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Inflation and Stock Market Performance in a Developing Country: The Bangladesh Outlook

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ABSTRACT
This research adds empirical evidence from a developing country to the research topic: how does inflation impact stock market performance? Stock market performance is measured by the all-stock index (DSEX) of the premiere bourse in Bangladesh – Dhaka Stock Exchange (DSE). A multivariate regression model is used to investigate the relationship between inflation and stock market performance in Bangladesh. Evidence from previous literature exists of positive and negative relationships between these two variables. By examining monthly data from June, 2012 until March, 2024. It is found that inflation is negatively related to stock market performance in Bangladesh. The research paper also uses three control variables: private sector credit growth, remittance, and exchange rate. Two of them are negatively related to the stock market index, and the other is positively related.

1. Introduction

Inflation in an economy is such a macroeconomic component that impacts all the other variables like interest rates, unemployment, savings, investments, exchange rates, and so on. How does it affect the stock market performance? This is the question, especially in the stock markets of growing economies like Bangladesh. The linkage between inflation rate and stock market performance has been a research topic for a long. Some argue that inflation is positively related to the stock market index. However, others empirically found that these two are related negatively (i.e Shapiro et al., 2022). Inflation affects the nominal interest rate, which affects the level of private-sector credit. Interest rates that have always been low for a long time limit the effectiveness of monetary policy (Bernanke, 2020). During a period of lower interest rates, firms will make more profitable investments, leading to better performance (Liu et al., 2022). Kebijakan penurunan suku bunga dapat meningkatkan pendapatan dan profitabilitas melalui pengembalian investasi yang tinggi (Nissim & Penman, 2003).

Remittances reinvested into productive businesses accelerate access to international capital markets (Xia et al., 2022). While several studies investigate the relationship between remittance and banking sector development, stock market development is left out of the picture (Qamruzzaman, 2023). However, the stock market and banking sector can substitute or

complement. Although the stock market volatility is higher, the stock market is more prominent during the Covid-19 pandemic crisis than the global financial crisis (Batten et al., 2023). Therefore, theoretically, a relationship exists between remittance and the stock market. Previous research has confirmed that research on the effect of remittances on stock prices is still very rare, while it is important to address these effects especially in developing countries (Qamaruzzaman & Karim, 2020). There is a research gap in this arena. In developing countries like Bangladesh, where the stock market is volatile and has systematic setbacks, the government can handle the macroeconomic variables, especially inflation, to impact the stock market indirectly, boosting investor confidence. The government can bring more stability to the market by considering the relationship between the macroeconomic variables, which the government controls, and stock market performance.

1. Inflation Rate and Stock Market Return

Equity stocks are a claim on real assets, which can serve as a hedge against inflation. When inflation is expected to change, investors can exchange their financial assets for real assets (Zubairu Surajo, 2022). Informasi tentang mekanisme ekonomi dan harga aset penting bagi investo untuk proses penilaian resiko investasi (Cieslak & Pflueger, 2023). According to the hypothesis, the stock prices should fully reflect the expected inflation change (Eldomiaty et al., 2020); therefore, a positive relationship should exist between these two variables (Seiler, 2020). Many empirical studies found that this relationship holds. Otieno et al., (2019) examining monthly data from 1993 to 2015 using the ARFIMA model, find a positive relationship between stock prices and inflation in Kenya such that stock market investment is a guard against rising inflation. Kwofie and Ansah (2018) also found a positive relationship by examining Ghana's monthly data from 2000 to 2013 using ARDL.

When inflation rises, bond yields increase. This has an impact on funds from the stock market declining due to reduced demand for equity shares (Alzoubi, 2022). However, this argument should be invalid because the real income from bonds remains unchanged. However, others found empirically that the relationship concerned is negative. Previous research argued that the surge in stock prices that was going on during that period might be an impact of positive output effects. Folorunso (2023) also finds similar results in the Nigerian economy using a GARCH model.

However, arguments of neutrality are not absent either. According to the valuation theory in finance, a company's share price depends upon investors' valuation, which depends on the company's cash flow and discount rate. Both of these items increase when inflation increases, cancelling the impact of inflation. Others argue that inflation and stock return are negatively related in the short run and positively in the long run. Therefore, the Fisher effect holds only partially true. Other schools of argument defend the positive relationship between inflation and stock market performance. However, when inflation is expected to grow, a fall in the P/E ratio occurs. Though share prices increase subsequently, the ratio remains permanently low because inflation permanently raises effective tax on corporate-source income.

The relationship between inflation and the stock market is a long-sought one. Some tried to explain it from different angles, and others tried to establish empirical evidence from various periods. This research paper adds another ply to the second category. Other research papers on the Dhaka Stock Exchange (DSE) deal with macroeconomic variables and the stock index. But only a few dealt with inflation. This research paper will add to the empirical evidence on the topic. The geographical area is a developing economy – Bangladesh, and the time frame includes the most recent times, too, which reflects worldwide inflation instability in the aftermath of COVID-19 and the ongoing wars.

2. Other Control Variables and Stock Market Index

Many research studies investigate the relationship between macroeconomic variables and stock market performance across different types of economies. Previous study finds a long-run equilibrium relation between the stock price index and each of the production index, trade balances,

exchange rate, and money supply. It found that the indices are not leading indicators of economic variables. Barakat et al. (2016) examined data from 1998 to 2014 from two emerging economies – Egypt and Tunisia, and found a causal relationship between CPI, money supply, exchange rate, and interest rate. However, they found that CPI is not causal in the Tunisian market index.

It has been a point of interest for development researchers and researchers on finance. The link between financial development and economic development is long sought. Besides, when an investor understands what economic variables affect the stock market in which way, he can decide when to enter the market and when to exit more efficiently. There is a strong positive relationship between stock market indices and macroeconomic variables like real GDP, money supply, capital expenditure, lagged inflation, industrial production, and interest rates in the United States. Furthermore, these variables affect the stock market index.

Different researchers have decided to deal with different variables in this regard. Most of the variables overlap the others across research. However, these results cannot be generalized due to the differences in market regulations, country location, investor profile, and other factors. The number of research on this topic is so vast that it will be efficient, instead of discussing who found what variables are related, to arrange them in a table (Table 1) format with a special focus on emerging economies since Bangladesh is also an emerging economy.

Table 1. List of journals that use variables of the same kind

Author/s	Period considered	Country	Macroeconomic variables	Relationship with stock market
(Abdullai et al., 2023)	2010–2021 (monthly)	Ghana	Inflation rate, interest rate, global economic uncertainty, exchange rates	Global economic uncertainty, inflation, and interest rate 'not significantly' negative, exchange rate significantly positive
(Khan et al., 2023)	2000–2018 (monthly)	China	Oil prices, gold prices, and exchange rate	Positive with oil prices and gold prices, negative with exchange rate
(Akçağlayan & Tuzcu, 2023)	2005–2021 (monthly)	Turkey	Oil prices	An increase in oil prices by 1% decreases stock returns by 0.67%; the opposite doesn't hold
(Hashmi & Chang, 2023)	2001–2019 (monthly)	E7 countries	FDI, industrial production index (IPI), trade balance, CPI, interest and exchange rate	All variables affect stock prices in the both short-run and long-run
(Islam et al., 2020)	2009–2017	Bangladesh	Exchange rate, domestic credit, industrial production index, crude oil price	Positive with exchange rate, domestic credit, and crude oil price

A range of studies deal with macroeconomic variables and stock market performance. However, a few studies are concerned with Bangladesh's stock market. No recent studies are found on this topic as per the best knowledge of this researcher. Other studies in Bangladesh deal with a set of variables, in which inflation is one of them. However, given the worldwide debate on how inflation impacts the stock market, this researcher believes that inflation should receive a special focus which investing the relationship between macroeconomic variables and stock market performance in a developing country (Diah Wulandari & Kushindrajati Aprilia, 2023). The other three chosen variables also give this research a unique outlook as no other research deals with the same set of variables. This study is a temporal and geographical addition to the research topic.

To the best of the researcher's knowledge, very few studies have been published that have dealt with this set of variables in the Bangladesh stock market's case. This research will contribute significantly to the development of the Bangladesh stock market. Also, the government policy recommendations will set a pathway for sustainable financial growth in the country. The research

will also start a snowball that will get bigger as the economic environment in the country becomes more solid and more researchers focus on the same topic with the same set of variables.

Objectives of the study:

- To examine the relationship between inflation and the stock market index in Bangladesh.
- To establish a relationship between stock market performance and private sector credit, remittance, and exchange rate.
- To add evidence to the research question of how inflation impacts the stock market in a developing country.

2. Methods

1. Description of the Data

The dependent variable is the broad market index of DSE. Independent variable of concern is inflation. However, the other three variables are control variables that might impact the DSEX index. But the main variable of concern here is inflation. A description of the data and their source is presented in Table 2.

Table 2. Description of the variables

Variables	Description	Units	Sources
DSEX	DSE broad market index	Index value at the beginning of each month	Investing.com
INF	Point-to-point monthly inflation rate	Percentage growth of CPI over 12 month period	Bangladesh Bank and BBS
PSCG	Point-to-point private sector credit growth	Growth percentage over 12 months period	Bangladesh Bank
REM	Monthly foreign remittance inflow	In million USD	Bangladesh Bank
ER	Monthly avg. of exchange rate Tk/USD	In Tk.	Bangladesh Bank

2. Model Specification

Multivariate regression analysis is used in this research to investigate the relationship between DSE and inflation (INF). For the purpose of regression analysis and to solve the scale problem all the variables are transformed into natural logarithm format. The following equation presents the model of the multiple regression.

$$l_n DSEX_t = \propto + \beta_1 lnINF_t + \beta_2 lnPSCG_t + \beta_3 lnREM_t + \beta_4 lnER_t + \varepsilon_t$$

3. Results

Table 3 below shows the summary statistics of the variables. The Jarque-Bera test's null hypothesis is, the variable is normally distributed. From the probability of the test, we see that we can reject the null hypothesis at or below 5% level for all variables except PSCG. The other variables are not normally distributed. However, had the sample been big enough, it is assumed that the variable would have approached normality. A total of 147 observations are included in the analysis starting from January 2012 up to March 2024.

Table 3 Descriptive statistics of the variables

	DSEX	INF	PSCG	REM	EX
Mean	5216.761	0.066761	0.132087	1445.503	85.01747
Median	5095.77	0.0605	0.127175	1331.33	82.97460
Maximum	7329.03	0.1159	0.2319	2598.21	110.8636
Minimum	3438.9	0.0496	0.023335	856.87	77.40060
Std. Dev.	874.8832	0.015316	0.035242	352.1457	9.292896
Skewness	0.269598	1.151683	0.352376	0.758726	1.758603
Kurtosis	2.019332	3.168693	2.960927	2.718931	4.935878
Jarque-Bera	7.671208	32.67046	3.051485	14.58955	98.72493
Probability	0.021588**	0.000000***	0.21746	0.000679***	0.000000***
Sum	766863.8	9.8139	19.41677	212489	12497.57
Sum Sq. Dev.	1.12E+08	0.034251	0.181327	18104958	12608.26
Observations	147	147	147	147	147

*p ≤ 10%, **p ≤ 5%, ***p ≤ 1%

Test for Stationarity

Table 4 below presents the results of unit root test on all the variables. It is observed using Akaike Information Criteria (AIC) that the main variables of concern DSEX and INF both are integrated of order 1. The other two variables – PSCG and REM, are also integrated of order 1. However, the exchange rate (EX) variable is a different one and it has a trend. Stationarity is achieved for this variable after 2nd difference is taken. Therefore, EX is integrated of order 2.

Table 4 Augmented Dickey-Fuller test results

Variable	Stationarity test type	Augmented Dickey-fuller test, Akaike Information Criteria (AIC) - intercept			Integration order
		t-statistic	Prob.	Critical value at 5% level	
DSEX	Level	-1.765316	0.3965	-2.881400	I(1)
	1st difference	-10.65747	0.0000***	-2.881400	
INF	Level	-2.187826	0.2117	-2.881400	I(1)
	1st difference	-11.86635	0.0000***	-2.881400	
PSCG	Level	-2.165788	0.2198	-2.883073	I(1)
	1st difference	-3.607648	0.0068**	-2.883073	
REM	Level	-0.476936	0.8909	-2.883073	I(1)
	1st difference	-4.142244	0.0012**	-2.883239	
EX*	Level	-1.977660	0.6079	-3.442955	
	1st difference	-2.900213	0.1658	-3.443201	I(2)
	2nd difference	-6.784244	0.0000***	-3.442955	

*Intercept and trend are considered as there is a clear trend

*p ≤ 10%, **p ≤ 5%, ***p ≤ 1%

Multiple Regression Results

Table 5 shows the multiple regression results following the OLS method. The regression is performed on the natural logarithm-transformed value of each variable. R-squared from the model is 47.69%, which indicates that the independent variables can explain about 48% of the dependent variable. The probability of F-statistic shows that the null hypothesis "all the coefficients are equal

to zero" is rejected at 1% level of significance, indicating the fitness of the model. In other words, at least one of the predictors has a coefficient not equal to zero. The results further show that inflation is negatively related to DSEX, with a 1% level of significance. From the control variables, PSCG and EX are positively related. PSCG is significant at 5% level and EX is significant at 1% level. The other variable REM is not significant and has a positive sign.

Table 5 Multiple regression results

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	1.626701	0.671682	2.421834	0.0167**
LNINF	-0.276828	0.062779	-4.409523	0.0000***
LNPSCG	0.106931	0.043147	2.478294	0.0144**
LNREM	0.114215	0.069505	1.643251	0.1025
LNEX	1.252042	0.167382	7.480132	0.0000***
R-squared	0.476889	Mean dependent var		8.545703
Adjusted R-squared	0.462154	S.D. dependent var		0.167552
S.E. of regression	0.122879	Akaike info criterion		-1.321808
Sum squared resid	2.144101	Schwarz criterion		-1.220093
Log likelihood	102.1529	Hannan-Quinn criteria		-1.28048
F-statistic	32.36326	Durbin-Watson stat		0.20513
Prob(F-statistic)	0.000000***			
*p ≤ 10%, **p ≤ 5%, ***p ≤ 1%				

Results of Multiple Regression: by Including Lagged Dependent Variable

Table 6 below shows the result of the new multiple regression. R-squared this time is 92.36%, the probability of F-statistic is less than 1%, and the Durbin-Watson stat is 1.72, which is closer to 2. Inflation (INF) is still negatively related. But PSCG and EX are now negatively related and REM is positively related. However, one important thing to note now is that all the variables are insignificant statistically.

Table 6 Multiple regression results: including the lagged variable

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**prob**
C	0.323726	0.267561	1.209914	0.2284
LNINF	-0.003478	0.026677	-0.130386	0.8964
LNPSCG	-0.000707	0.01703	-0.041546	0.9679
LNREM	0.02563	0.026886	0.953264	0.3421
LNEX	-0.010709	0.078147	-0.137041	0.8912
LNDSER(-1)	0.944913	0.032842	28.77127	0.0000
R-Squared	0.923631	Mean dependent var		8.547168
Adjusted R-squared	0.920903	S.D. dependent var		0.167181
S.E. of regression	0.047018	Akaike info criterion		-3.236329
Sum squared resid	0.309502	Schwarz criterion		-3.113715
Log likelihood	242.252	Hannan-Quinn criteria.		-3.18659
F-statistic	338.6387	Durbin-Watson stat		1.721106
Prob(F-statistic)	0.00000			

Significance test: Wald Test

Coefficient diagnostic done with the Wald test shows that the probability is less than 5%. So, the null hypothesis of any of the coefficients equal to zero is rejected. The results are shown in Table 7.

Table 7 Wald test results

Test Statistic	**Value**	**df**	**Probability**
F-statistic	804383.8	(6, 140)	0.0000
Chi-square	4826303	6	0.0000
Null Hypothesis: C(1)=0, C(2)=0, C(3)=0, C(4)=0, C(5)=0, C(6)=0			
Normalized Restriction (= 0)		**Value**	**Std. Err.**
C(1)		0.323726	0.267561
C(2)		-0.003478	0.026677
C(3)		-0.000707	0.017030
C(4)		0.025630	0.026886
C(5)		-0.010709	0.078147
C(6)		0.944913	0.032842

Granger Causality Test

From the Granger Causality test in Table 8, it is found that inflation doesn't significantly cause DSEX. PSCG unidirectionally causes DSEX at 10% level of significance, and so does REM. DSEX unidirectionally causes EX at 5% level of significance. A bivariate relationship is found between EX and INF. Also, INF unidirectionally causes PSCG at 1% level of significance. REM causes PSCG at 10% level of significance and EX causes REM at 5% level of significance.

Table 8 Granger Causality Test results

Null Hypothesis	Obs	F-Statistic	Prob.
LNINF does not Granger Cause LNDSEX	145	1.57946	0.2097
LNDSEX does not Granger Cause LNINF	145	1.63249	0.1991
LNPSCG does not Granger Cause LNDSEX	145	2.81052	0.0636
LNDSEX does not Granger Cause LNPSCG	145	0.35281	0.7033
LNREM does not Granger Cause LNDSEX	145	2.38091	0.0962
LNDSEX does not Granger Cause LNREM	145	1.36389	0.2590
LNEX does not Granger Cause LNDSEX	145	0.09883	0.9060
LNDSEX does not Granger Cause LNEX	145	4.58912	0.0117
LNPSCG does not Granger Cause LNINF	145	0.42007	0.6578
LNINF does not Granger Cause LNPSCG	145	6.28547	0.0024
LNREM does not Granger Cause LNINF	145	3.12219	0.0471
LNINF does not Granger Cause LNREM	145	0.0446	0.9564
LNEX does not Granger Cause LNINF	145	3.96983	0.021
LNINF does not Granger Cause LNEX	145	8.77121	0.0003
LNREM does not Granger Cause LNPSCG	145	2.86381	0.0604
LNPSCG does not Granger Cause LNREM	145	0.96705	0.3827
LNEX does not Granger Cause LNPSCG	145	1.41011	0.2476
LNPSCG does not Granger Cause LNEX	145	0.25454	0.7756
LNEX does not Granger Cause LNREM	145	3.13533	0.0466
LNREM does not Granger Cause LNEX	145	1.56618	0.2125

4. Discussion

The empirical analysis provided a nuanced view of the relationships between the selected variables. The summary statistics and Jarque-Bera test reveal that most variables deviate from normality, except for PSCG. While non-normality can complicate certain analyses, the assumption that larger sample sizes would lead to an approximation of normality is reasonable, aligning with the central

limit theorem. Nevertheless, it is essential to consider potential biases or distortions arising from the non-normal distributions when interpreting the results. In terms of stationarity, the unit root tests indicate that most variables, including DSEX, INF, PSCG, and REM, are integrated of order 1, while EX is integrated of order 2. This suggests that the series are non-stationary at their levels but achieve stationarity upon differencing. The inclusion of differenced variables in the regression models is appropriate for avoiding spurious results in the context of time-series data.

The multiple regression results, while initially promising with an R-squared value of 47.69%, indicate some concerns regarding the independence of residuals, as detected by the serial correlation LM test. Although the subsequent regression model, which incorporates a lagged dependent variable, addresses this issue—leading to a significant increase in the explanatory power (R-squared of 92.36%)—the statistical insignificance of all variables except the lagged dependent variable raises questions about the robustness of the model. This insignificance suggests potential multicollinearity or overfitting issues that could obscure the relationships between the independent variables and the dependent variable (DSEX). The multicollinearity diagnostic, based on VIF values, showed that no severe multicollinearity exists among the independent variables, which is a positive indicator for model reliability. However, the VIF values for the lagged regression model were not reported, and future iterations of the model should verify the absence of multicollinearity in this extended framework as well.

Diagnostic tests, including the residual normality test, indicate that the residuals are normally distributed, which enhances the validity of the model's inferences. The lack of heteroscedasticity, confirmed through the White test, further supports the reliability of the regression estimates. Nevertheless, the presence of autocorrelation, identified before the inclusion of the lagged dependent variable, underscores the need for careful model specification and the potential use of alternative estimation techniques, such as generalized least squares (GLS), in future research. The results of the Granger causality tests highlight several important dynamic relationships between the variables. The fact that inflation (INF) does not Granger-cause DSEX, but that PSCG and REM unidirectionally cause DSEX at the 10% level of significance, suggests that control variables may play a more substantial role in determining market indices like DSEX. Additionally, the bidirectional relationship between EX and INF, as well as the unidirectional causality from EX to REM, provides valuable insights for policymakers and researchers into the interconnected nature of macroeconomic variables. However, these findings should be interpreted with caution, as causality does not necessarily imply direct or simple economic relationships, particularly in complex financial markets.

The study presents a well-rounded statistical analysis, but the results highlight both opportunities for refinement and limitations that future research must address. The significant improvements achieved by including a lagged dependent variable in the model suggest that dynamic models might better capture the complexity of the relationships. Further research could explore alternative model specifications, consider additional control variables, or examine potential structural breaks over the sample period to enhance the understanding of these economic relationships.

5. Conclusion

The scope of the research paper is to empirically add evidence to the research interest on the connection between inflation and stock market performance, from a developing country like Bangladesh. The main variable of interest is inflation and the broad market index of the main stock exchange of the country DSE. The researcher employs the other variables as control variables and these are not studied. There exists little literature on the variables like private sector credit growth and remittance's impact on stock market performance. However, according to the literature review section of this research, there are reasons to believe that these variables can affect the stock market index. The research employed multivariate regression analysis to examine the relationship between variables. It is observed from the regression results that inflation is negatively related to the stock market index in Bangladesh. Therefore, during a period of rising inflation, the stock market does

perform poorly. The recent drop in the DSEX after the Covid-19 pandemic is associated with a high inflation rate. Newspaper reports show that people are struggling to meet their basic needs due to high inflation. Also, there are reports that the National Board of Revenue's (NBR) plan to impose tax on capital gain as well as the current worrying condition of the economy induced forced-selling and thus a bearish trend (DSEX falls below 5,400 first time in 3yrs., 2024, June 15). The research also finds that private sector credit growth and exchange rate are negatively related to stock market performance. The depth of the stock market may be affected by the lack of interest of the firms to get listed on the stock exchange as long as they can avail bank loans. A positive relationship is found with remittance. The scope of this research is to add evidence on the topic of the relationship between the inflation rate and the stock market index. The research deals with three control variables which pave the way to finding a relationship between these variables and stock market performance in future research. This study is limited as long as empirical evidence on the relationship between inflation and the stock market index from a developing country like Bangladesh goes. This is the first article to focus on specific geography that examines economic dynamics within the context of emerging markets.

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