

The Relationship Between Stock Price Indices and Inflation Rate in India: An Empirical Analysis of NSE Nifty

Roshan Kumar*

The objective of this paper is to determine the relationship between inflation rate and stock price indices (NSE Nifty). The duration of the study is from January 1, 2008 to March 31, 2019. The data is analyzed for cointegration and causality by using Johansen cointegration test, Vector Error Correction Model (VECM) and Granger causality test. For determining the relationship between the variables, Pearson correlation test has been used. The ADF test results show that the variables are non-stationary at level and are integrated of order one. The correlation results show a negative relationship between stock market indices and inflation rate in India. Johansen cointegration test results indicate cointegration between the variables. The Granger causality test shows that inflation rate does not affect the stock market indices, and stock market indices are not affected by the inflation rate. The VECM model and Wald test results show that there is no long run and short run causality between the variables.

Introduction

Stock market is an important component of Indian financial system as it helps in the growth of the economy as well as boosts the development of the financial sector of the country. As competent and efficient stock market is important for economic development, it is necessary to focus on the factors that determine stock returns. The macroeconomic variables are important factors and play a vital role in determining the stock prices. Among the macroeconomic variables, inflation is considered to be one of the most important factors affecting stock returns. Inflation is an increase in the average price of all the products and services during a particular period of time, and it can also be defined as a rise in the price level which implies a decrease in the purchasing power and increase in the cost of living index (Mousa *et al.*, 2012). Therefore, inflation rate has to be kept constant by the policy makers.

Inflation occurs due to various reasons, of which expansion of the money supply is one of the reasons. It means that the country's central bank issues more money than the economy needs for growth, and this is the reason for high prices in the economy. Inflation can be classified as expected inflation and unexpected inflation. Expected inflation means inflation rate which is expected by the economic agents and unexpected inflation is the unpredictable inflation rate and it may be above or below that which is expected during the year.

Inflation creates a problem in the evaluation of the market performance of the share price in the long run. Inflation and other macroeconomic variables affect the behavior of the

* Associate Professor, Department of Management, Jharkhand Rai University, Ranchi, Jharkhand, India.
E-mail: roshan.singh79@gmail.com

financial market. Inflation affects the performance of the share market but the relationship between unexpected inflation and share price is not clear. There are a lot of studies on the relationship between the unexpected inflation and share price performance. Fama (1981) and Schwert (1981) found a negative relationship between stock price and inflation rate. But Hardouvelis (1988) found no relationship between the above variables. Therefore, the relationship between inflation rate and stock prices is not clear, and it is an important area for the researcher to find out the relationship between the variables. The stock market's relationship with inflation has been subjected to research, especially for the developed nations as discussed by Fraser and Oyefeso (2000) and Pascual (2003).

Literature Review

A lot of studies have been conducted on the relationship between the stock market return and inflation rate. These studies try to find out the impact of inflation on the stock market return.

Fielstein (1980) examines the impact of inflation rate on stock market performance by considering income, depreciation and taxation. The study concludes that when the inflation rate increases, the depreciation value affects the organizational profit.

Fama (1981) studies the relationship between inflation and its impact on stock market returns and found that there is a significant negative relationship between stock market and inflation.

Choudhry (2001) examines the relationship between stock market return and inflation in four countries: Chile, Venezuela, Mexico and Argentina. The time period for the study is from 1980 to 1990. The study observes a one-to-one relationship between Chile and Argentina, which indicates a significant positive relationship between inflation and stock market return.

Adrangi *et al.* (2000) investigate the relationship between inflation rate and stock return in Brazil. The result indicates that there is a negative relationship between the stock return and unexpected inflation.

Omran and Pointon (2001) investigate the effect of inflation rate on the performance of the Egyptian stock market. It is observed that there is a short-run and long-run relationship between the stock market performance variables and inflation rate.

Wongbampo and Sharma (2002) study the relationship between stock market prices and macroeconomic variables including inflation in five Asian countries (Thailand, Indonesia, Singapore, Philippines, and Malaysia). They use the consumer price index as the indicator for inflation and concludes that there is a negative relationship between stock prices and inflation in all the five selected Asian countries.

Hondroyannis and Papapetrou (2006) investigate the association between stock market performance and expected and unexpected inflation by using a Markov Switching Vector Autoregressive model. This model is used to find out the structural breaks during the estimation time. The findings show that inflation does not affect stock market performance.

Ozurunba (2012) examines the relationship between stock market return and inflation in Nigeria for the period 1991 to 2010. They use multiple linear regression analysis and Granger causality test. The results show a positive relationship between the inflation and stock market return. The causality test shows unidirectional causality running from stock market return to inflation rate.

Akinlo (2013) conducts a study to investigate the association between the inflation and the stock price index in Nigeria. The time period is from 1986 -2010. They use the Vector Error Correction Model, and conclude that there exists long-run association between inflation and stock price index. The results confirm the theory of Fisher effect in the short run and long run.

Kotha and Sahu (2016) investigate the long and short-run association between macroeconomic variables like inflation rate, interest rate, money supply and exchange rate. The time period of the study is from 2001 to 2015. Cointegration techniques and error correction model are used for data analysis. The study supports the existence of long-run association between the stock indices and selected macroeconomic variables.

Raju *et al.* (2018) examine the effect of inflation and GDP on Indian capital market. They consider National Stock Exchange as capital market and they take the 10 years data from 2007 to 2017 and use Augmented-Dicker Fuller test, Johansen cointegration test, vector error correction model and Granger causality test. The results show that increase in inflation is associated with negative growth or decline in the Nifty return but inflation has a positive impact on the GDP.

Hamad *et al.* (2020) examine the effect of inflation rate on stock market indices in Turkey. BIST-100 index is used for the study. The monthly data of the Apex bank of Turkey is used for the study. The time duration is from 2009 to 2020. For the data analysis, VAR model and Granger Causality test are used. The results show that there is one-way causality between inflation and stock indices.

Research Gap

It is observed from the above studies that the results of different studies vary. Different results in different studies might be due to different techniques applied, different sets of data series used, different time durations used, etc. There is a lot of research conducted outside India on different stock markets but less research is done in the context of stock market in India. Therefore, this study is likely to fill this gap.

Objective

The main objective of the study is to examine the relationship between inflation and stock market indices and examine the short-term and long-term relationship between the variables.

Hypotheses

Based on the above objective the following hypotheses are formulated:

H_{01} : *There is no significant relationship between the inflation and stock market indices (NSE Nifty).*

H_{02} : *NSE Nifty indices do not affect the inflation rate.*

H_{03} : *Inflation rate does not affect the NSE Nifty indices.*

Data and Methodology

The study considers NSE Nifty indices and inflation rate as the two main variables. Inflation rate is represented by the Consumer Price Index (CPI). The time period for the study is from January 1, 2008 to March 31, 2019. The values of closing indices of Nifty are collected from the website of National Stock Exchange, and the CPI-related data is collected from the various issues of *Handbook of Statistics on Indian Economy* published by Reserve Bank of India.

Statistical Tools

To determine the relationship between the variables, Pearson correlation test is used after the series of data is initially tested for unit root by using the Augmented-Dickey Fuller (ADF) test. This is followed by Johansen cointegration test to determine the number of cointegrating vectors. After determining the cointegration vectors that depict the long-run relationship between the variables, the short-run relationship is determined using the VECM. To check the causality level, Granger causality test has been used.

Results and Discussion

Table 1 shows the descriptive statistics of the variables: inflation and NSE Nifty. The mean values of inflation and NSE Nifty are 0.708881 and 7,123.329, while maximum values are 6.320000 and 11,760.20, respectively. The values of Kurtosis coefficient (12.04673 and 2.157637, respectively) and Jarque-Bera values (552.6394 and 7.540855, respectively) show that the series data is normally distributed. It shows that value is more than 5%.

Pearson Correlation Test

Pearson correlation is used to check the relationship between inflation and stock market indices (NSE Nifty) (see Appendix). The inflation rate is considered as the independent variable and NSE Nifty indices as the dependent variable. From the correlation analysis, it is found that the r -value is -0.1441 . It shows the existence of a weak negative correlation between the inflation and stock market indices.

Table 1: Descriptive Statistics*		
Statistics	Inflation	NSE Nifty
Mean	0.708881	7,123.329
Median	0.635000	6,284.100
Maximum	6.320000	11,760.20
Minimum	-1.650000	2,969.750
SD	1.070115	2,236.221
Skewness	2.069841	0.397184
Kurtosis	12.04673	2.157637
Jarque-Bera	552.6394	7.540855
Probability	0.000000	0.023042
Sum	94.99000	961,649.4
Sum-Sq. Dev.	152.3045	6.70E+08
Observations	134	134
Note: * EViews 9.5 version is employed.		

Long-Run Association Between Inflation and Stock Market Indices

Unit Root Test (Stationarity Test)

At Level

Table 2 shows that the critical value of inflation is more than 5%, therefore, inflation has no unit root but the Nifty calculated value of the test statistic t , which is less than its critical value (3.429), which means that variables inflation and Nifty are non-stationary at their levels.

Table 2: Unit Root Test for Inflation and Nifty, Series with Constant and Trend at Level					
Period 2008-2019	Variable	No. of Observations	ADF Test Value	Critical Value at 5%	p-Value
Level	Inflation	226	14.03165	3.429834	0.0000
	Nifty	226	2.725920		

At Difference 1

Table 3 shows the ADF value at first difference, and the calculated values are greater than the critical value of 3.429 and so, unit root does not exist. According to time series, inflation and Nifty are stationary at their first difference and are found to be integrated of order one $I(1)$.

Table 3: Unit Root Test for Inflation and NSE Nifty, Series with Constant and Trend at First Difference				
Period 2008-2019	Variable	No. of Observations	ADF Test Value	Critical Value at 5%
First Difference	Inflation	226	11.95376	3.429
	Nifty	226	12.51364	

Cointegration Test

After the ADF test, Johansen's cointegration test is used on the variables to check the long-run relationship, if any, between inflation and stock market indices. The cointegration test results (Table 4) indicate that the maximal Eigen statistic (λ_{max}) of 50.20536 is greater than the 5% critical value of 14.26460 and the trace test statistic (λ_{trace}) of 50.39954 is greater than the critical value of 15.49471. The null hypothesis of no cointegration is rejected. The test statistic λ_{trace} (at 1) = 0.194186 is less than the 5% critical value of 3.841461, and hence we cannot reject traces at most one cointegrating equation at 0.05 level. Therefore, there exists a single (i.e., $r = 1$) cointegrating relationship between the variables.

Table 4: Johansen's Cointegration Test Result				
Inflation Rate/NSE Nifty		Sample: January 1, 2008 to March 31, 2019		
Trend Assumption: Linear Deterministic Trend (Restricted) Observation: 217				
Unrestricted Cointegration Test (Trace)				
Hypothesis No. of CE(s)	Eigenvalue	λ	Absolute Value @ 5%	Prob.*
None	0.206547	50.39954	15.49471	0.0000
At 1	0.000894	0.194186	3.841461	0.6595
Unrestricted Cointegration Test (Maximum Eigenvalue)				
None	0.206547	50.20536	14.26460	0.0000
At 1	0.000894	0.194186	3.841466	0.6595
Note: λ_{trace} and Maximum Eigenvalue tests indicate 1 cointegration at 0.05 level; * denotes rejection of hypothesis at 0.05 level;				

Granger Causality Test

The results of cointegration test show that there exists a single (i.e., $r = 1$) cointegrating relationship between the variables. But it does not show the direction of causality, so the Granger causality test is applied (Table 5).

Table 5: Granger Causality Test			
Null Hypotheses	Observation	F-Statistic	Prob.
<i>NSE Nifty does not Granger-cause inflation rate</i>	217	0.96782	0.3815
<i>Inflation rate does not Granger-cause NSE Nifty</i>	217	0.01089	0.9892

The F -statistic obtained for both the variables, inflation and NSE Nifty, is not significant as testified by their p -values which are above 0.05, which indicates that we cannot reject the null hypothesis of no causality. Therefore, the above test results prove that there is no short-run relationship between the two variables.

Vector Error Correction Model

In the VECM, C1 shows that coefficient is negative and p -value of C1 is more than 5% (84.97%) which is insignificant. The estimated long-run relationship from error correction

Table 6: Vector Error Correction Model				
	Coefficient	Std. Error	t-Statistic	Prob.
C1	-0.000552	0.002909	-0.189679	0.8497
C2	0.169685	0.088875	1.909262	0.0574
C3	0.009778	0.085610	0.114218	0.9092
C4	9.786054	30.91730	0.316524	0.7519
C5	-13.33862	21.83249	-0.610953	0.5418
C6	46.00381	23.33413	1.971524	0.0498
C7	-8.69E-05	1.18E-05	7.360374	0.0000
C8	2.38E-05	0.000361	0.065836	0.9476
C9	0.000968	0.000348	2.784216	0.0058
C10	0.131500	0.125449	1.048239	0.2956
C11	0.033614	0.088584	0.379458	0.7047
C12	-0.029634	0.095026	-0.311848	0.7554
Source: E-views Software 9				

model shows that the variables do not have long run causality with Nifty index and inflation does not cause Nifty index in the long run.

After examining the long-run causality relationship between the variables, the next process is to check the short-run causality between the variables. The results of Wald test (Table 7) indicate that the probability value is more than 5% (45.99), therefore, it indicates that null hypothesis can be rejected. It means that there is no short-run causality between the variables from NSE Nifty to inflation.

Table 7: Wald Test			
Test Statistics	Value	df	Probability
Chi-square	1.553468	2	0.4599

Conclusion

The present paper studies the relationship between the stock price indices and inflation which are the important variables of the economy. The duration of the study is from January 2008 to March 2019. The monthly indices of NSE Nifty and inflation rate are used for the study. The econometric tests like ADF and Granger causality have been used for interpretation. The results show that time series of variables used is non-stationary at level, but stationary at first difference. The results of Johansen's cointegration indicate single cointegrating relationship between the variables. Granger causality test results indicate that there is no short-run relationship between the two variables.

Future Scope: The present study used limited macroeconomic variables. It can be extended to longer periods by considering more macroeconomic variables. Further, the study can be extended by covering other countries in Asia. The future research can also focus on the effect of inflation on stock market performance in developed and developing countries. ▲

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Appendix

Table A1: Pearson Correlation Test					
NSE Nifty	Inflation Rate	NSE Nifty	Inflation Rate	NSE Nifty	Inflation Rate
6,357.1	0	5,138	1.82	5,169.25	1.55
5,545.2	0.75	5,221.85	0.6	5,399.7	0.51
5,222.8	1.48	5,310.85	1.78	5,326.45	0.51
5,230.75	0.73	4,992	-1.16	5,099.25	-1.01
5,298.85	0.72	5,329.55	0	5,217	0.51
4,908.8	0.72	5,399.65	0	5,629.95	0.51
4,539.45	2.14	5,278.7	1.18	5,499.4	1.01
4,649.85	1.4	5,366.75	1.16	5,378.75	1.99
4,558	0.69	5,477.5	2.3	5,279.6	0.49
4,000.5	1.37	5,549.8	0	5,286.25	0.97
3,240.55	0	6,073.5	0.56	5,348.55	1.92
3,110.45	-0.68	6,284.1	1.12	5,448.6	0.94
3,147.2	0.68	6,338.5	0.55	5,735.15	0.47
2,969.75	0	6147.3	1.65	5,815.35	0.93
3,123.35	0	6,181.05	1.62	5,885.25	0.46
3,517.25	1.35	5,599.25	-1.6	5,965.15	0.46
4,509.4	0.67	5,872	0	6,111.8	0.91
4,693.2	1.32	5,944.45	0.54	6,052.95	0.9
4,669.75	4.58	5,775.25	0.54	5,971.2	0.45
4,743.75	1.25	5,657.9	1.07	5,962.3	0.89
5,087.6	0.62	5,740.4	2.12	6,229.45	0.88
5,181.95	1.23	5,551.9	0.52	6,011	1.32
$r = -0.1441$					

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