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Impact of Monetary Policy on Post Crashed Stock Market Performance: Evidence from Dhaka Stock Exchange

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Abstract

This paper investigates the impact of monetary policy variables on the performance of recent post crashed stock market of Bangladesh using monthly data from 2011. As a dependent variable Dhaka Stock Exchange (DSE) General Index (DGEN) has been used as a proxy for stock market performance and three independent variables have been used namely money supply, repo rate and inflation rate as proxies for monetary variables. The study used econometric techniques of measuring the functional relationship between monetary variables and market index using the concept of Unit root test and Cointegration technique. Causal relationships have been investigated using Granger causality test. The coefficients of all the explanatory variables are found statistically significant. By employing Cointegration technique it is observed that in the volatile stock market of Bangladesh, a one percent increase in inflation, in money supply and in repo rate contributes 2.61and 12.98 percent decrease and 6.08 percent increase in the market index respectively. Finally, Granger causality analysis suggests the existence of unidirectional causality from inflation to DGEN index and money supply to DGEN index.

Key Words: Dhaka Stock Exchange, Crash, Monetary Policy, Index, Money Supply, Co-integration, Granger Casualty

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1. Introduction

"Growth of new businesses or an economy would not be possible without availability of stocks and development of financial markets" (Hafer and Hein, 2007). As a part of the financial market, stock market performs a crucial role for economic development as an intermediary between investors and firms. Money market and Capital market are two different markets but both are interlinked. Regulators have great impact on the stock market through the money supply channel. As a regulator of money market, the Central Bank is responsible for monitoring activities of commercial banks and other financial institutions listed and involved in stock market trading. Since there exist functional relationship between monetary policy and market index, so it is necessary for the central bank to determine the impact of monetary variables such as money supply, interest rate and inflation rate on the performance of stock market. Besides, a stock market is not always blessed with upbeat condition. Bearish condition, market crash or corrections are the common phenomenon for any stock market. Stock market crash is a straight and sudden decline usually a steep double-digit percentage loss in a stock market index over a certain period of time. Crashes are driven by investors' irrational behavior as much as by underlying economic factors including monetary policy also. The Wall Street Crash in 1929, Crash of 1987, Asian Crisis in1997 or the Global financial crisis in 2008 are all classical examples of stock market crises. After the market crash, usually a number of initiatives are taken to make the market stable through different policies, different rejuvenation packages or change in monetary policy and so on. Recently the stock market of Bangladesh has observed a massive crash where the index lost more than 50 percent from its peak of 8, 918 points to around 4000 points. Besides different initiatives, the central bank of Bangladesh 'Bangladesh Bank' is also trying to improve the condition through controlling different monetary variables. But the question is; how effective the policy of Bangladesh Bank is and what are the short-run and long-term effects of its monetary policy on post crashed stock market prices.

An expansionary monetary policy increases cash in the hands of public.

With the excess money people intend to invest more in stock market. As a result there is an increase in demand for stocks. A higher demand for stocks causes its price to go up. On the other hand, inflation being positively related to money growth reduces the real value of financial assets. At this stage people are likely to shift their investment to other real assets like gold, commodities or real estate to outperform financial assets during the inflationary period. This situation lowers demand and price of stock. An expansionary monetary policy also causes the interest rate to decline. A reduction in interest rate leads to lower cost of borrowing and has two effects on the stock market; people either tend to take more loans at a lower cost to invest in the stock market or lower interest rate make investors reluctant to invest or keep money in the bond market, in fact they tend to move money from the bond market to the equity market and higher demand for stocks in turn lead to sharp increase in stock prices.

This paper attempts to determine the impact of monetary policy on post crashed stock market of Bangladesh through different econometric approaches. It aims at investigating the impact of monetary variables considering inflation rate, repo rate and money supply on the performance of post crashed stock market. For this purpose the paper employs different econometric techniques such as stationarity test, Cointegration and Granger Causality test in analyzing statistical phenomenon of these variables. The importance of the study is to determine the effectiveness and consequences of the various monetary policy variables initiated by the central bank in the process of restoring stable market conditions.

2. Brief Overview of DSE

The country's first stock exchange, Dhaka Stock Exchange (DSE) was established in 1954 and commenced its operations in 1956. It started its journey with 196 listed securities and total paid up capital of Taka 4 billion. The trading activities of the exchange were suspended during the time of independence but were resumed again in 1976. High development of the market is noticeable after initiation of financial sector reforms during 1990s.

The number of listed securities of DSE stood at 153 at the end of 1993. The stock market of Bangladesh first collapsed in 1996 where market index dropped from a peak level of 3648 points to 757 points.

The causes of this crash were attributed to the absence of automated trading system and circuit breakers, weak surveillance by market regulators, adoption of wrong policies and trading of fake paper shares.

After the 1996 crash, the stock market of Bangladesh had to struggle hard to regain market stability. At the end of December, 2010 total number of listed securities stood at 445 with market capitalization of Taka 3472502 million. As shown in figure 1, on 5th December, 2010 the DSE General Index (DGEN) reached at its peak of 8918.51 points. But the market faced first bearish condition on 19th December when the index fell to 7654 points. The second decline occurred on 10th January, 2011 when the index declined to 6499 points and at the end of February it stood at 5200 points; the volatile condition of market still prevails. To stabilize the market and regain its position, a number of policy measures are taken by policy makers and regulators including the Bangladesh Bank.

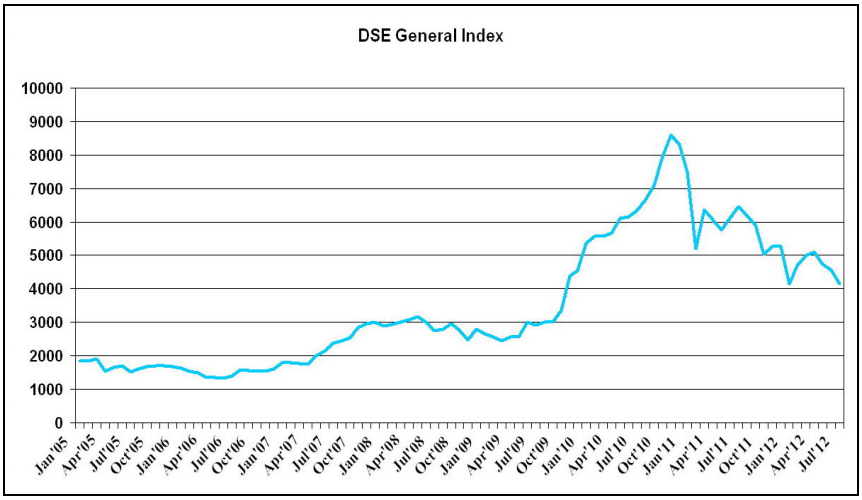

Fig. 1 Recent Movement of DSE General Index
Source: www.dsebd.org

3. Literature Review

As a key component of a financial system, a capital market performs a crucial role in the economic development of a country. On the other hand, monetary policy is a measure designed to control the supply of money and credit, to adjust interest rate with the objective of influencing the overall level of economic activity. "Because of their potential impact on the macro economy, stock market movements are likely to be an important determinant of monetary policy decisions" (Rigobon and Sack, 2003). The existing literature provides a number of theories demonstrating the relation between stock market and economic activity proxied by different macroeconomic variables. On the basis of some asset price channels of the monetary policy transmission mechanism, it is generally agreed that restrictive monetary policy leads to lower stock prices and expansionary monetary policy leads to higher stock prices. This is strongly supported by several models like Tobin's q-theory and Modigliani's wealth effect model. Using Tobin's q theory, James Tobin (1969) demonstrated that the association between money supply and stock prices is positive. Modigliani (1971) and Mishkin (1977) suggested that lower interest rates increase stock prices which in turn lead to increased business investment. Normally, a lower interest rate leads to higher capital flows towards the stock market in expectation of a higher rate of return, where as a higher interest rate encourage savings in banks and consequently reduce the flow of capital to the stock markets. The study of Fama and Schwert (1977) showed inverse relationship between common stock returns and treasury bill rates. Through monetary policy, a central bank not only influences interest rates but also inflation expectations. When there is an unanticipated rise in inflation then it is expected that more restrictive monetary policy will be imposed which subsequently leads to decline in the stock prices. In fact, the relationship of inflation with stock prices is negative (Fama and Schwert, 1979). There is an observed inverse relationship between stock returns and both actual and expected inflation due to the economic agent's money demand (Fama, 1981) or countercyclical monetary policy (Kaul, 1987).

To determine the effect of monetary policy on stock and bond return, Booth and Booth (1997) used two variables of monetary policy. One is the discount rate and another is the federal fund rate. The findings of their study show that a decrease in monthly return of both large and small bond and stock portfolio is associated with a restrictive monetary policy. Using Vector Auto Regression (VARs) model to determine the effect of monetary policy on US stock markets, Patelis (1998) also confirmed these findings. Thorbecke (1997) finds that monetary policy not only effects ex-post return but also ex-ante return and a positive (negative) stock return is associated with an expansionary monetary policy (contractionary). Considering real GDP, inflation, real M3 balances, short term interest rate, bond yield, and real stock prices; Cassola and Morana (2004) conclude that a permanent monetary shock has a strong but temporary effect on stock market while it has a permanent impact on inflation in the euro area. Using monthly data from 1971 to 1990, Mukherjee and Naka (1995) studied the association of stock prices in Tokyo Stock market with a set of macroeconomic variables. Their Vector Error Correction Model of the study suggests a positive relationship between stock price and money supply, stock prices and industrial production, stock price and exchange rate. Among other variables the relationship between inflation and stock price is found to be negative where interest rates have a mixed relationship. Using the Vector Autoregressive model, Tsoukalas's (2003) study demonstrated a strong relationship of stock prices with money supply, exchange rate, industrial production and consumer prices in Cyprus. Jensen and Johnson (1995) stated that the pattern of stock returns are associated with monetary policy decisions. Their study shows that a decreased discount rate leads to increase in long term stock returns that are higher than the returns followed by increased discount rate. The study of Abdullah and Hayworth (1993) imply that the relationship of money growth and inflation rate with stock return is positive; on the other hand trade deficit, budget deficit and interest rates have an inverse relationship with stock returns. With respect to the short run analysis, the stock market index is affected by only interest rate and not the money supply movements. Using Cointegration test, Granger causality and Impulse response analysis, Hasan and Javed (2009) explored the relationship

between equity prices of Pakistan stock market with the money supply, foreign exchange rate, treasury bill rate, and the CPI. A unidirectional causality is found from the monetary variables to the equity market. They also found that the relationship of interest rate and exchange rate with equity market returns is negative whereas the relationship is positive between money supply and stock market returns.

The effectiveness of monetary policy also depends on market conditions and business cycle. Several studies confirm this statement. Jensen et al. (1996) concluded that besides monetary policy, stock market returns also depend on business conditions; a tight monetary policy result in higher stock returns. Considering the bull and bear market conditions, Chen (2005) attempts to inspect the impact of monetary plan on stock market performance. He concludes that the impact of monetary policy is greater on stock returns when the market is in a bearish condition. There is an asymmetric impact of interest rate changes on the duration of both bull and bear markets (Lunde and Timmermann, 2004). Brahmasrene and Jiranyakul (2007) examined the association between stock market index and a set of macroeconomic variables during the postfinancial liberalization (pre-financial crisis) and post-financial crisis in Thailand. Their results show that in the post-financial liberalization period the impact of money supply on the market index is positive where as exchange rate, oil prices and the industrial production index exert negative impact on the stock market index.

Few studies examining the relationship between monetary variables and stock returns can be found in the case of Bangladesh. Applying the Causality test Chowdhury (1995) revealed that money supply does not help in predicting stock prices of Dhaka Stock Exchange. Hossain and Moosarof (2006) reported that growth rate of GDP, volume of imports and exports, total foreign exchange reserves, rate of inflation, stock of money supply and interest rate on advances affected the DSE index. Applying Cointegration test, Vector Error Correction Model and Granger Causality test, Imam and Amin (2007) examined the association between DSE stock index and a set of macroeconomic variables comprising money supply, GDP, interest rate, 91

day T-bill rate and Industrial production index. In the VECM test, they found that the lagged stock index was adjusted to long run equilibrium by 43.82 percent by the combined lagged influence of all the selected macroeconomic variables. The study also discovered a unidirectional causality from interest rate change to stock market return. The regression analysis of the study of Khan (2010) shows a strong correlation between certain interest rates and DSE index. Ali (2011) showed that inflation and remittances exert a negative impact on stock returns of DSE. Alam and Uddin (2009) examined the impact of interest rates on stock exchange for fifteen developed and developing countries including Bangladesh. For all of the countries, it is found that interest rates have significant negative relationship with share prices. For six countries, it is found that changes in interest rates have significant negative relationship with changes in share prices.

4. Data and Methodology

The study investigates the relationship between market performance in a volatile situation represented by DSE General Index with other variables related to monetary policy including money supply, repo rate and inflation rate. Monthly time series data is taken from monthly economic trends published by the Bangladesh Bank and Dhaka Stock Exchange website for the post recent market crash period of January, 2011 to March, 2013.

Market Index: The DSE General Index (DGEN) is chosen as a measure of stock market performance that captures the daily price movement of equities at the stock exchange.

Money Supply (M2): Money supply measured in terms of Crore Taka includes the sum of currency outside banks, time deposits and demand deposits.

Inflation Rate: Inflation is a constant increase in the general price level in an economy over a certain period of time. Inflation rate reflects change in the cost to the average consumer of acquiring a basket of goods and services.

Inflation rate is announced by Bangladesh Bank on monthly basis taking base year of 1995=100.

Repo Rate: A Repurchase Agreement (Repo) is money making instrument through which the central bank lends short-term loans to the commercial banks against securities.

A structural model expressing the relationship between stock market performance and monetary policy variables is stated as below:

$$Yt = \beta_0 + \beta_1 INF_t + \beta_2 MS_t + \beta_3 REPO_t + \varepsilon_t \quad (1)$$

Where,

Y is the DSE General Index (DGEN)

INF is the Inflation Rate

MS is the Broad money supply i.e. M2

REPO is the Repo Rate

β_0 and β_i are the parameters known as the intercept and slope coefficients and ε_t is the classical random disturbance term. Data are transformed in logarithms to smoothen the data. L is added prior to each variable to indicate the inclusion of logs. Thus, the above equation can be represented by the following linear logarithmic regression form,

$$LY_t = \beta_0 + \beta_1 LINF + \beta_2 LMS_t + \beta_3 LREPO_t + \varepsilon_t \quad (2)$$

In order to avoid spurious regression results, the variables in a regression model must be stationary or co-integrated. So among different stationary tests, unit root test is applied using the Augmented Dickey and Fuller (ADF) model. The ADF null hypothesis of non-stationarity is rejected if the

calculated ADF statistics is less than the critical value.

ADF is performed by adding the lagged values of the dependent variable ΔY_t. The null hypothesis for ADF test for unit root test is $\alpha_i=0$. The following regression is used for the ADF test:

$$\Delta Y_t = B_1 + B_2 t + \delta Y_{t-1} + \alpha_i \Sigma \Delta Y_{t-i} + \varepsilon_t \quad (3)$$

Where ε_t is a white noise error term, $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$ and so are the number of lagged difference terms that are determined empirically. Using Schwarz Information Criterion (SIC) the lag length is selected automatically by E-views software.

The next step is to determine whether the variables have a stable and non-spurious cointegrating relationship among themselves. The concept of cointegration is that non-stationary time series are cointegrated if a linear combination of these variables is stationary. For the purpose of testing Johansen cointegration, Johansen procedure is chosen and based on Schwarz Bayesian Criteria (SBC) a lag order of 2 is selected.

The final step of our analysis is to test for causality between market index and it's determinants in the long run using Granger causality test. "A variable (y_1) is said to Granger-cause another (y_2) if the present value of y_2 can be predicted with greater accuracy by using past values of y_1, all other information being identical" (Thomas, 1997).

4. Analysis & Findings

4.1 Descriptive Statistics

Summary statistics of the variables is reported in table 1, where the total number of observations used in the empirical analysis, mean, standard deviation, skewness, kurtosis, minimum and maximum values of study variables are given.

Table 1
Summary Statistics of the Study Variables

	DGEN Index	Inflation Rate	Money Supply	REPO Rate
Mean	5090.023	9.186667	488789.6	7.185185
Median	4990.320	9.110000	480799.3	7.250000
Maximum	7484.230	10.96000	578682.2	7.750000
Minimum	3722.400	7.000000	401840.5	5.500000
Std. Dev.	924.6573	1.329095	54303.55	0.722551
Skewness	0.712371	-0.106772	0.111696	-1.119538
Kurtosis	2.815703	1.711768	1.811063	3.086488
Jarque-Bera	2.321834	1.918285	1.646409	5.648555
Probability	0.313199	0.383221	0.439022	0.059352
Sum	137430.6	248.0400	13197319	194.0000
Sum Sq. Dev.	22229768	45.92880	7.67E+10	13.57407

4.2 Stationarity Test

Table-2 shows ADF statistic used to check the presence of unit root in data series of DSE General Index, Inflation, Money Supply and Repo Rate.

Table 2
Results of ADF test

Variables	ADF Test Statistic	
	Level	First difference
LDGEN	-5.171694***	----------
LINF	-3.390898*	----------
LMS	-1.993136	-10.15696***
LREPO	-4.704973***	----------

Note: *** and * indicate statistically significant at the 1% and 10% level, respectively.

These results in Table 2 show that ADF tests reject the null of non-stationary for all of the variables except LMS. LDGEN, LINF and LREPO have ADF test statistics that are greater than the critical values and thus are stationary in levels, implying that these are integrated of order 0 or I (0). LDGEN and LREPO are stationary at the 1% and LINF is stationary at the 5% significance level. After first differencing, the results show that LMS is stationary at the 1% significant level, implying that this variable is integrated

of order I(1). The following graph shows a stationary trend after first differencing the variables.

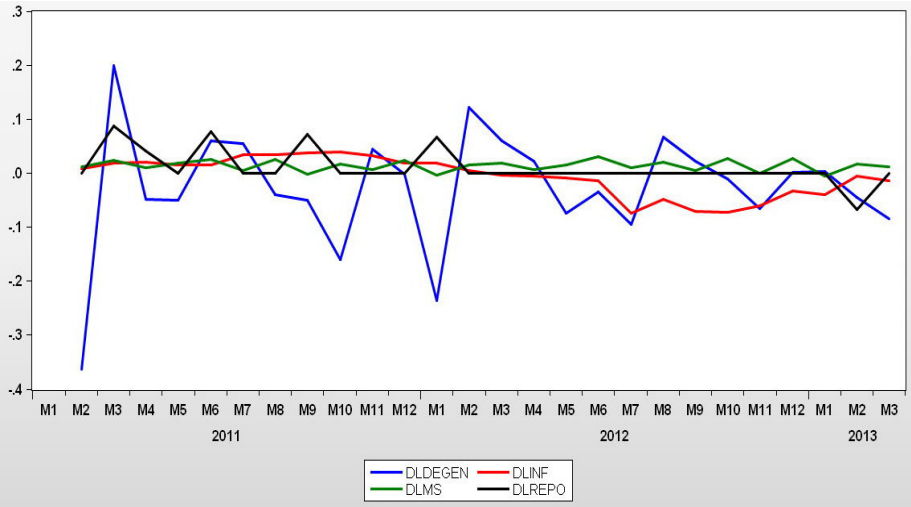

Fig. 2 Trend with Stationary

4.3 Testing Cointegration

For testing cointegration and to find out the number of cointegrating vectors both the Maximal Eigenvalue and Trace statistics were used. The results of Maximum Eigenvalue and Trace Statistics are reported in Table 3 and 4 respectively.

Table 3
Unrestricted Cointegration Rank Test (Trace)

Hypothesized			0.05	
No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value	Prob.**
None *	0.853438	85.93294	47.85613	0.0000
At most 1 *	0.576634	39.84553	29.79707	0.0025
At most 2 *	0.549932	19.21708	15.49471	0.0131
At most 3	0.002351	0.056502	3.841466	0.8121

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table-4

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized			0.05	
No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Critical Value	Prob.**
None *	0.853438	46.08741	27.58434	0.0001
At most 1*	0.576634	21.62845	21.13162	0.0507
At most 2 *	0.549932	19.16057	14.26460	0.0078
At most 3	0.002351	0.056502	3.841466	0.8121

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

As shown above, the null hypothesis of no cointegrating relationship is rejected at five percent significance level and confirms the presence of relationship among the proposed variables. Both the Maximal Eigen Value and Trace statistic identified three cointegrating vectors and the estimated normalized cointegrating coefficients are reported in Table-5.

Table 5
Normalized Cointegrating Coefficients

LDGEN	LINF	LMS	LREPO
1.000000	2.609255	12.98038	-6.082605
Std. Error	0.54753	1.78277	1.50271
t-value	4.76550	7.28101	-4.04776
P- value	0.04132**	0.01834**	0.05595*
Log Likelihood	266.6778		

Note: ** and * indicate statistically significant at the 5% and 10% level, respectively.

The signs of coefficients are reversed after the normalization process and the estimated equation is written as:

$$LDGEN = -2.61\ LINF - 12.98\ LMS + 6.08\ LREPO$$

This clearly shows that in the long run repo rate has a positive impact on market index where inflation and money supply have a negative impact on market index. The relationship between market index and all other independent variables is found to be statistically significant. These results imply that in the volatile stock market of Bangladesh, a one percent increase in inflation and money supply contributes to decrease in market index by

2.61 and 12.98 percent respectively. Whereas the repo rate contributes to 6.08 percent increase in market index. Besides, it is observed that among the three independent variables the most influential one is money supply.

4.4 Granger Causality Test

In this section, results of the pairwise granger causality test are reported on the series of LDGEN, LINF, LMS and LREPO with lag length 2.

Table 6
Granger Causality Test

Null Hypothesis	F-Statistic	P-Value	Granger Causality
LINF does not Granger Cause LDGEN	19.5000	0.0002***	Yes
LDGEN does not Granger Cause LINF	0.25162	0.6207	No
LMS does not Granger Cause LDGEN	15.3194	0.0007***	Yes
LDGEN does not Granger Cause LMS	2.03704	0.1669	No
LREPO does not Granger Cause LDGEN	2.07143	0.1636	No
LDGEN does not Granger Cause LREPO	0.20651	0.6538	No

Note: *** indicate statistically significant at the 1% level

Results reported in Table 6 suggest that the null hypotheses, LINF does not Granger cause LDGEN and LMS does not Granger cause LDGEN, is rejected at 1 percent significant level. It means there is a uni-directional causality running from inflation to DGEN index and money supply to DGEN index. Finally, there is weak unidirectional causality, i.e. Repo Rate on DGEN index.

5. Conclusion

This study attempts to analyze the impact of different monetary variables on the performance of recent post crashed stock market of Bangladesh using different econometric frameworks. These results reveal that repo rate has a positive influence on market index where inflation and money supply have a

negative impact on market index. The coefficients of all the explanatory variables are statistically significant. Evidence from Granger causality analysis suggests the existence of unidirectional causality from inflation to DGEN index and money supply to DGEN index.

The market is trying to recapture its stable condition by employing different policies since the crash occurred. Of these policies, the use of monetary policy instruments affects the performance of the stock market significantly. The Central Bank can influence stock market performance by targeting monetary policy properly and especially by targeting money supply which is a better predictor of market performance rather than other monetary variables.

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