# Discovery

# The relationship between the macroeconomic factors and stock market price: empirical evidence from Bangladesh

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**Citation**
Anwarul Islam KM. The Relationship between the Macroeconomic Factors and Stock Market Price: Empirical Evidence from Bangladesh. *Discovery*, 2016, 52(250), 2006-2014

## ABSTRACT

This paper examines the changes of the stock price as the consequence of the movement of the macroeconomic factors. Here money supply, inflation rate, exchange rate, interest rate and index of production are employed to judge for explaining power of the variability of the stock price and find out the relationship with the stock price. Multiple regression analysis is conducted to find out the relationship macroeconomic factors with the stock price. All share general price index of the Dhaka Stock Exchange is used as a dependent variable. No significant relationship is found between the stock price and exchange rate, money supply, index of production, inflation rate except the interest rate. It is known that macroeconomic factor works as the systematic risk factor for the asset pricing. Again government is inclined to know which factors have significant affect on the stock market index.

**Keywords:** Macroeconomic Factors, Stock Market, Share Price.

**JEL classification:** C22, E44, G15.

## 1. INTRODUCTION

Any government cannot provide all the funds needed for the development of industry especially in a developing country like Bangladesh. The private sector plays a vital role to accumulate the necessary fund. Stock exchange plays a sine qua non in mopping up the necessary idle money of the savers to make a strong industrial base. It is found that stock exchange plays a role of hub for the industrialization process and acts as a barometer for an economy. Sachdeva (1994) asserts, "the importance of stock exchanges may very well be gauged from the fact that it is a major institution not only in capitalist economy but also in socialistic economy. Even the former USSR acknowledged the vital role played by stock exchanges in the development of its economy." Keeping in view the growth of the stock exchanges and the enormous funds they raise from the public, it is necessary to unearth the macro factors, if any, which have the relationship with stock market index.

## 2. LITERATURE REVIEW

Money supply plays a crucial role in the determination of price level and interest rate. It is generally presumed that money supply is determined by the policy of central bank. Ahuja (2004) states, "By money supply we mean the total stock of monetary media of exchange available to a society for use in connection with the economic activity of the country. According to the standard concept of money supply, it is composed of two elements (1) Currency with the public and (2) Demand deposit with the public."

Mankiw (2000) states, "The market price at which resources are transferred between the present and the future. The return of saving and the cost of borrowing."
Mankiw (2000) states, "An increase in the overall level of prices."
Gordon (1993) says, "The exchange rate is the price of foreign currency."
Pearce, and Roley (1985) calculated the stock market return by taking the daily percentage changes in an index of closing stock prices.
Anderson, Sweeney, and Williams (2002) states that Index of industrial production is a quantity index that is designed to measure changes in the physical volume or production levels of industrial goods over time.

The response of equity prices to changes in the excess supply of money is also as predicted. Increase in the supply of money raise stock prices while increase in nominal income (which raise the demand for money) lower stock prices (Hamburger & Kochin, 1972). He also finds that the higher the variation in the money supply, the lower the level of stock market prices. One reason for the post war bull market is that during that period the standard deviation of the rate of change of money fell to its lowest level in history. In his paper it is found that the response of stock prices to the long term interest rate reverses the anticipated pattern. A rise in the yield of an alternative asset should raise the expected yield demanded on equities and lower their prices. He asserts that the negative response of equity prices to changes in the anticipated rate of inflation. As measured by the ten-year average of past price changes, is also somewhat surprising. However, it is similar to the results obtained with the quarterly data. The higher the anticipated rate of inflation, the lower the real rate of interest associated with any given level of nominal interest and the higher should be the stock market.

Ripley (1973) conducted a research based on the stock-price indices for 19 developed countries, has found that stock prices are affected by interest rate movements, the equalization of national interest rates will result in co variation between national stock price indices.

As with the articles by Jaffe, and Mandelker (1976) and Nelson (1976) the basic hypothesis being tested is 'that expected rates of return on common stocks consist of a "real" return plus the expected rate of inflation and that the real rate of return is independent of the expected rate of inflation'. This hypothesis has been referred to as the 'Fisher effect' following the work of Irving Fisher. In their studies, they have found a negative relationship between the stock market rates of return and expected inflation.

Fama, and Schwert (1977) find that a direct, negative effect could emerge if a positive surprise in announced inflation induces agents to raise their level of expected inflation since a number of studies have found that higher expected inflation depress stock prices. The explanation of the finding, however, is still in dispute. Modigliani, and Cohn (1979) argue that investors incorrectly use inflation-swelled nominal interest rates to capitalize corporate earnings. Feldstein (1980) and Summers (1981), on the other hand, believe that the tax treatment of depreciation charges and inventory changes results in inflation reducing real after-tax corporate profits and hence lowering stock prices. A second channel by which inflation surprises may affect stock prices occurs if agents believe that policymakers react to inflation news. Unexpectedly high inflation may lead to more restrictive polices, which in turn lead to reduced cash flows for firms and lower stock prices. Similarly, if a positive inflation surprise causes agents to revise upward their assessment of future money demand, higher interest rates and lower stock prices may result if agents further expect the Federal

Reserve to maintain its previous monetary growth objectives. In any event, all of these potential links suggest that stock prices may be negatively related to surprises in announced measures of inflation.

Fama, and Schwert (1977) also found negative slope coefficients in regressions of common stock returns on treasury bill rates. There is also evidence that a single "beta" model should allow for interest rate-related changes in the relative risks of common stocks and fixed-income securities.

J. Kraft and A. Kraft (1977) studied the causal relationship between stock prices and several determinants of stock prices. The determinants used were the money supply, the rate of change in the money supply, the corporate interest rate and the risk. To test the hypothesis of causality between stock prices and their determinants, seasonally adjusted monthly data for the period 1955 through 1974 was subject to regression and spectral analysis. The findings of this study indicated that money variables were significant determinants of the behavior of common stock prices and that there was no causal relationship between the money supply, percentage change in the money supply, and Moody's AAA corporate bond rate (taken as a measure of sum of the risk less rate of interest and the risk premium) and common stock prices.

Chawla, and Srinivasan (1980) studied the relationship between the security prices and two major monetary variables, viz., money supply and interest rate by using multiple linear regression technique. They found that money supply and interest rate bear correct and significant relation in explaining the variations in security prices. These two factors jointly explained the 35 per cent of total variations in security prices. Impact of money supply on security price was stable across seasons.

Folger, John, and Tipton (1981) has found that inclusion of an interest rate factor adds substantial explanatory power to the simple single-factor market model, where the return on an index of common stocks is used as a proxy for the market portfolio.

Based on the augmented market model, Flannery, and James (1984) find evidence of interest rate sensitivity for Financial Institution's (FI) stock returns which they explain by means of the duration gap between their assets and liabilities. A few empirical studies have also examined the sensitivity of FIs' stock returns to Foreign Exchange (Foreign Exchange) rate changes while others have jointly estimated the impact of FX rate and interest rate changes.

Pearce, and Roley (1983) examined the short-run reaction of stock prices to weekly money supply announcements and drew the following conclusions. First, stock prices respond only to the unanticipated change in the money supply as predicted by the efficient markets hypothesis. Second, an unanticipated increase in the announced money supply depresses stock prices while an unanticipated decrease elevates stock prices. Third, the stock price response does not depend on the relationship of the money supply to the long run. Finally the stock price response is essentially complete early in the subsequent trading day.

Pearce, and Roley (1985) again examined the daily response of stock prices to announcements of the narrowly defined money stock, the consumer price index, the producer price index, the unemployment rate, industrial production and the federal Reserve's discount rate. Except for the discount rat, survey data on market participant's expectations of these announcements were used to identify the unexpected component of the announcement in order to test the efficient market hypothesis that only the unexpected part of any announcement, the surprise, moves stock prices. The empirical results supported this hypothesis and indicated further that surprises related to monetary policy significantly affect stock prices. There was only limited evidence of an impact from inflation surprises and no evidence of an impact from real activity surprises on announcement days.

Chen, Roll, and Ross (1986) conducted a research in US market, examined whether innovations in macro-economic variables, like the spread between long and short interest rates, expected and unexpected inflation, industrial production and the spread between high and low grade bonds, are rewarded in the stock market. Several of these economic variables were found to be significant in explaining expected stock returns, most notably industrial production, changes in the risk premium, twists in the yield curve, and somewhat more weakly, measures of unanticipated inflation and changes in expected inflation during periods when these variables were highly volatile. They also examined the impact of an index of oil price changes on assets pricing and found no overall effect.

Jain (1988) examined hourly stock prices and hourly trading volume, for the period 1978 to 1984, to investigate the response of market participants to announcements about the money supply, consumer price index, producer price index, industrial production and the unemployment rate. The empirical results indicate that surprises in announcements about money supply and consumer price index are significantly associated with stock price changes. The announcement of the other three variables does not affect stock prices considerably. Trading volume is not affected by any of the five economic variable announcements, indicating that market participants do not differ substantially in the interpretations of the effects of announcements. The speed of adjustment analysis indicates that the effect of information on stock prices is reflected in a short period of one hour or so. This suggests that it is advantageous to use hourly stock returns data in research projects investigating the effects of announcements of economic variables.

Cutler, Poterba, and Summers (1989) finds that industrial production growth is significantly positively correlated with real stock returns over the period 1926-1986, but not in the 1946-1985 sub period. Cutler et. al. provides no support for the hypothesis that

inflation, money supply, and long term interest rate reliably affect stock returns. More generally, Cuter et. al. seeks economic news events that might explain large stock market return ex post.

Darrat (1990) made a research on Canadian stock Exchange, finds that when the volatility of interest rates begins to rise, investors would want to shift out of bonds and into equities, exerting upward pressure on stock prices. He said, "a persistent rise in interest volatility could be interpreted as a rise in the overall economic uncertainty. This would, in turn, raise the risk premium attached to stocks, leading to a fall in stock prices." He also finds that industrial production index exhibits a significant negative coefficient. Also a noteworthy finding in his research is the negative relationship between the inflation rate and stock returns.

Choi, Elyasiani, and Kopecky (1992) report much stronger evidence of interest rate sensitivity than FX rate sensitivity although the degree of sensitivity varies by bank groups.

Wetmore, and Brick (1994) found empirical results for US banks stock return in the stock market. They also report that the extent of FX rate sensitivity has increased over time while interest rate sensitivity has decreased.

Chamberlain, Howe, and Potter (1997) report weak evidence of FX rate sensitivity for US banks. Their cross-section regression results show that accounting measures can in fact explain the degree of FX rate sensitivity. Japanese banks do not appear to be exposed to FX rate changes and the degree of sensitivity also appears to vary over time. In contrast, Choi, and Elyasiani (1997) report much stronger evidence of FX rate sensitivity than interest rate sensitivity for US banks. Most of the banks in their study exhibited FX rate sensitivity.

## 3. PROBLEM STATEMENT

Economic factors are basically influence the stock market index. Chen, Roll, and Ross (1986) asserts, "A rather embarrassing gap exists between the theoretically exclusive importance of systematic "state variables" and our complete ignorance of their identity. The co movements of asset prices suggest the presence of underlying exogenous influences, but we have not yet determined which economic variable, if any, are responsible." In multifactor asset pricing models, any variable that affects the future investment opportunity set or the level of consumption could be a priced factor in equilibrium (Merton, 1973; Breeden, 1979). Securities affected by such un diversifiable risk factors should then earn risk premia in a risk-averse economy (Ross, 1976). Flannery, and Propapadakis (2002) stated that macroeconomic variables are excellent candidates for these extra market risk factors, because macro changes simultaneously affect many firms' cash flows and may influence the risk-adjusted discount rate. Economic conditions may also influence the number and types of real investment opportunities. Yasaswy (1994) states, "to gain an insight into the complexities of the stock, one need to develop a sound economic understanding and be able to interpret the impact of important economic indicators on stock markets"

Pearce, and Roley (1985) found that there is significant relationships exist between the money supply and stock market price. Weak support has been found relationship between the stock market price and inflation rate, index of production. This paper will extend this research by adding two other variables like interest rate and exchange rate in context of Bangladesh Economy.

## 4. OBJECTIVES OF THE RESEARCH

Stock market has to survive in an economy like the men have to live in the environment. Effect on the environment affects the human life also. This also happens in case of stock market. Any policy which has been taken to balance the economy will make a vibration in the stock market consequentially or inconsequentially. So there are relationships between the stock market index and the macroeconomic factors which are interest rate, exchange rate, index of production, inflation rate and money supply. Now this paper is a venture to find out the significant relationship between the stock market index and macroeconomic factors, if there is any.

## 5. HYPOTHESES DEVELOPMENT

Based on the literature review, following hypotheses are produced:
• There is a significant relationship between the money supply and stock market return in context of Bangladesh.
• There is a significant relationship between the index of production and stock market return in context of Bangladesh.
• There is a significant relationship between the inflation rate and stock market return in context of Bangladesh.
• There is a significant relationship between the interest rate and stock market return in context of Bangladesh.
• There is a significant relationship between the exchange rate and stock market return in context of Bangladesh.

## 6. RESEARCH METHODOLOGY

### 6.1. Research design

In this research, relationship has been searched with dependent variable and independent variables. Cooper, and Schindler (2003)

stated, "Research that studies the relationship between two or more variables is also referred to as a correlation study." In this paper, the dependent variable is stock market return. The independent variables are interest rate, exchange rate, and index of production, money supply and inflation rate.

## 6.2. Sampling
The sampling period for the paper begins from September, 1996 to ends in December,2015.

## 6.3. Data collection procedure
Macro variables are collected from the monthly report named "Economic trends" which is published by the Bangladesh Bank. The DSE all general share price index is collected from the dataset of the Dhaka Stock Exchange library.

## 6.4. Measures of variables
### Dependent variable Stock Market Return
Quarterly percentage change in an index of closing price is used. The particular stock index employed is the Dhaka Stock Index's all general share price index. Firstly from the daily closing price index, the three month average price index is calculated. Then the following way the calculation is done by Pearce, and Roley (1985).

$$MR= \{(Q_t-Q_{t-1})/Q_{t-1}\}*100$$

## 6.5. Interest Rate
Quarterly change in interest rate is used. Calculation is used by Joseph and Vezos (2006) in the following way:

$$IR = (IR_t-IR_{t-1})$$

Where $IR_t$ : Quarterly interest rate in time t. $IR_{t-1}$ : Quarterly interest rate in time t-1.

## 6.6. Data analysis procedure
To analyze the data, various statistical tools are used. Mean, standard deviation, maximum, minimum, graphs are used to have and idea of the general profile of the variables. To know the extent of association among different variables, Spearman rank coefficient of correlation is used. For testing the significance of correlation coefficient, the students t-test is used.

To find out the linear relationship, Multiple Regression analysis is conducted. Chawla, and Srinivasan (1980) studied the relationship between the security prices and two major monetary variables, viz, money supply and interest rate by using multiple linear regression technique.

It is grudging admittance from the researchers that autocorrelation is found in time series data. Dougherty (2002) stated, "Autocorrelation normally occurs only in regression analysis using time series data." Again Gujrati (1992) confesses that time series data can also suffer from the heteroscedasticity problem. Atindehou, and Gueyle (2001) made research on Canadian stock return to find out the influence of exchange rate on Canadian bank stock return. They tested autocorrelation and heteroscedasticity and remove these problem. In this paper results are presented after removing the problem of autocorrelation and heteroscedasticity. The significance of the coefficient of explanatory variables are tested by computing the student t-statistics. To determine the proportion of explained variation in the dependent variable, coefficient of multiple determination ($R^2$) is worked out.
The statistical package Stata SE 8 is used to analyze the above techniques.

# 7. RESULTS AND DISCUSSION
## 7.1. Result

**Table 1** Summarization of the variables

| Variables Observations | | Mean | Std. Dev. | Minimum | Maximum |
|---|---|---|---|---|---|
| MR | 76 | 4.12 | 19.81 | -35.45 | 111.78 |

| | | | | | |
|---|---|---|---|---|---|
| MS | 76 | 1236.31 | 5871.98 | -46999.9 | 7744.2 |
| IP | 69 | 1.32 | 9.90 | -30.18 | 45.77 |
| IF | 73 | 1.02 | 1.40 | -2.48 | 5.88 |
| ER | 76 | 0.46 | 0.59 | -0.58 | 2.6 |
| IR | 67 | -0.05 | 0.29 | -0.94 | 0.6 |

From the table 1, it is found that the number of observation for the market return is 76 and the average of the market return is 4.12 and the dispersion from the mean is 19.81. The maximum value is 111.78 and the minimum value is -35.45. The observations of the money supply are 76 and the mean value of money supply is 1236.31 and the standard deviations are 5871.98. The maximum value is 7744.2 and the minimum value is - 46999.9. Index of production is based on the 69 observations. The mean value is 1.32 and the dispersion from the mean is 9.90. The maximum and the minimum value is 45.77 and -30.18 respectively. Number of observations for the inflation rate is 73 and the mean value is 1.02. The standard deviation is 1.40. The minimum and maximum value is -2.48 and 5.88 respectively. Exchange rate is based on the 76. The mean value is 0.46 and the standard deviation is 0.59. The maximum and the minimum value is 2.6 and - 0.58 respectively. Interest rate is based on the sample of 67. The mean value is -0.05 and the dispersion from the mean is 0.29. The maximum and minimum value is 0.6 and -0.94 respectively.

**Table 2** Correlation matrix for money supply, index of production, inflation rate, exchange rate and interest rate with stock market return.

| Variable MR | | MS | IP | IF | ER | IR |
|---|---|---|---|---|---|---|
| MR | 1.0000 | | | | | |
| MS | 0.0385 | 1.0000 | | | | |
| | 0.7415 | | | | | |
| IP | -0.0327 | -0.0182 | 1.0000 | | | |
| | 0.7898 | 0.8818 | | | | |
| IF | -0.1667 | -0.1229 | -0.1868 | 1.0000 | | |
| | 0.1585 | 0.3004 | 0.1272 | | | |
| ER | -0.1222 | 0.0716 | 0.1472 | -0.0184 | 1.0000 | |
| | 0.2929 | 0.5389 | 0.2275 | 0.8772 | | |
| IR | -0.1352 | -0.1335 | 0.2266* | -0.0928 | 0.0109 | 1.0000 |
| | 0.2753 | 0.2814 | 0.0791 | 0.4446 | 0.9275 | |

Note: *p value is less than 0.10

Aczel (1995) mentioned, "the correlation between two variables, X and Y, is a measure of the degree of linear association between the two variables." Jahangir (2003) asserts, "the bivariate correlation procedure was subject to a two tailed test of statistical significance at two different levels highly significant ($p < 0.001$) and significant ($p < 0.01$) or ($p < 0.05$)."

Correlation matrices among the studied variable in this paper are listed in table 2. Second row of the every variable shows the

significance level of each correlation coefficient. No significant association was found among the variables in the 5%, 1% and 0.1% level. Significance association of index of production with interest rate is found at the 10% level.

**Table 3** Regression analysis: Estimation results and summary statistics from the multiple regression model

| | Estimated coefficients | | | | | | Summary Statistics | |
|---|---|---|---|---|---|---|---|---|
| | $\beta_1$ | $\beta_2$ | $\beta_3$ | $\beta_4$ | $\beta_5$ | $\beta_6$ | $_R2$ | D-W |
| MR | 3.10 | 0.0009 | -0.08 | -0.002 | -1.59 | -10.42 | | |
| | (3.36) | (0.001) | (0.21) | (1.49) | (3.20) | (6.65) | 0.0826 | 1.28 |
| MR$_r$ | 1.44 | 0.001 | -0.12 | 0.53 | 0.57 | -7.99 | | |
| | (3.88) | (0.001) | (0.17) | (1.48) | (2.87) | (5.96) | 0.0957 | 2.07 |
| MR$_h$ | 3.10 | 0.0009 | -0.08 | -0.002 | -1.59 | -10.42* | | |
| | (3.05) | (0.001) | (0.21) | (1.76) | (2.50) | (5.21) | 0.0826 | 1.28 |

*Notes: *p value less than 0.10*

Standard error is shown in the parentheses.
D-W: Dublin- Watson d-statistic.
MR$_r$: After eliminating the problem of autocorrelation.
MR$_h$: After eliminating the problem of heteroscedasticity

In the first row, Market return (MR) represents the coefficient before the removing the problem of autocorrelation and heteroscedasticity. In that case, $R^2$ is 0.0826. It means that 8.23% variability of the market return can be explained by the market return, index of production, inflation rate, exchange rate and interest rate. No significant relationship is found at the 5%, 1% and 0.1% level. Even no significant relationship is found at the 10% level also. So it is found that beta coefficients are not individually statistically difference from the zero. Again d statistics is 1.28. Presence of positive autocorrelation is found. Removing the problem of autocorrelation the beta coefficients are presented in the second row.

In the second row beta coefficients are given after taking the remedial measures. After the remedial measures d statistics has been improved. It is near to 2 which mean the no autocorrelation. In this scenario, $R^2$ has been improved. It is 0.0957. It means that after eliminating the autocorrelation, 9.6% variability of the market return can be explained by the explanatory. It also found that estimated coefficient does not improve. Those estimated coefficient individually are not statistically difference from the zero at the 10% level.

In the third row, the estimated coefficients are presented after taking the remedial measures for the heteroscedasticity. In this case, the $R^2$ is found what it was before eliminating the problem of autocorrelation. In this scenario, the estimated coefficient of interest rate is significant at the 10% level. It shows a negative relationship with the market return. When the interest rate has been increased by 1 unit, holding other variable constant, market return has been decreased by 10.42 units. Other estimated coefficients are not statistically different from the zero.

### 7.2. Discussion

The hypothesis that macroeconomic developments have significant relationship between with stock market return has strong intuitive appeal but almost no empirical support in our economy. Though Pearce, and Roley (1985) found the relationship between the change in money supply, change in index of production and inflation rate with the market return in the U. S Economy. But in case of Bangladesh, it does not match with them. In Bangladesh no significant relationship is found. Again Atindehou, and Gueyle (2001) found that stock returns were related with interest rate and exchange rate in Canadian Economy. In our economy this does not happen. But after removing the problem of heteroscedasticity, the interest rate is related with the market return at the 10% significant level which was also found in the Canadian economy after removing the problem of heteroscedasticity in the research of

Atindehou, and Gueyle (2001).

## 8. CONCLUSION

This research paper reveals that there is almost no significant relationship between the macro economic factors and stock market return in our economy. Future research can be done to find out the relationship among the expectational data and stock market price. Again other models like GARCH model, EGARCH model, logarithomic multiple regression model can be used for more logical findings than the present one. This paper is limited to find out the relationship of macroeconomic factors with Dhaka Stock Exchange index. Relationship can be searched with the Chittagong Stock Exchange (CSE) index.

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