News of Inflation and Effect on Stock Prices in India

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Abstract

The article investigates into the impact of the inflation rate on stock market in India during the period 1993 to 2013. The study explores into the long-run co-movement between the rate of inflation and stock prices in India and attempts to reveal whether inflation rate causes stock market movement in India. The study also reveals that both the Indian stock markets are strongly exogenous in the sense that shocks to inflation rate explain only a small portion of the forecast variance error of the market indices and notices that a positive shock on inflation rate has a negative and persistent effect on Indian stock markets.

Keywords: *Inflation Rate, Stock Market, Cointegration, Granger Causality Test.*

I. BACKGROUND OF THE STUDY

The stock market is one of the important financial sectors of the economy that affect almost all economic activities of a country through its various forms. The relationship between stock prices and inflation has been a topic of great interest both in theoretical and empirical literature. Despite the extensive research on the exact relationship between them, the issue still remains vexing. The linkage, if any, between inflation and real stock returns has received considerable attention over the last half century, starting with the pioneering work of Fisher (1930). This is due, at least in part, to the theoretical differences which exist between the Fisher hypothesis and the traditional view that equities ought to act as a hedge against inflation. The Fisher hypothesis asserts that nominal interest rates rise with rises in expected rate of inflation and the real stock returns are suggested as a good potential hedge against inflation. And since interest rates have a negative impact on stock prices, an increase in expected inflation should also negatively impact stock prices. Many studies have found a negative causal relation from interest rates to stock prices. The main logic for this causal relation is that as interest rates rise, the cost of corporate borrowing increases, profits decrease, and thus present values of profits; stock prices decline. The combination of the negative relation between interest rates and stock prices and the positive relation between inflation and interest rates has led some researchers to conclude that there should be a causal negative relation from inflation rates to stock prices.

Other studies on the other hand have argued that for corporations with little or no debt, or with debt at secured interest rates, input good costs may increase with inflation, but interest rate-associated cost increases would be negligible. The inflationary presence, however, would allow for marginal profit increases as product price is kept in line with inflation. Accordingly, as inflation rises, corporate cash flows and thus present values of these cash flows; stock prices, will increase. This situation would suggest a positive causal relationship may exist from expected inflation and stock prices.

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The issue may be of crucial importance in advancing our understanding of stock markets, and in providing benchmarks for decision-making about asset allocation. The relationship between stock returns and inflation has been the subject of extensive research. In this backdrop, our present study attempts to investigate empirically the impact of inflation rate on Indian stock market. The rest of the study is organized into four sub sections. Section 2 discusses review of some related literature to find out research gaps; section 3 discusses the data and methodology used in the study i.e. the research design; while section 4 presents the findings of the study; and finally, section 5 summarizes the result and concludes the study.

II. AN OVERVIEW OF THE EXISTING LITERATURE

The linkage between stock market returns and inflation if any has drawn the attention of researchers and practitioners since the early twentieth century. From an empirical perspective, a substantial academic and professional literature, especially in the developed countries, explores the interaction between inflation rate and stock market performance. According to Fisher (1930), the nominal interest rate can be decomposed into two components, a real rate plus an expected inflation rate. He claims a one-to-one relationship between inflation and interest rates in a world of perfect foresight, with real interest rates being unrelated to the expected rate of inflation and determined entirely by the real factors in an economy, such as the productivity of capital and investor time preference. According to him, inflation should not affect real stock returns. He suggests that stock market serves as a hedge against inflation. This implies that investors are fully compensated for increases in the general price level through corresponding increases in the nominal stock market returns and thus the real returns remain unaffected. According to him, the real returns are independent of inflationary expectations.

Using monthly data from January 1953 to July 1971 Fama and Schwert (1977) have tried to estimate the extent to which various assets are hedged against the expected and unexpected components of the inflation rate. Using regression analysis they find that the common stock returns of US stocks are negatively related to the expected and unexpected component of the inflation rate. But according to Fama (1981), the relationship observed between real stock returns and inflation in the United States is a consequence of a spurious relationship. The negative stock returns-inflation relations are induced by the positive correlation between stock returns and real activity and the negative correlation between inflation and real activity. It implies that high rate of inflation may decrease the demand for money that decreases growth in real activity. On the other side, the increase in rate of inflation reduces the future expected profits, which ultimately impact the decrease in stock prices. In conformity with the study made by Fama (1981), Adrangi, Chatrath and Shank (1999) investigate the relationship for the developing markets of Peru and Chile. They basically test whether the negative relationship between equity returns and inflation is a result of a 'proxy effect', namely, a negative relationship between inflation and real economic activity. The long-run equilibrium had been tested by using Johansen and Juselius cointegration tests. However, in both the economies, stock prices and general price levels show a strong long-run equilibrium relationship with the real economic activity, which indicates that the negative relationship between equity returns and inflation is a result of a proxy effect not the actual one.

The study made by Solnik (1983) provides empirical evidence on the relation between stock returns and inflationary expectations for nine countries over the period from 1971 to 1980. In his study the Fisherian assumption that real returns are independent of inflationary expectations is soundly rejected for each major stock market of the world. Using interest rates as a proxy for

expected inflation, his study provides a consistent support for the hypothesis that stock price movements signal (negative) revisions in inflationary expectations. Similarly, Mukherjee and Naka (1995) have found that the Japanese stock market (Index of Tokyo Stock Exchange) is cointegrated with a group of six macroeconomic variables namely exchange rate, money supply, inflation, industrial production, long-term government bond rate and call money rate for the period from January 1971 to December 1990. They also find that the inflation and long term government bond are negatively associated with Japanese stock index. Adams, McQueen and Wood (2004) have explored the relationship of unanticipated inflation news and stock return by looking at the response (in minutes and trades) of stock prices to unexpected changes in the Producer Price Index (PPI) and Consumer Price Index (CPI) announcements. By using intra-day returns they find that the unexpected increases in both the PPI and the CPI cause stock prices to fall. They further conclude that the stocks prices tend to respond to inflation news in about 10-20 minutes. According to them, this non-instantaneous response is primarily due to non-trading in the first few minutes of the day. At the same time, Al-Khazali (2004) investigates the generalized Fisher hypothesis for nine equity markets in the Asian countries viz. Australia, Hong Kong, Japan, Korea, Taiwan, Thailand, Malaysia and the Philippines during the period from January 1980 through December 1994. The regression results of his study indicate that stock returns in general are negatively correlated to both expected and unexpected inflation, and that common stocks provide a poor hedge against inflation. However, the results of the VAR model of his study indicate the lack of a unidirectional causality between stock returns and inflation. It also failed to find a consistent negative response neither of inflation to shocks in stock returns nor of stock returns to shocks in inflation in all countries. He finally concludes that the generalized Fisher hypothesis in the Asian markets is as puzzling as in the developed markets. In the line of the previous studies Omran and Pointon (2001), Coleman and Tettey (2008) and Rafique et al. (2013) observe that the stock prices are negatively related to the inflation rate in the context of Egypt, Ghana and Pakistan respectively. Beside the above studies Bhattacharya and Mukherjee (2002), Sahu and Gupta (2011), Naik and Padhi (2012), Saluja et al. (2012) and Naik (2013) also conclude the same thing that the inflation rate negatively affects the stock market returns in India.

Another group of researchers like Ratanapakorn and Sharma (2007) and Sohail and Hussain (2012) find the existence of positive relationship between inflation rate and stock prices in US and Pakistan respectively. They argue that the market rate of interest includes anticipated inflation and along with rise in the rate of inflation which leads to increase the nominal rate of interest. Consequently, real rate of interest remain same in the long run. Thus, they conclude that there is a positive one to one linkage between rate of inflation and stock prices, and share prices provide hedge against inflation rate.

But Chen, Kim and Kim (2005), Nair (2008) and Menaje (2012) did not support the hypothesis that inflation rate affect the stock return. Analyzing monthly data of inflation rate and stock market indices they do not find any significant impact of inflation on stock return in Taiwan, India and Philippine respectively.

From the review of earlier literature it is observed that a large number of studies have been made to determine the relationship between change in inflation rate and stock price movement. Undoubtedly, the above mentioned research studies have a great contribution in this field but most of these studies typically focus on developed economies and the effects of inflation rate on the stock prices of developing Asian countries like India is less obvious. Moreover, the findings of these studies are mixed and inconsistent. These findings are sensitive to the choice of countries, methodology employed and the time period studied. It is difficult to generalize the results because

each market is unique in terms of its own rules, regulations, and type of investors. Moreover, the results of those researches relating to the developed countries are debatable in the context of an emerging economy like India due to differences in socioeconomic conditions and prevailing regulatory environment of the country. In these circumstances, the study of the impact of inflation rate on security prices in Indian during the long and the short runs becomes a logical prolongation of the existent academic analysis. The present study under the title "Does the Inflation Rate Affect the Performance of the Stock Market? Evidence from India" is an endeavor to overcome these limitations through the empirical analysis to come to a valid conclusion.

III. DATA AND METHODOLOGY

Data

The empirical investigation is carried out using monthly data from April, 1993 to March, 2013 which covers 240 monthly observations. The monthly closing values of S&P BSE Sensex and S&P CNX Nifty have been considered as a proxy of the Indian Stock Market and have been used to obtain a measure of market price movement of Indian securities. Consumer price index (CPI) of industrial workers has been used as a proxy of inflation in Indian economy. The base year of CPI is 2001 and the base value is 100.

Closing data pertaining to Sensex and Nifty are collected from the respective web site of Bombay Stock Exchange and National Stock Exchange, and the inflation rate (CPI) related data are collected from various issues of Handbook of Statistics on the Indian Economy and Reserve Bank of India Bulletin, published by Reserve Bank of India and from the official web site of Labour Bureau, Government of India. Microsoft Office Excel 2007 and Eviews-7 package are used for econometric analyses.

Methodology

Given the nature of the problem and the quantum of data, we first study the data properties from an econometric perspective with the help of descriptive statistics and unit root test to show the nature and basic characteristics of the variables used in the analysis and to find out whether the data series are stationary or non stationary. This would help us applying Cointegration test, Vector Error Correction Model (VECM), Variance decomposition test and Impulse Response Analysis to establish the long and short-run dynamic relationship between the variables and Granger causality test to identify the direction of causality.

The stationarity of a data series is a prerequisite for drawing meaningful inferences in a time series analysis and to enhance the accuracy and reliability of the models constructed. The unit root test is one of the common methods to find whether a time series is stationary or not. The unit root test result gives an idea whether the data series contain unit root property or not. The test results also indicate the order of integration. When applying regression models or cointegration techniques, the order of integration is essential. If the applied data has not the correct order of integration, spurious regressions or wrong test statistics are the consequences and can make the analysis useless. There are a large number of unit root tests available. We, however, use only three of the most popular and commonly used tests like Augmented Dickey-Fuller (ADF) test, Phillips-Perron (PP) test and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. The decision regarding the unit root property could be taken by considering the two popularly used unit root test results namely ADF Test and PP test. If there arise any contradiction among the two results derived from two different

unit root tests, than for this case, the decision regarding the unit root property can be taken with the help of the unit root result obtained from KPSS test.

As the autoregressive model is sensitive to the selection of appropriate lag length, the study ascertains the appropriate lag length prior to estimation. However, a large lag order in the VAR model can rapidly exhaust the degree of freedoms in small samples. There is no commonly agreed technique on how to select the lags and variables structure, while the outcome of the estimation heavily depends on the estimated settings. The study determines the optimum lag length based on the Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC) and Hannan-Quinn Information Criteria (HQC).

To determine the long-run relationship between the inflation rate and Indian stock market the study considers VAR-based approach of cointegration test suggested by Johansen (1988). In this approach of cointegration test, Trace test (or Likelihood ratio test) as well as Maximum Eigen value test are applied to decipher the stated long term dynamics. The concept of cointegration becomes more relevant when the time series being analysed are non-stationery in level and all the variables used in the study should be integrated in same order. In econometric terms, two or more variables are said to be cointegrated if they share common trend. Appropriately, the test provides us information on whether the variables, particularly measures of Indian stock prices and the inflation rate, are tied together in the long run. The presence of cointegration indicates interdependence of the endogenous variables, which may be the result of economic linkage between the markets or the arbitrage activities among investors.

There often exists a long-run equilibrium relationship between two or more variables but in the short run there may be disequilibrium. The nature of the relationship between inflation rate and stock market indices in the short-run can be explored by considering the Vector Error Correction Mechanism. A vector error correction model is a restricted VAR that has cointegration restrictions built into the specification, so that it is designed for use with non-stationary series that are known to be cointegrated. The error correction term of VECM specification indicates the rate at which it corrects its previous period disequilibrium or speed of adjustment to restore the long-run equilibrium relationship.

The study applies the Granger causality test to identify the existence and nature of the causal relationship between the variables. It can be conducted in two different ways depending on the results of the long-run analysis. The Granger test (Granger, 1969) is suitable for analyzing the short-run causal relationship if no cointegration exists among the variables. On the other hand, when the variables are cointegrated, the standard Granger test is misspecified and the error correction strategy suggested by Engle and Granger (1987) should be used. The study proceeds with a Granger causality test in the form of vector error correction model, as the variables are found to be cointegrated. VECM allows the modelling of both the short-run and long-run dynamics for the variables involved in the model. The error correction term of VECM indicates the direction of long-run causality and the short term causality among the variables are tested through VEC Granger causality test or Block Exogeneity Wald test.

Despite the importance of conducting causality tests, the empirical inferences based on the causality test do not determine the strength of the causal relationships between the variables nor do they describe the relationship between these variables over time. Variance decomposition test is used to explore the degree of exogeneity of the variables involved in this study. It illustrates the share of the forecast error of one variable as a result of changes in the other variables. Hence, the relative significance of each variable can be determined which causes oscillations in the other variable.

Similarly, the empirical inferences based on the Granger causality test helps to qualify the flow of influences but the estimates of the Impulse Response Analysis can give us a quantitative idea about the impacts for several periods in future. The estimated impulse response of the VAR system enables us to examine how each of the variables responds to innovations from other variables in the system. More specifically IRFs essentially map out the dynamic response path of a variable due to a one standard deviation shock to another variable.

IV. FINDINGS OF THE STUDY

Findings from the Descriptive Statistics

The basic statistical values of the variables are calculated in the first phase of our study. The descriptive statistics provide a historical background for the behaviour of the data used in the study. From the descriptive statistics presented in Table- 1 it is observed that the inflation rates as well as the values of Sensex and Nifty are not stable at all during the study period. In respect of CPI the maximum value of 224 and the minimum value of 52.91, with an average of 115.59, justify that the values of inflation (represented by CPI) are highly unstable during the study period. High value of standard deviation also shows the variability of the monthly value of inflation rate. During the study period the Sensex and Nifty also have very high and significant variability from their mean. The high differences between maximum values and minimum values reveal that the stock prices are also highly unstable during this period. However, in most of the cases values of the data series lie within $\overline{X} \pm 3\sigma$, where, $\overline{X}$ and σ represent mean and standard deviation respectively.

TABLE- I

Descriptive Statistics

Statistics	S&P BSE Sensex	S&P CNX Nifty	Consumer Price Index (CPI)
Mean	8313.83	2502.31	115.59
Median	4754.20	1415.10	106.04
Maximum	20509.09	6138.60	224.00
Minimum	2122.30	622.42	52.91
Standard Deviation	6010.22	1792.46	43.66
Skewness	0.75	0.75	0.76
Kurtosis	1.89	1.92	2.75
Jarque-Bera Test Statistic	34.66	34.25	23.97
Probability	0.0000	0.0000	0.0000

From the descriptive information it can be said that none of the variables are normally distributed, though, in most of the cases, the median values of variables are very close to average values. The measures of skewness suggest that the variables are not distributed symmetrically. Both the Indian stock indices and the values of CPI are skewed. The values of the kurtosis indicate that all

the variables are less peaked than the normal distribution, i.e., they follow platykurtic distribution. Results obtained from Jarque-Bera statistic confirm that none of the series are normally distributed.

Findings from Long-Run Analysis

As mentioned before, the long-run analysis is conducted using the Johansen cointegration test. Typically, the Johansen cointegration test consists of three general steps. First, examine whether all variables in the model are integrated of the same order, which can be established by unit root tests. Second, determine the optimal lag length for the VAR model to verify that the estimated residuals are not autocorrelated. Third, estimate the VAR model to construct the cointegration vectors in order to determine the cointegrating relationship. For this, it is necessary to establish the trace and the maximum eigen value statistics tests. The following subsections present the results for each step.

Results of Unit Root Test

As already stated, testing stationarity of a data series is a prerequisite for drawing meaningful inferences in a time series analysis. It enhances the accuracy and reliability of the models constructed. So, it is necessary to determine the unit root property and order of integration for each variable included in the system. All the unit root tests (ADF, PP and KPSS) are performed with intercept, and time trend and intercept for all variables in their levels and then the tests are performed with their first difference values, and so on.

Table- 2 and Table- 3 presents the Augmented Dickey-Fuller and Phillips-Perron unit root test results of the variables in their level and first difference. The result shows that for the ADF test, all the variables appear to be I(1) except consumer price index. The ADF test statistics of consumer price index fail to reject the null hypothesis of the existence of a unit root in its levels and first difference values. The ADF test statistics of CPI, in its second difference, for the two models Intercept and Trend & Intercept are -11.7261 and -11.7438 respectively with 1 percent significance level shows that consumer price index is integrated of order two i.e. I(2).

TABLE- II

Results of Augmented Dickey-Fuller (Adf) Unit Root Test

Variables	Level		First Difference		Result
	Intercept	Trend and Intercept	Intercept	Trend and Intercept	
SENSEX	-0.4033 [0] (0.9052)	-2.0411 [0] (0.5754)	-15.2228 [0] (0.0000)	-15.2191 [0] (0.0000)	I(1)
NIFTY	-0.4374 [0] (0.8992)	-2.1616 [0] (0.5084)	-15.7822 [0] (0.0000)	-15.7785 [0] (0.0000)	I(1)
CPI	5.5177 [7] (1.0000)	3.5881 [7] (1.0000)	-1.1855 [11] (0.6811)	-2.3907 [11] (0.3834)	I(2)

Notes: ( ) MacKinnon (1996) one-sided p-values; [ ] Lag lengths for ADF Test;
I(1): Stationary after first difference; I(2): Stationary after second difference

TABLE- III

Results of Phillips-Perron (Pp) Unit Root Test

Variables	Level		First Difference		Result
	Intercept	Trend and Intercept	Intercept	Trend and Intercept	
SENSEX	-0.5434 [7]	-2.2705 [7] (0.4480)	-15.2777 [6]	-15.2691 [6] (0.0000)	I(1)
NIFTY	-0.4995 [6]	-2.3028 [6] (0.4304)	-15.7869 [6] (0.0000)	-15.7811 [6] (0.0000)	I(1)
CPI	4.7798 [2] (1.0000)	2.0280 [3] (1.0000)	-11.2195 [4]	-11.8762 [2] (0.0000)	I(1)

Notes: ( ) MacKinnon (1996) one-sided p-values; [ ] Lag lengths for PP Test; I(1): Stationary after first difference

From the result of the Phillips-Perron unit root test presented in Table- 3 it is clear that the null hypothesis of non-stationarity cannot be rejected for any of the series in their levels since PP statistics of the variables are not less than the critical values at any significance level, i.e., 1%, 5%, and 10%. Therefore, the PP test concludes that all series are non-stationary in level. Applying the same test to their first differences shows that the null hypothesis of a unit root is rejected in all cases even at a 1% significance level. So, the PP unit root test results show that both the stock market indices and CPI are integrated of order one i.e., I(1).

The ADF and PP test results of consumer price index are not consistent with each other. So, a contradiction arises between the two results obtained from two different unit root tests. The ADF test result suggests that CPI is integrated of order two whereas the PP test result suggests that the CPI is integrated of order one. For this contradictory case the final decision regarding the unit root property can be taken with the help of the unit root test result obtained from Kwiatkowski-Phillips-Schmidt-Shin test. The KPSS test results presented in Table- 4 show that the consumer price index follow I(1) process as the null hypothesis of KPSS test (i.e., the series does not contain unit root) are rejected in level but accepted in their first difference. So, from the unit root tests results, it is observed that all the variables are stationary at their first difference.

TABLE- IV

Results of Kwiatkowski-Phillips-Schmidt-Shin (Kpss) Unit Root Test

Variables	Level		First Difference		Result
	Intercept	Trend and Intercept	Intercept	Trend and Intercept	
CPI	1.9415*** [11]	0.4203*** [11]	1.3457 [6]	0.3265 [2]	I(1)

*Notes: *** Statistical significance at 1% level; [ ] Lag lengths for KPSS Test; I(1): Stationary after first difference*

Selection of Optimum Lag Length

As the autoregressive model is sensitive to the selection of appropriate lag length, the study is to ascertain the appropriate lag length before conducting the cointegration analysis in line with Johansen. The optimum lag length based on the three commonly used criteria, namely AIC, SIC and

HQC are presented in Table- 5. The three lag length selection criteria suggest three different lag lengths as optimum lag. The AIC and HQC criteria suggest higher lag length, but the present study could not take the risk of over parameterization by considering too higher lags for the VAR model. Therefore, the study chose SIC criteria for optimum lag length selection and the optimum lag length is 1, having the lowest SIC value.

TABLE V

Var Lag Order Selection Criteria

Lag Length	AIC		SIC		HQC	
	SEN & CPI	NIF & CPI	SEN & CPI	NIF & CPI	SEN & CPI	NIF & CPI
0	28.97535	26.47000	29.00543	26.50008	28.98749	26.48214
1	18.99315	16.62949	19.08339 *	16.71973*	19.02956	16.66590
2	18.95771	16.59686	19.10812	16.74727	19.01840	16.65755*
3	18.97167	16.61577	19.18224	16.82635	19.05663	16.70073
4	18.97689	16.63328	19.24762	16.90402	19.08612	16.74252
5	18.96071	16.61292	19.29161	16.94382	19.09422	16.74643
6	18.92177	16.58161	19.31284	16.97268	19.07955	16.73940
7	18.88323	16.55477	19.33446	17.00600	19.06529	16.73683
8	18.78781	16.45401	19.29921	16.96540	18.99415*	16.66034
9	18.79452	16.45901	19.36608	17.03057	19.02513	16.68962
10	18.75732 *	16.42774 *	19.38904	17.05946	19.01220	16.68262
11	18.76479	16.43459	19.45667	17.12647	19.04394	16.71374
12	18.75849	16.42995	19.51053	17.18200	19.06191	16.73338

*Notes: * Indicates lag order selected by the criterion*

Results of Johansen Cointegration Test

The calculated values of trace statistics of Johansens cointegration test (presented in Table-6) for CPI & Sensex and CPI & Nifty, when the null hypothesis is r = 0 (i.e., no cointegration), are 22.97 and 23.52 respectively and maximum eigen statistics (presented in Table- 7) are 19.34 and 19.52 respectively. Here the null hypothesis of no cointegration when r = 0, is rejected at 5 per cent level of significance, as the calculated value of trace statistics and maximum eigen statistics are higher than the MacKinnon-Haug-Michelis critical value at 5 percent level of significance. This indicates the existence of one cointegrating vector among consumer price index and each of the stock market indices. So the Johansen's cointegration test result support the hypothesis that inflation rate (CPI) and stock prices (Sensex and Nifty) are cointegrated and there exist long term cointegrating relationship. The long run cointegrating equations are

$$\text{Sensex} = 11661.66 - 29.16974\ \text{CPI} + u_t$$

$$\text{Nifty} = 3131.557 - 5.500400\ \text{CPI} + u_t$$

The above cointegrating equations indicate the existence of negative co-movement between inflation rate and stock prices in India, which means that they move together in the opposite direction.

TABLE- VI

Results of Johansen Cointegration Test (Trace Statistics)

Model	H_0	H_1	Trace Statistics	5% Critical Value	Probability*
SEN & CPI	r = 0	r = 1	22.96703	15.49471	0.0031
	r ≤ 1	r = 2	3.628033	3.841466	0.0568
NIF & CPI	r = 0	r = 1	23.52002	15.49471	0.0025
	r ≤ 1	r = 2	3.598469	3.841466	0.0555

** MacKinnon-Haug-Michelis (1999) p-values*

TABLE VII

Results of Johansen Cointegration Test (Maximum Eigen Statistics)

Model	H_0	H_1	Maximum Eigen Statistics	5% Critical Value	Probability*
SEN & CPI	r = 0	r = 1	19.33899	14.26460	0.0072
	r ≤ 1	r = 2	3.628033	3.841466	0.0568
NIF & CPI	r = 0	r = 1	19.52155	14.26460	0.0067
	r ≤ 1	r = 2	3.598469	3.841466	0.0555

** MacKinnon-Haug-Michelis (1999) p-values*

Findings from Short-Run Analysis

Having established that each of the stock indices and consumer price index are cointegrated between themselves, the fundamental question regarding the nature of the relationship between these variables in the short run can be answered by considering the vector error correction mechanism.

Result of the Vector Error Correction Mechanism

Table- 8 and Table- 9 present the results of the vector error correction model for Sensex & CPI and Nifty & CPI respectively. The t-values associated with the coefficient of the lag value of the CPI are statistically significant when Sensex or Nifty is used as a dependent variable, which indicate that consumer price index negatively affect the Indian stock indices in short run also.

Moreover, the VECM results indicate that consumer price index adjusts the disturbances to restore long-run equilibrium significantly and in right direction, but the Sensex and Nifty do not react significantly. The coefficients of error correction term for two separate models, having Sensex

and Nifty, are -0.0013 (Table- 8) and -0.0009 (Table- 9) respectively, which are significant at 1 percent level of significance. These values indicate the rate at which they correct the disequilibrium of the previous period. Thus, the speed of adjustment towards the long-run equilibrium is about 0.13 per cent and 0.09 per cent per month for sensex and nifty respectively.

TABLE- VIII

Results of Vector Error Correction Model (Sensex & CPI)

Independent Variables	Dependent Variables	
	D(SENSEX)	**D(CPI)**
ECT (γ_1)	0.003630 [0.50368]	-0.001260*** [-4.40917]
D(SENSEX(-1))	-0.001571 [-0.02406]	0.000113 [1.27831]
D(CPI(-1))	-96.09576** [-2.04434]	0.218230*** [3.41515]
C	138.7142** [2.37154]	0.554007*** [6.96741]

*Notes: *** Statistically significant at 1% level; ** Statistically significant at 5% level; [ ] t-values*

TABLE- IX

Results of Vector Error Correction Model (Nifty & CPI)

Independent Variables	Dependent Variables	
	D(NIFTY)	**D(CPI)**
ECT (γ_1)	0. 003737 [0.47313]	-0.000852*** [-4.43214]
D(NIFTY(-1))	-0.038644 [-0.59099]	0.000312 [1.07966]
D(CPI(-1))	-29.17765** [-2.01879]	0.218189*** [3.41238]
C	42.79446** [2.37872]	0.555362*** [6.97774]

*Notes: *** Statistically significant at 1% level; ** Statistically significant at 5% level; [ ] t-values*

Findings from Causality Test

As the variables are cointegrated, the standard Granger test is misspecified and the error correction strategy suggested by Engle and Granger (1987) is used to identify the long and short term causal relationship among the variables. The result of the long-run and the short-run causality test under VECM framework are reported below.

Long-run Causality

The t-values associated with the error correction terms of VECM, reported in Table- 8 and Table- 9, indicate the existence of significant unidirectional long-run causality. Any change in stock prices causes a change in consumer price index as the coefficients of the error correction term -0.0013 and -0.0009 are statistically significant at 1 percent level.

Short-run Causality

The results of short-run causality test among the variables based on VEC Granger Causality test are presented in Table- 10. According to the obtained results, it can be said that there exists a unidirectional short-run causal relationship between the stock market indices and consumer price index. But in short-run the study shows a reverse direction of causality from that of the in long-run. In short-run the movement of consumer price index causes the movement of Indian stock market indices as the Chi-square statistics are statistically significant when the stock indices are used as dependent variable.

TABLE- X

Result of Vec Granger Causality / Block Exogeneity Wald Test

Model	Dependent Variables	Independent Variables	Chi-Square Value	Probability Value	Implication
SENSEX & CPI	SENSEX	CPI	4.179321	0.0409	Existence of Causality
	CPI	SENSEX	1.634070	0.2011	No Causality
NIFTY & CPI	NIFTY	CPI	4.075523	0.0435	Existence of Causality
	CPI	NIFTY	1.165657	0.2803	No Causality

Results of Variance Decompositions Test and Impulse Response Functions Analysis

The study has estimated the impulse response functions and variance decompositions under the VECM framework to investigate the dynamic relationship between inflation rate and stock prices in India.

Table-11 and 12 indicate that Sensex and Nifty are strongly exogenous because almost 97 per cent of their own variances are explained by its own shock even after 24 months while the explanatory power of CPI, is found insignificant. A very small portion of the forecast error variance of stock indices is explained by the consumer price index. This is due to the fact that, during the study period, stock prices are more dependent on themselves than on the CPI. The results also indicate that the values of CPI are comparatively less exogenous than the Indian stock market in the sense that the percentage of the error variance of CPI accounted by its own is approximately 80 per cent at time horizon of 24 months.

TABLE- XI

Variance Decomposition of Sensex and CPI

Variance Decompositions of	Period	Percentage of Forecast Error Variance Explained by Innovation in:	
		Sensex	CPI

Sensex	1	100.00	0.00
	4	98.29	1.71
	8	97.79	2.21
	12	97.62	2.38
	16	97.54	2.46
	20	97.48	2.52
	24	97.44	2.56
CPI	1	0.05	99.95
	4	1.12	98.88
	8	3.30	96.70
	12	6.41	93.59
	16	10.32	89.68
	20	14.86	85.14
	24	19.84	80.16

TABLE- XII

Variance Decomposition of Nifty and CPI

Variance Decompositions of	Period	Percentage of Forecast Error Variance Explained by Innovation in:	
		Nifty	CPI
Nifty	1	100.00	0.00
	4	98.32	1.68
	8	97.85	2.15
	12	97.68	2.32
	16	97.60	2.40
	20	97.55	2.45
	24	97.51	2.49
CPI	1	0.08	99.92
	4	0.88	99.12
	8	3.00	97.00
	12	6.22	93.78
	16	10.36	89.64
	20	15.21	84.79
	24	20.55	79.45

The results of the impulse response analysis for a time horizon of 24 months to a 'one standard deviation' shock in Sensex and CPI are shown in Figure-1. Figure-2 summarizes the impulse responses of Nifty to one standard deviation shock in CPI and vice versa for the next 24 months. The responses generated from a positive shock on CPI are negative and persistent effect on Indian stock markets. The responses are negative for both the stock indices.

Summary of the Results and its Interpretation

The study investigates the impact of inflation rate on Indian stock market over the period from April 1993 to March 2013. Existing financial and economic literatures advocate a relationship

FIGURE-1: Impulse Responses of Sensex and Cpi to One Standard Deviation Shock in the Variables

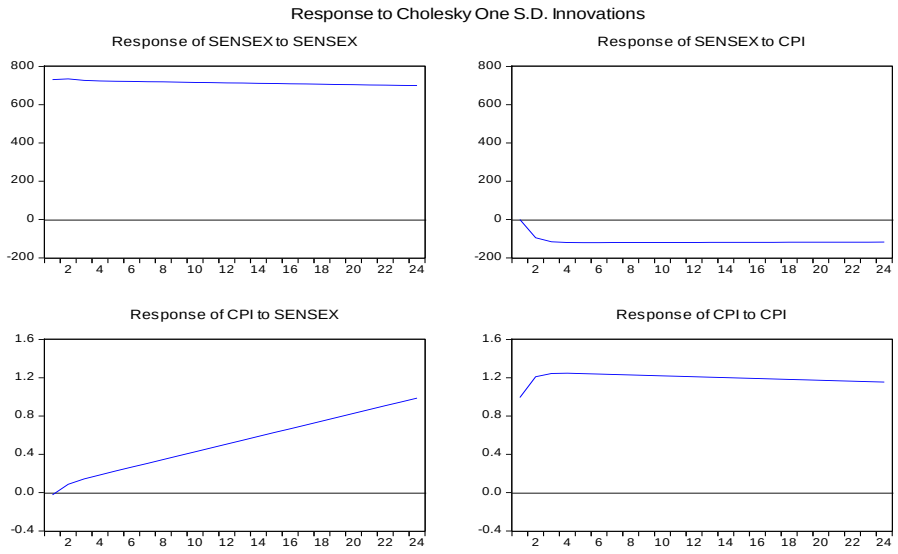
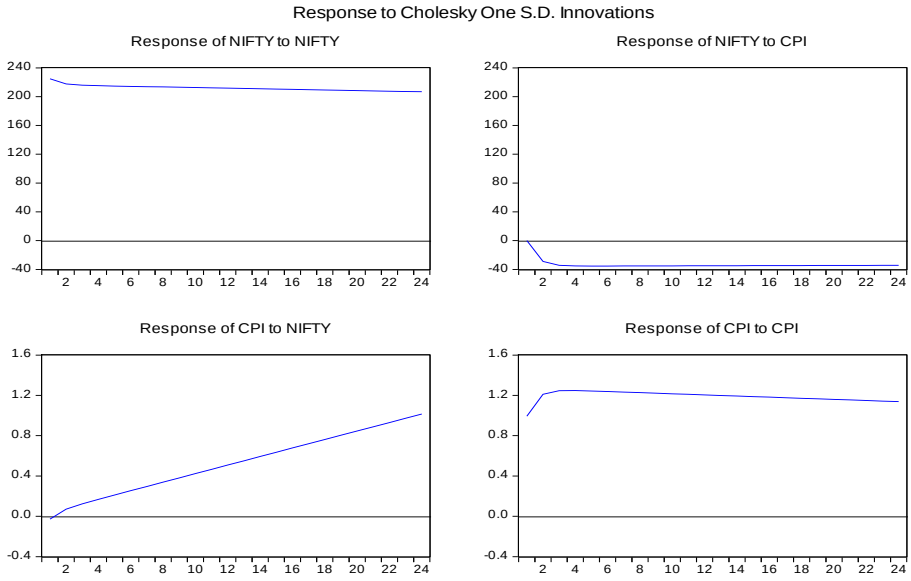


FIGURE-2: Impulse Responses of Nifty and CPI to One Standard Deviation Shock in the Variables



between the stock market and inflation rate. However, these literatures suggest some contradictory findings regarding the nature of the relationship and the degree of influencing power. These contradictory findings of the earlier studies are the principal motivation behind conducting this research work in Indian context.

Findings of this study provide a comprehensive understanding of the dynamic relationship between the movement of inflation rate and stock prices in India. In line with the earlier findings made by Fama and Schwert (1977), Solnik (1983), Mukherjee and Naka (1995), Omran and Pointon (2001), Bhattacharya and Mukherjee (2002), Sahu and Gupta (2011), and Naik and Padhi (2012) our present study based on Johansen's cointegration test confirms the existence of a significant negative long run co-movement between inflation rate and stock prices in India. The VECM result indicates

that in short-run the inflation rate negatively affects the Indian stock market. Moreover, the Granger Causality test confirms that in short-run inflation rate causes the stock market movement. However, the error correction term of the VECM framework indicates that in long-run inflation rate does not causes the stock market movement rather the movement of stock prices causes the change in inflation rate.

Under normal circumstances, a rise in expected inflation rate leads to restrictive monetary policies, which in turn may lead to an increase in interest rate and thereby raise the discount rate in the valuation model. This increase in the discount rate would reduce the present value of net income, and thus should lead to lower stock prices. Further, rise in interest rates will increase the firms borrowing costs, which will reduce net income and thus stock prices. Moreover, the inflationary tendency would decrease the value of money and the purchasing power of the people. High rate of inflation increases the cost of living and a shift of resources from stock market instruments to consumables. This leads to a reduction in the demand for stock market instruments which tends to reduce the volume of trading. Another possible implication of this result is that the Indian stock market is not an effective hedge against inflation; hence investors probably would shift their portfolios from stock market, which is risky, to real assets if the expected inflation rate becomes high. Furthermore, high inflation can cause uncertainty about future prices and trigger precautionary savings. Higher precautionary savings will impact consumption and hence corporate sales growth. In the longrun, it is observed in the study that stock market influences inflation --- which is theoretically not possible. However, the explanation can be had from Fisher (1930). The nominal interest rate is the sum of real interest rate and expected inflation. The economic activity is influenced by nominal interest and also by real or published inflation figures. So, stock market gets affected by the nominal interest rate of the country i.e. by real interest rate and also by expected inflation rate. The stock market players try to stay ahead of time by estimating inflation data indirectly from different economic indicators and news. Thus, stock market reacts even before the official publication of news of inflation in the long run. However, when the exact inflation data is published, the stock market gets adjusted to be more precise. So, in the short run again we found that news on inflation influences stock market.

V. CONCLUSION

In this study we have presented extensively the evidences on the relationships between inflation rate and the stock prices in India. The estimated results indicate that the Indian stock market is sensitive to changes in inflation rate in the long run as well as in short run and the rate of inflation negatively affects the movement of stock prices.

Evidence of this study provides a comprehensive understanding on the dynamic relationship between inflation rate and stock market in India. It discusses the theoretical hypotheses on this captioned relationship and compares with empirical evidences from prior research. The study extends the literature by examining the relationship in the emerging market of the Indian economy. This study is expected to offer some insights for financial regulators and policymakers for formulating economic and financial policies. The sense of this inter-relationship is also useful to shareholders and portfolio managers as it provides a better understanding of portfolio structure and evaluation to improve overall portfolio design and performance. Thus, it is worth to carry out such studies on emerging economies like India as the study contributes to the managerial science by providing scientific elements through identification and validation of the effects of inflation rate on the stock market performance. Therefore, more efficient risk measurement and management models

can be established allowing greater confidence levels to the decision making process in stock market investments.

Scope of Further Studies

This study suggests some future research to enhance our understanding about the relationship between inflation rate and stock market movement. Further research efforts could either eliminate some of the limitations or expand the scope of investigation in this study. The possible extension of this study is to consider the impact of inflation rate along with other important macroeconomic determinants such as interest rate, growth rate in real sector etc. which are not included in the analysis. Moreover, instead of using only the quantitative macroeconomic variables the study suggests the inclusion of socio-economic and political factors as dummy variables on these grounds. Further, the study could empirically test the relationship by considering the potential structural breaks in the time series data. But, this is beyond the aim of this present study. It is left for further research.

References

Adams. G., McQueen. G. and Wood. R. (2004). The Effect of Inflation News on High Frequency Stock Returns. *The Journal of Business*, 77, 3, 547-574

Adrangi. B., Chatrath. A. and Shank. T. M. (1999). Inflation, Output and Stock Prices: Evidence from Latin America. *Managerial and Decision Economics*. 20 (2), 63-74

Al-Khazali. O. M. (2004). The Generalized Fisher Hypothesis in the Asian Markets, *Journal of Economic Studies*. 31(2), 144-157

Bhattacharya. B., and Mukherjee. J. (2002).The Nature of the Causal Relationship between Stock Market and Macroeconomic Aggregates in India: An Empirical Analysis, *Conference Volume – I, Sixth Capital Market Conference*, UTI Institute of Capital Markets, Mumbai, December 2002.

Chen. M.-H. Kim. W. G. and Kim. H. J. (2005). The Impact of Macroeconomic and Non-macroeconomic Forces on Hotel Stock Returns. *Hospitality Management.* 24, 243-258

Coleman. A. K. and Tettey. K. F. A. (2008). Impact of Macroeconomic Indicators on Stock Market Performance, *The Journal of Risk Finance*, 9(4), 365-378

Fama. E. F. (1981). Stock Returns, Real Activity, Inflation, and Money, *The American Economic Review*. 71(4), 545-565

Fama. E. F. and Schwert. G. W. (1977). Asset Returns and Inflation, *Journal of Financial Economics*, 5, 115-146

Fisher. I. (1930). The Theory of Interest, Macmillan, New York, First Edition, Available online at: http://www.econlib.org/library/ YPDBooks/Fisher/fshToI. html, Accessed on 17-05-2013.

Menaje. P. M. (2012), Impact of Selected Accounting and Economic Variables on Share Price of Publicly Listed Banks in the Philippines from 2002-2008, *DLSU Business & Economics Review,* 22(1), 35-62

Mukherjee. T. K. and Naka, A. (1995), "Dynamic Relations between Macroeconomic Variables and the Japanese Stock Market: An Application of a Vector Error Correction Model", *The Journal of Financial Research*, Vol.- XVIII, No.- 2, 223-237

Naik. P. K. (2013). Does Stock Market Respond to Economic Fundamentals? Time-series Analysis from Indian Data, *Journal of Applied Economics and Business Research*, 3(1), 34-50

Naik, P. K. and Padhi, P. (2012). The Impact of Macroeconomic Fundamentals on Stock Prices Revisited: Evidence from Indian Data, *Eurasian Journal of Business and Economics*, 5, (10), 25-44.

Nair. L. R. (2008). Macroeconomic Determinants of Stock Market Development in India, *NSB Management Review*, 1(1), 1-10,

Omran. M. and Pointon. J. (2001). Does the Inflation Rate Affect the Performance of the Stock Market? The Case of Egypt, *Emerging Markets Review*, 2, 263-279

Rafique. A., Amara. Naseem, M. A. and Sultana, N. (2013). Impact of Macroeconomic Variables on Stock Market Index (A Case of Pakistan). *Finance Management.* 57, 14099-14104

Ratanapakorn. O. and Sharma. S. C. (2007). Dynamic Analysis between the US Stock Returns and the Macroeconomic Variables, *Applied Financial Economics*, 17, 369-377

Sahu. T. N. and Gupta. A. (2011). Do the Macroeconomic Variables Influence the Stock Return? - An Enquiry into the Effect of Inflation*, Global Business Recession: Lessons Learnt,* Vol.-1, (136-145), Book Edited by Bhakar, S. S., Nathani, N., Singh, T. and Bhakar, S., Published by Crescent Publishers, Allahabad.

Saluja. H. S., Sharma, M., Sitlani, B. and Khurana H. S. (2012). Impact of Macroeconomic Variables on Indian Stock Market - A Study of BSE Sensex. *Anvesha.* 5(1), 12-17

Sohail. N. and Hussain. Z. 2012, Macroeconomic Policies and Stock Returns in Pakistan: A Comparative Analysis of Three Stock Exchanges, *Interdisciplinary Journal of Contemporary Research in Business*, 3,(10),

Solnik. B. (1983). The Relation between Stock Prices and Inflationary Expectations: The International Evidence, *The Journal of Finance*, XXXVIII, 1,35-48