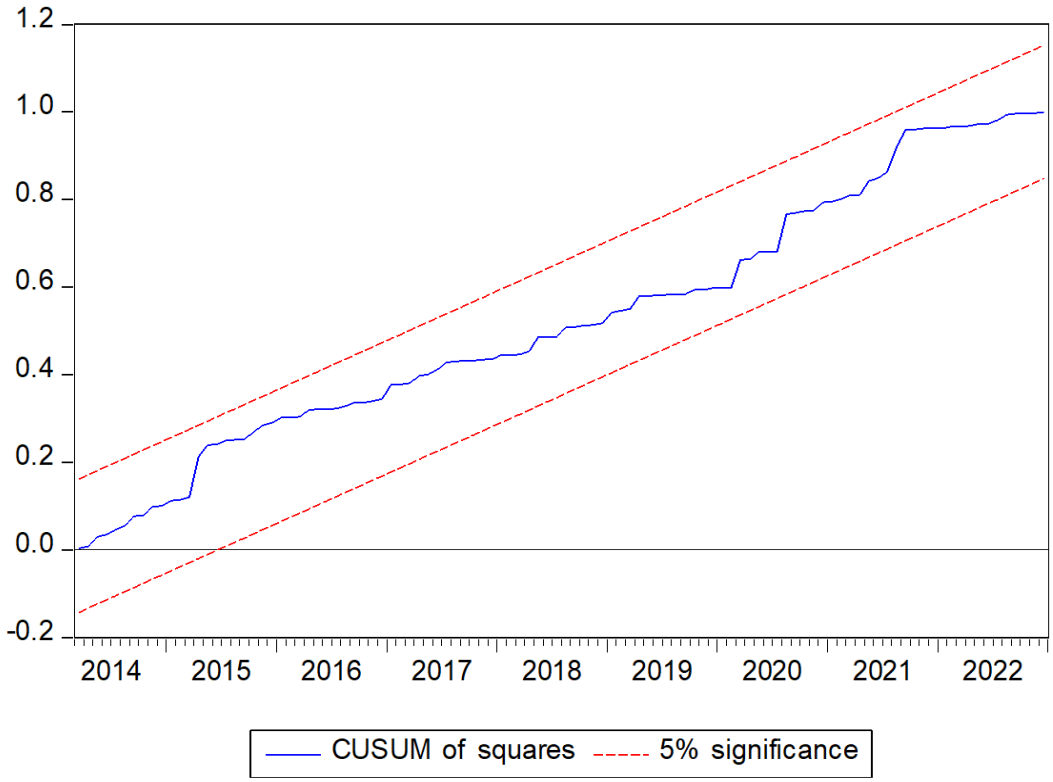
Test statistics	Value	Probability	Value
F-statistic	1.23	Prob. F(6,110)	0.296

Stability test

Appendix Table E. Ramsey reset test.

Test statistics	Value	Probability
t-statistic	1.126	0.262
F-statistic	1.269	0.262

Recursive Estimate



Appendix Figure B. CUSUM square test.