Impact of Macroeconomic News on Sectoral Equity Returns: Evidence from India

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Abstract

Different sectors behave differently in response to macroeconomic shocks due to the underlying differences in market and industrial characteristics. To find the link between macro economy and sectoral stock returns, the technique of regression has been used largely in the earlier studies. We used in this study for the first time a comprehensive set of techniques, bivariate and multivariate Johansen Cointegration and VECM models, Granger Causality tests and Garch (1, 1) model. Contrary to the popular opinion, we found similar macroeconomic factors affecting the returns of most of the sectors both in the short-run and the long-run.

Keywords: Sectoral returns, Stock Market, India, VECM, Garch, Macroeconomic news, Granger Causality, Johansen Cointegration.

JEL Code : *C23, E44, Q43*

1. Introduction:

Due to the underlying difference in industrial and market characteristics, to macroeconomic shocks, sector-specific responses may not be identical. Financial market participants in today's investment world are not just interested in how individual stocks perform but also in how various sectoral indices perform. As benchmarks to track the performance of actively managed portfolios and publicly traded stocks, market practitioners use sectoral indices. Allowing them to target the performance of a particular industry or sector, of late, as sectoral indices yield different risks and returns, institutional investors, fund managers and individual investors are beginning to look at sectoral performances. In this research, we will be focusing on the impact of domestic macroeconomic shocks on the sectoralstock returns of the Indian stock market. 12 important sectors of India have been considered to do the analysis, Automobile, Banking, Consumer Durables, Energy, Healthcare, Industrials, Information Technology, Power, Realty, Telecom, PSU and FMCG. The following are the research objectives, to analyse the response of different sectoral stock returns to the macroeconomic shocks, to find out whether macroeconomic shocks affect the returns of all the sectors in a similar manner or there is a difference in each sector's response according to their market and industrial characteristics, are there any common macroeconomic factors that affect the stock returns of all the sectors, what is the difference between the short-run response of the sectoralreturns to the macroeconomic shocks and long-run response of the sectoral returns to the macroeconomic shocks.

The research has been divided in the following manner, the first part will discuss the literature review. The second part will be dedicated to the empirical analysis to find out the impact of the macroeconomic news on the sectoral stock returns. Multivariate Johansen Co-integration and VECM will try to find out the general long-run response of the sectoral returns to all the selected macroeconomic factors. Bivariate Johansen Co -integration and VECM will try and analyse the specific long-run response of the sectoral returns to each selected macroeconomic variable. Pairwise Granger Causality Test will throw light on the short -run response of the sectoral returns to each selected macroeconomic variable and Garch (1, 1) model will give the evidence of the response of the volatility of the sectoral returns to each selected macroeconomic factor. The third part will discuss the interpretation of the empirical tests and the fourth part will be the conclusion part which will discuss the answers of the research questions put forward at the beginning of the research.

2. Literature Review:

Based on the discounted cash flow model, the intrinsic value of equities was established by two fundamental variables. These two variables are the firm's ability to generate cash flows and the discount rate. The two variables may be affected by the macroeconomic variables (Shiller, 1981; Leroy and Porter, 1981). The traditional arbitrage and equilibrium based models, such as Arbitrage Pricing Theory (APT) and Capital Asset Pricing models also incorporate that stock returns are influenced by a number of macroeconomic factors.

To test the validity of the APT model an empirical model was pioneered by Chen et al. (1986) and whether risks of macroeconomic factors' innovations are rewarded in the stock market was investigated. It was found by them that in the United States stock market returns reflect changes in the bond market, industrial production, inflation and interest rate spread. Fama (1981), Pearce and Roley (1988), Chen (1991) , Hondroyiannis and Papapetrou (2001), Hooker (2004) and Tsouma (2009) are some of the other researches that examined the relationship between the stock prices and economic factors, in cluding yield spread, interest rate, money supply, inflation, economic growth, etc.

The literature that links stock markets to macroeconomic factors so far, primarily deals with the aggregate performance of the stock markets. However, the sectoral effects of macroeconomic performance have comparatively received less coverage. Due to the fundamental variability in the industrial and market properties, the sector-based reaction to macroeconomic shocks may not be the same as per Ewing et al. (2003). Along wit h the performance of individual stocks, the performance of sectoral indices is of equally high importance to the stakeholders of financial market in the contemporary investment world. To trace the performance of actively controlled portfolios and stocks traded publicly, sectoral indices act as yardsticks for the market professionals. Due to the difference in risks and returns of sectoral indices, the fund managers, institutional investors and individual investors have recently started to look at sectoralperformance which allows them to track the industry-specific or sector-specific performance. According to Balli and Balli (2011), sectoral indices are less reliant on the euro area's aggregate stock index, indicating that diversification across sectors within the region will be much more efficient in minimising portfolio risk.

In the Indian context, the researchers mostly used regression analysis to study the connection between macroeconomic factors and the sectoral stock returns. Using regression technique (Sailaja and Mandal, 2018) studies the impact of crude oil prices, foreign institutional investment and exchange rate on the industry returns of the following sectors, Automobile, Banking, Energy and IT. Foreign Institutional Investmen ts were found to be most effective in affecting the stock returns of most of the sectors. Different sectoral indices were selectively affected by rest of the macroeconomic variables. (Jambotkar and Raju, 2018) used ordinary least square regression model, the individual macroeconomic factors were found to be having less explanatory power in explaining sectoral stock returns as compared to the combined power of the macroeconomic factors. (Sivakumar and Naveen, 2016) used multivariate and lagged regression models, specific sectoral returns were found to be affected by many macroeconomic factors but exchange rate and crude oil prices were the two factors which had a pervasive impact on the sectoral indices. (Chavannavar, Patil and Simoes, 2016) with the use of the regression analysis tried to evaluate the impact of the macroeconomic variables related with the monetary policy on the stock returns of the sectors. The changes in the monetary policy tools were found to be having a linear relationship with the sect oral returns. Variations in monetary tools jointly explain ed majority of the variations in the stock returns of the sectors.

The studies which used regression analysis to determine the short run relationship between sectoralstock market returns and macroeconomic variables are many. But some of the studies also used Granger Causality tests to determine the short run impact of macroeconomic variables of the sectoral stock returns of India. (Lakshmy, 2014) analysed the impact of Foreign Institutional Investment on the stock returns of the sectors in India. At varying degrees, almost on the stock returns of all the sectors, FIIs were found to be having an impact. (Makan, Ahuja and Chauhan, 2012) analysed the impact of IIP, CPI, interest rate, exchange rat e, FII, Oil Prices and gold prices on the stock returns of the following sectors, Metals, Auto, Consumer Durables, Fast Moving Consumer Goods and Capital Goods. Regression and Granger Causality tests were used to do the analysis. Call money rate, foreign institutional investment and exchange rate were the variables found to be having a significant influence on the stock returns of most of the sectors.

Very few studies concentrated on finding the long-run impact of the macroeconomic factors on the sectoral stock returns in India. (Manu, 2018) used cointegration method to evaluate the long -run relationship. Exchange rate and crude oil prices were found to be sharing cointegrating relationship with the stock returns of the sectors of banking and Information technology. The stock market returns of metal industry and automobile sector did not found to be sharing cointegrating relationship with any of the macroeconomic variables considered. (Joshi and Giri, 2015) with the help of ARDL bounds testing approach and VECM method tested the short-run and long-run impact of the macroeconomic factors on the sectoral stock returns in India.

Most of the studies were of the opinion that to macroeconomic shocks the stock returns of different sectors behave differently. In the Indian context, the studies which have tried to analyse the impact of the macroeconomic variables on the sectoral stock market returns are very few. To the best of our knowledge no study tried to use volatility modelling in this area in the Indian context. Also, we found no study that tried to use the bivariate Johansen Cointegration and VECM tests to find the long-run impact of the individual macroeconomic variables on the sectoral stock returns of India. The volatility modelling is a new and much more reliable technique to assess the impact of the macroeconomic variables on the stock returns and it is necessary to use this modelling to explore the contemporary relationship between macroeconomic variables and the stockmarket returns. For the

policy makers, the assessment of long-run impact of individual macroeconomic variables on sectoralstockreturns is necessary for the policy making purpose. Thus, the use of volatility modelling and bivariate long -run tests in finding the impact of the macroeconomic variables on the sectoral stock returns in the Indian context will further enrich the literature and will fill some key gaps.

3. Empirical Testing:

3.1. Model Specification:

To investigate the impact of macroeconomic factors on the sectoral stockreturns following general specifications have been used:

$$LS\&PAUTO = \alpha_0 + \alpha_1 LCMR + \alpha_2 LOP + \alpha_3 LER + \alpha_4 LFII + \alpha_5 LGP + \alpha_6 IIP + \alpha_7 LIR + \alpha_8 MS + \varepsilon_t \quad (3.1.1)$$

Where, LS&PAUTO is the log value of BSE S&P Auto. BSE S&P Auto represents the stock market returns of the automobile sector.

$$LS\&PBANKEX = \alpha_0 + \alpha_1 LCMR + \alpha_2 LOP + \alpha_3 LER + \alpha_4 LFII + \alpha_5 LGP + \alpha_6 IIP + \alpha_7 LIR + \alpha_8 MS + \varepsilon_t \quad (3.1.2)$$

Where, LS&PBANKEX is the log value of BSE S&P Bank ex. BSE S&P Bank ex represents the stock mark et returns of the banking sector.

$$LS\&PCONSUMERDURABLES = \alpha_0 + \alpha_1 LCMR + \alpha_2 LOP + \alpha_3 LER + \alpha_4 LFII + \alpha_5 LGP + \alpha_6 IIP + \alpha_7 LIR + \alpha_8 MS + \varepsilon_t \quad (3.1.3)$$

Where, LS&PCONSUMERDURABLES is the log value of BSE S&P Consumer Durables. BSE S&P Consumer Durables represents the stock market returns of consumer durables sector.

$$LS\&PENERGY = \alpha_0 + \alpha_1 LCMR + \alpha_2 LOP + \alpha_3 LER + \alpha_4 LFII + \alpha_5 LGP + \alpha_6 IIP + \alpha_7 LIR + \alpha_8 MS + \varepsilon_t \quad (3.1.4)$$

Where, LS&PENERGY is the log value of BSE S&P ENERGY. BSE S&P Energy represents the stock market returns of the energy sector.

$$LS\&PHEALTHCARE = \alpha_0 + \alpha_1 LCMR + \alpha_2 LOP + \alpha_3 LER + \alpha_4 LFII + \alpha_5 LGP + \alpha_6 IIP + \alpha_7 LIR + \alpha_8 MS + \varepsilon_t \quad (3.1.5)$$

Where, LS&PHEALTHCARE is the log value of BSE S&P Healthcare. BSE S&P healthcare represents the stock market returns of the healthcare sector.

$$LS\&PINDUSTRIALS = \alpha_0 + \alpha_1 LCMR + \alpha_2 LOP + \alpha_3 LER + \alpha_4 LFII + \alpha_5 LGP + \alpha_6 IIP + \alpha_7 LIR + \alpha_8 MS + \varepsilon_t \quad (3.1.6)$$

Where, LS&PINDUSTRIALS is the log value of BSE S&P Industrials. BSE S&P Industrials represents the stock market returns of the industrial sector.

$$LS\&PINFORMATIONTECHNOLOGY = \alpha_0 + \alpha_1 LCMR + \alpha_2 LOP + \alpha_3 LER + \alpha_4 LFII + \alpha_5 LGP + \alpha_6 IIP + \alpha_7 LIR + \alpha_8 MS + \varepsilon_t \quad (3.1.7)$$

Where, LS&PINFORMATIONTECHNOLOGY is the log value of BSE S&P Information Technology. BSE S&P Information Technology represents the stock market returns of the Information Technology sector.

$$LS\&PPO??ER = \alpha_0 + \alpha_1 LCMR + \alpha_2 LOP + \alpha_3 LER + \alpha_4 LFII + \alpha_5 LGP + \alpha_6 IIP + \alpha_7 LIR + \alpha_8 MS + \varepsilon_t \quad (3.1.8)$$

Where, LS&PPOWER is the log value of BSE S&P Power. BSE S&P Power represents the stock market returns of the power sector.

$$LS\&PREALTY = \alpha_0 + \alpha_1 LCMR + \alpha_2 LOP + \alpha_3 LER + \alpha_4 LFII + \alpha_5 LGP + \alpha_6 IIP + \alpha_7 LIR + \alpha_8 MS + \varepsilon_t \quad (3.1.9)$$

Where, LS&PREALTY is the log value of BSE S&P Realty. BSE S&P Realty represents the stock market returns of the realty sector.

$$LS\&PTELECOM = \alpha_0 + \alpha_1 LCMR + \alpha_2 LOP + \alpha_3 LER + \alpha_4 LFII + \alpha_5 LGP + \alpha_6 IIP + \alpha_7 LIR + \alpha_8 MS + \varepsilon_t$$

(3.1.10)

Where, LS&PTELECOM is the log value of BSE S&P Telecom. BSE S&P Telecom represents the stock market returns of the telecom sector.

$$LS\&PPSU = \alpha_0 + \alpha_1 LCMR + \alpha_2 LOP + \alpha_3 LER + \alpha_4 LFII + \alpha_5 LGP + \alpha_6 IIP + \alpha_7 LIR + \alpha_8 MS + \varepsilon_t$$

(3.1.11)

Where, LS&PPSU is the log value of BSE S&P PSU. BSE S&P PSU represents the stock market returns of the PSU sector.

$$LS\&PFMCG = \alpha_0 + \alpha_1 LCMR + \alpha_2 LOP + \alpha_3 LER + \alpha_4 LFII + \alpha_5 LGP + \alpha_6 IIP + \alpha_7 LIR + \alpha_8 MS + \varepsilon_t$$

(3.1.12)

Where, LS&PFMCG is the log value of BSE S&P FMCG. BSE S&P FMCG represents the stock market returns of the FMCG sector.

LCMR is the natural log of call money rate.

LOP is the natural log of international oil prices.

LER is the log value of the exchange rate.

LFII is the log value of Foreign Institutional Investment.

IIP is the Industrial Index of Production.

LIR is the log value of the inflation rate.

LMS is the log value of the money supply.

α_0 *is the constant of the model.*

ε_t *is the error term.*

$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7, \alpha_8$ *denote the coefficients of the independent variables.*

3.2. Johansen Co-integration and VECM analysis:

(Johansen, 1988; Johansen, 1990) proposed two test statistics to test the presence of co-integration, which in the literature are known as the trace test and the maximum eigenvalue test. For an appropriate representation of the DGP, a liner time pattern or seasonal dummy variables are needed, including deterministic terms such as an intercept. One way to include deterministic terms is to assume that there are two additive terms in th e non-stationary time series y_t i.e.,

$$y_t = \mu_t + \tilde{y}_t \quad (3.2.1)$$

where μ_t represents the deterministic part and y_t the stochastic part.

In this case, it is assumed that y_t has a VAR or VECM representation as in (3.2.1) and (3.2.2). Further, to present the co-integration tests, let us assign $\mu_t = \mu_0 + \mu_1 t$ so that

$$y_t = \mu_0 + \mu_1 t + \tilde{y}_t \quad (3.2.2)$$

Based on the specific assumptions about the deterministic aspect of y_t, there are three practicable cases:

Case (1): μ_0 arbitrary and $\mu_1 = 0$ i.e., there is no deterministic trend term, however a constant meanCase exists;

(2): A linear deterministic term in the DGP so that μ_0

$$\mu_0 + \mu_1 t = 0;$$

Case (3): Both μ_0 and μ_1 arearbitrary.

First, case one is considered. In this demonstration, $y_t = \mu_0 + \tilde{y}_t$, and hence $y_t - \mu_0 = \tilde{y}_t$. Consequently, taking into account the VECM of y_t, VECM of y_t take up the following two forms – the mean adjusted form attributable to (Saikkonen and Luukkonen, 1997) and (Saikkonen and Lutkepohl, 2000) (equation (3.2.3) below), and the Johansen (1995) intercept form(equation (5.4.4) below).

$$\Delta y_t = \mu_0^* + \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + u_t = \Pi^* \left(y_{t-1} - \mu_0 t \right) + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + u_t \quad (3.2.3)$$

and $\Delta y_t = \Pi(y_{t-1} - \mu_0) + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + u_t$ (3.2.4)

Where $\Pi^* = [\Pi \ \mu_0^*]$ is of order $k \times (k+1)$ and $\mu_0^* = -\Pi\mu_0$. It may be observed that the intercept term can be incorporated into the co-integrating relationships in the latter case and thus $\Pi^* = \alpha\beta^*$ has rank *r*.

It is obvious that both VECM versions can be used to test the rank of co -integration. Johansen (1995) considered the intercept version (3.2.4) and he and (Osterwald-Lenum, 1992) have presented the critical values for the LR test called the trace test. Table 3.2.1 gave the results of gave the results of the multivariate Johansen Juselius Cointegration and VECM tests. Table 3.2.2 gave the results of the bivariate Johansen Cointegration and VECM modelling.

3.2.1. Multivariate Johansen Juselius Cointegrationand VECM modelling

1. Automobile.

Series: AUTO CMR COP ER FII GP IIP IR MS

Dependent Variable: D(AUTO)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) t-Statistic	(C1) Prob.
257.013* **	0.000	3	-0.029	-1.869	0.063

2. Banking.

Series: Bankex CMR COP ER FII GP IIP IR MS

Dependent Variable: D(Bankex)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) t-Statistic	(C1) Prob.
267.282* **	0.000	4	-0.078***	-4.826	0

3. Consumer Durables.

Series: Consumer Durables CMR COP ER FII GP IIP IR MS

Dependent Variable: D(Consumer Durables)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) t-Statistic	(C1) Prob.
266.684* **	0.000	4	-0.056***	-3.579	0.000

4. Energy.

Series: Energy CMR COP ER FII GP IIP IR MS

Dependent Variable: D(Energy)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) t-Statistic	(C1) Prob.
281.924* **	0.000	4	-0.022***	-6.494	0

5. Healthcare.

Series: Healthcare CMR COP ER FII GP IIP IR MS

Dependent Variable: D(Healthcare)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) t-Statistic	(C1) Prob.
287.275* **	0.000	4	-0.031	-1.518	0.130

6. Industrials.

Series: Industrials CMR COP ER FII GP IIP IR MS

Dependent Variable: D(Industrials)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) t-Statistic	(C1) Prob.
263.607* **	0.000	4	-0.068***	-6.176	0

7. Information Technology.

Series: Information Technology CMR COP ER FII GP IIP IR MS

Dependent Variable: D(Information Technology)

Lags interval (in first differences): 1 to 4

A. JC			**B.** VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) t-Statistic	(C1) Prob.
262.179* **	0.000	4	-0.029**	-2.280	0.023

8. Power.

Series: Power CMR COP ER FII GP IIP IR MS

Dependent Variable: D(Power)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) t-Statistic	(C1) Prob.
277.789* **	0.000	5	-0.255***	-6.479	0

9. Realty.

Series: Reality CMR COP ER FII GP IIP IR MS

Dependent Variable: D(Reality)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) t-Statistic	(C1) Prob.
284.522* **	0.000	4	-0.080***	-5.545	0

10. Telecom.

Series: Telecom CMR COP ER FII GP IIP IR MS

Dependent Variable: D(Telecom)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) t-Statistic	(C1) Prob.
283.200* **	0.000	6	-0.080***	-3.784	0.000

11. PSU.

Series: PSU CMR COP ER FII GP IIP IR MS

Dependent Variable: D(PSU)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) t-Statistic	(C1) Prob.
237.860* **	0.000	2	-0.046***	-2.700	0.007

12. FMCG.

Series: FMCG CMR COP ER FII GP IIP IR MS

Dependent Variable: D(FMCG)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) t-Statistic	(C1) Prob.
250.226* **	0.000	4	-0.013	-1.841	0.067

Notes: (1) The lag order of the model is based on Akaike information criterion (AIC).

(2) ** and * indicate significant at 5 and 1 percent level of significance, respectively.**

(3) CE(s) = Cointegrating Equations, JC = Johansen Cointegration, VECM = Vector Error Correction Modelling.

Table 3.2.2: Bivariate: Johansen Cointegration and Vector Error Correction Modelling (VECM).

1. Automobile.

A. Non-Cointegrated Series.

	JC	
Series	(None) Trace Statistic	(None) Prob.
Sensex IR	13.885	0.086
Sensex IIP	14.386	0.072
Sensex GP	5.886	0.708
Sensex ER	3.458	0.942
Sensex COP	6.959	0.582

B. Cointegrated Series

	JC		VECM		
Series	(None) Trace Statistic	(None) Prob.	C(1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS	17.521**	0.024	-0.068***	3.798	0.000
Sensex FII	18.720***	0.015	0.001	1.528	0.127
Sensex CMR	16.294**	0.024	-0.000***	3.133	0.002

2. Consumer Durables.

A. Non-Cointegrated Series.

	JC	
Series	(None) Trace Statistic	(None) Prob.
Sensex IR	13.039	0.113
Sensex IIP	16.354	0.037
Sensex GP	7.650	0.503
Sensex ER	6.308	0.659
Sensex COP	7.236	0.550

B. Cointegrated Series

	JC		VECM		
Series	(None) Trace Statistic	(None) Prob.	C(1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS	18.238**	0.018	-0.033**	-2.314	0.021
Sensex FII	30.782***	0.000	0.005***	2.721	0.007
Sensex CMR	20.265***	0.008	0.006***	3.587	0.000

3. Healthcare.

A. Non-Cointegrated Series.

	JC	
Series	(None) Trace Statistic	(None) Prob.
Sensex IR	14.720	0.065
Sensex IIP	12.159	0.149
Sensex GP	7.406	0.530
Sensex ER	4.660	0.843

Sensex COP	6.994	0.578			
Sensex CMR	12.818	0.121			

B. Cointegrated Series

	JC		VECM		
Series	(None) Trace Statistic	(None) Prob.	C(1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS	17.856**	0.021	-0.049***	-2.675	0.008
Sensex FII	19.985***	0.009	0.000	0.468	0.639

4. Information Technology.

A. Non-Cointegrated Series.

	JC	
Series	(None) Trace Statistic	(None) Prob.
Sensex IIP	15.317	0.053
Sensex GP	10.533	0.241
Sensex ER	7.854	0.481
Sensex COP	8.016	0.463
Sensex CMR	13.889	0.086

B. Cointegrated Series

	JC		VECM		
Series	(None) Trace Statistic	(None) Prob.	C(1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS	17.446**	0.025	-0.062***	-2.848	0.004
Sensex IR	15.774**	0.045	-0.002***	-3.601	0.000
Sensex FII	21.295***	0.006	0.000	0.104	0.916

5. PSU.

A. Non-Cointegrated Series.

	JC	
Series	(None) Trace Statistic	(None) Prob.
Sensex IR	15.281	0.053
Sensex IIP	12.012	0.156
Sensex GP	9.916	0.287
Sensex ER	3.384	0.946
Sensex COP	13.932	0.084

B. Cointegrated Series

	JC		VECM		
Series	(None) Trace Statistic	(None) Prob.	C(1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS	24.303***	0.001	-0.013	-0.969	0.333
Sensex FII	24.496***	0.001	0.000	1.693	0.091
Sensex CMR	19.177**	0.013	-0.011***	-3.248	0.001

6. Banking.

A. Non-Cointegrated Series.

	JC	
Series	(None) Trace Statistic	(None) Prob.
Sensex IR	10.671	0.232
Sensex IIP	12.903	0.118
Sensex GP	7.453	0.525
Sensex ER	12.647	0.128
Sensex COP	11.284	0.194
Sensex CMR	13.808	0.088

B. Cointegrated Series

	JC		VECM		
Series	(None) Trace Statistic	(None) Prob.	C(1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS	41.145***	0.000	0.000	-0.115	0.908
Sensex FII	23.534***	0.002	-0.003***	-2.926	0.004

7. Energy.

A. Non-Cointegrated Series.

	JC	
Series	(None) Trace Statistic	(None) Prob.
Sensex IR	12.614	0.129
Sensex GP	13.121	0.110
Sensex ER	10.286	0.259

B. Cointegrated Series

	JC		VECM		
Series	(None) Trace Statistic	(None) Prob.	C(1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS	41.730***	0.000	0.000	-0.496	0.620
Sensex IIP	21.621***	0.005	-0.028	-1.551	0.123
Sensex FII	35.899***	0.000	0.009***	4.661	0.000
Sensex COP	17.366**	0.025	-0.078***	-4.485	0.000
Sensex CMR	17.779**	0.022	-0.031***	-3.354	0.001

8. Industrial.

A. Non-Cointegrated Series.

	JC	
Series	(None) Trace Statistic	(None) Prob.
Sensex IR	12.498	0.134
Sensex GP	9.692	0.305
Sensex ER	14.755	0.064

B. Cointegrated Series

	JC		VECM		
Series	(None) Trace Statistic	(None) Prob.	C(1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS	41.307***	0.000	0.001	0.189	0.850
Sensex IIP	17.175**	0.027	-0.010	-1.133	0.259
Sensex FII	31.558***	0.000	-0.005***	-3.935	0.000
Sensex COP	16.855**	0.031	-0.059***	-3.554	0.000
Sensex CMR	16.545**	0.034	-0.005***	-2.719	0.007

9. Power.

A. Non-Cointegrated Series.

	JC	
Series	(None) Trace Statistic	(None) Prob.
Sensex IR	12.615	0.129
Sensex ER	12.772	0.123

B. Cointegrated Series

	JC		VECM		
Series	(None) Trace Statistic	(None) Prob.	C(1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS	42.112***	0.000	5E-06	0.009	0.992
Sensex IIP	18.312**	0.018	-4E-02	-1.592	0.114
Sensex GP	19.950***	0.009	-9E-02***	-2.640	0.009
Sensex FII	37.497***	0.000	6E-03***	3.557	0.000
Sensex COP	16.388**	0.036	-4E-02***	-3.061	0.002
Sensex CMR	32.694***	0.000	-1E-01***	-5.370	0.000

10. Realty.

A. Non-Cointegrated Series.

	JC	
Series	(None) Trace Statistic	(None) Prob.
Sensex IR	7.702	0.497
Sensex IIP	15.000	0.059
Sensex GP	14.356	0.073
Sensex ER	12.642	0.128
Sensex COP	13.020	0.114

B. Cointegrated Series

	JC		VECM		
Series	(None) Trace Statistic	(None) Prob.	C(1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS	41.382***	0.000	-0.001	-0.826	0.410
Sensex FII	28.561***	0.000	-0.015***	-4.274	0.000
Sensex CMR	16.926**	0.030	-0.026***	-2.663	0.008

11. Telecom.

A. Non-Cointegrated Series.

	JC	
Series	(None) Trace Statistic	(None) Prob.
Sensex IR	10.859	0.220
Sensex ER	8.642	0.399
Sensex COP	12.054	0.154
Sensex CMR	15.235	0.054

B. Cointegrated Series

	JC		VECM		
Series	(None) Trace Statistic	(None) Prob.	C(1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS	41.041***	0.000	0.630	-0.481	0.630
Sensex IIP	15.880**	0.043	0.612	-0.508	0.612
Sensex GP	15.581**	0.048	0.018**	-2.380	0.018
Sensex FII	30.591***	0.000	0.000***	-3.614	0.000

12. FMCG.

A. Non-Cointegrated Series.

	JC	
Series	(None) Trace Statistic	(None) Prob.
Sensex IR	14.684	0.066
Sensex IIP	13.534	0.096
Sensex GP	10.359	0.254
Sensex ER	9.042	0.361
Sensex COP	12.843	0.120

B. Cointegrated Series

	JC		VECM		
Series	(None) Trace Statistic	(None) Prob.	C(1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS	21.090***	0.006	-0.037***	-2.828	0.005
Sensex FII	22.873***	0.003	0.002	1.531	0.127
Sensex CMR	16.966**	0.029	0.003**	2.447	0.015

Note: (1) The lag order of the model is based on Akaike information criterion (AIC).

(2) ** and * indicate significant at 5 and 1 percent level of significance, respectively.**

(3) CE(s) = Cointegrating Equations, JC = Johansen Cointegration, VECM = Vector Error Correction Modelling.

3.3. Short-run Granger Causality Analysis:

Granger-causality test is performed to evaluate whether there are lead-lag relationships between Index returns and various macroeconomic variables. The Granger test based on a VAR model in differences is appropriate when the long-run analysis indicates that there is no long-run relationship between variables that are integrated of same order, i.e., $y1t$, $y\ 2t \sim I(1)$. As in Enders (2004), if a variable's time series is non-stationary, $I(1)$ and is not co-integrated, the Granger-causality test starts with the VAR model being estimated in the following differences.

$$\Delta y_{1t} = \alpha_{1i} + \sum_{i=1}^{p} \beta_{1i} \Delta y_{1t-i} + \sum_{i=1}^{p} \gamma_{2i} y_{2t-i} + \varepsilon_{1t}$$
$$\Delta y_{2t} = \alpha_{2i} + \sum_{i=1}^{p} \beta_{2i} \Delta y_{2t-i} + \sum_{i=1}^{p} \gamma_{1i} y_{1t-i} + \varepsilon_{2t} \qquad (3.3.1)$$

Where $\Delta y1t$ and $\Delta y2t$ are the first differences of time series under investigation; α, β and γ arethe parameters to be estimated and, ε_{1t} and ε_{2t} are white noise error terms. Tables 3.3.1. presented the results of the pairwise Granger causality tests.

Table 3.3.1: Pairwise Granger Causality Tests.

1. S&P BSE Automobile:

Null Hypothesis:	F-Statistic	Prob.	Decision
CMR dnc S&P BSE AUTO	2.620**	0.025	Rejected
COP dnc S&P BSE AUTO	1.354	0.243	Accepted
ER dnc S&P BSE AUTO	1.756	0.123	Accepted
FII dnc S&P BSE AUTO	3.355***	0.006	Rejected
GP dnc S&P BSE AUTO	1.168	0.325	Accepted
IIP dnc S&P BSE AUTO	1.504	0.190	Accepted
IR dnc S&P BSE AUTO	0.790	0.557	Accepted
MS dnc S&P BSE AUTO	0.966	0.439	Accepted

2. Banking:

Null Hypothesis:	F-Statistic	Prob.	Decision
CMR dnc S&P BSE BANKEX	3.225***	0.008	Rejected
COP dnc S&P BSE BANKEX	2.534**	0.031	Rejected
ER dnc S&P BSE BANKEX	2.564**	0.030	Rejected
FIIS dnc S&P BSE BANKEX	3.643***	0.004	Rejected

GP dnc S&P BSE BANKEX	0.520	0.760	Accepted
IIP dnc S&P BSE BANKEX	1.659	0.149	Accepted
IR dnc S&P BSE BANKEX	0.452	0.810	Accepted
MS dnc S&P BSE BANKEX	0.240	0.944	Accepted

3. Consumer Durables:

Null Hypothesis:	F-Statistic	Prob.	Decision
CMR dnc S&P BSE CONSUMER DURABLES	3.392***	0.005	Rejected
COP dnc S&P BSE CONSUMER DURABLES	1.633	0.152	Accepted
ER dnc S&P BSE CONSUMER DURABLES	1.472	0.200	Accepted
FII dnc S&P BSE CONSUMER DURABLES	4.024***	0.001	Rejected
GP dnc S&P BSE CONSUMER DURABLES	0.436	0.822	Accepted
IIP dnc S&P BSE CONSUMER DURABLES	1.244	0.290	Accepted
IR dnc S&P BSE CONSUMER DURABLES	1.540	0.178	Accepted
MS dnc S&P BSE CONSUMER DURABLES	0.216	0.955	Accepted

4. S&P BSE S&P BSE ENERGY:

Null Hypothesis:	F-Statistic	Prob.	Decision
CMR dnc S&P BSE ENERGY	6.249	3.00E-05	Accepted
COP dnc S&P BSE ENERGY	4.417***	0.001	Rejected
ER dnc S&P BSE ENERGY	2.048*	0.076	Rejected
FIIS dnc S&P BSE ENERGY	6.113	4.00E-05	Accepted
GP dnc S&P BSE ENERGY	0.851	0.516	Accepted
IIP dnc S&P BSE ENERGY	1.615	0.160	Accepted
IR dnc S&P BSE ENERGY	0.996	0.422	Accepted
MS dnc S&P BSE ENERGY	0.631	0.675	Accepted

5. Healthcare:

Null Hypothesis:	F-Statistic	Prob.	Decision
CMR dnc S&P BSE HEALTHCARE	2.306**	0.045	Rejected
COP dnc S&P BSE HEALTHCARE	0.174	0.972	Accepted
ER dnc S&P BSE HEALTHCARE	0.314	0.903	Accepted
FII dnc S&P BSE HEALTHCARE	4.398***	0.000	Rejected
GP dnc S&P BSE HEALTHCARE	0.467	0.800	Accepted
IIP dnc S&P BSE HEALTHCARE	1.000	0.418	Accepted
IR dnc S&P BSE HEALTHCARE	2.527**	0.030	Rejected
MS dnc S&P BSE HEALTHCARE	0.143	0.981	Accepted

6. S&P BSE INDUSTRIALS:

Null Hypothesis:	F-Statistic	Prob.	Decision

CMR dnc S&P BSE INDUSTRIALS	4.502***	0.000	Rejected
COP dnc S&P BSE INDUSTRIALS	3.221***	0.009	Rejected
ER dnc S&P BSE INDUSTRIALS	2.040*	0.077	Rejected
FIIS dnc S&P BSE INDUSTRIALS	5.491***	0.000	Rejected
GP dnc S&P BSE INDUSTRIALS	0.915	0.473	Accepted
IIP dnc S&P BSE INDUSTRIALS	2.076*	0.072	Rejected
IR dnc S&P BSE INDUSTRIALS	0.500	0.775	Accepted
MS dnc S&P BSE INDUSTRIALS	0.551	0.737	Accepted

7. Information Technology:

Null Hypothesis:	F-Statistic	Prob.	Decision
CMR dnc S&P BSE IT	0.605	0.696	Accepted
COP dnc S&P BSE IT	0.978	0.431	Accepted
ER dnc S&P BSE IT	0.056	0.997	Accepted
FII dnc S&P BSE IT	0.736	0.596	Accepted
GP dnc S&P BSE IT	0.804	0.547	Accepted
IIP dnc S&P BSE IT	0.687	0.633	Accepted
IR dnc S&P BSE IT	4.475***	0.000	Rejected
MS dnc S&P BSE IT	0.695	0.627	Accepted

8. Power:

Null Hypothesis:	F-Statistic	Prob.	Decision
CMR dnc S&P BSE POWER	4.082***	0.001	Rejected
COP dnc S&P BSE POWER	2.349**	0.044	Rejected
ER dnc S&P BSE POWER	2.244*	0.053	Rejected
FIIS dnc S&P BSE POWER	5.873	6.00E-05	Accepted
GP dnc S&P BSE POWER	0.415	0.837	Accepted
IIP dnc S&P BSE POWER	1.712	0.136	Accepted
IR dnc S&P BSE POWER	0.524	0.757	Accepted
MS dnc S&P BSE POWER	0.133	0.984	Accepted

9. Realty:

Null Hypothesis:	F-Statistic	Prob.	Decision
CMR dnc S&P BSE REALTY	4.025***	0.002	Rejected
COP dnc S&P BSE REALTY	1.999	0.083	Rejected
ER dnc S&P BSE REALTY	1.053	0.389	Accepted
FIIS dnc S&P BSE REALTY	5.143***	0.000	Rejected
GP dnc S&P BSE REALTY	0.988	0.427	Accepted
IIP dnc S&P BSE REALTY	1.014	0.411	Accepted
IR dnc S&P BSE REALTY	0.535	0.748	Accepted

MS dnc S&P BSE REALTY	0.369	0.868	Accepted

10. Telecom:

Null Hypothesis:	F-Statistic	Prob.	Decision
CMR dnc S&P BSE TELECOM	2.182*	0.060	Rejected
COP dnc S&P BSE TELECOM	2.971**	0.014	Rejected
ER dnc S&P BSE TELECOM	0.502	0.774	Accepted
FIIS dnc S&P BSE TELECOM	4.048***	0.001	Rejected
GP dnc S&P BSE TELECOM	1.193	0.316	Accepted
IIP dnc S&P BSE TELECOM	1.404	0.227	Accepted
IR dnc S&P BSE TELECOM	0.425	0.830	Accepted
MS dnc S&P BSE TELECOM	0.586	0.710	Accepted

11. PSU:

Null Hypothesis:	F-Statistic	Prob.	Decision
CMR dnc S&P BSE PSU	2.826**	0.017	Rejected
COP dnc S&P BSE PSU	1.177	0.321	Accepted
ER dnc S&P BSE PSU	2.322**	0.044	Rejected
FII dnc S&P BSE PSU	3.354***	0.006	Rejected
GP dnc S&P BSE PSU	0.493	0.780	Accepted
IIP dnc S&P BSE PSU	0.223	0.951	Accepted
IR dnc S&P BSE PSU	1.854	0.103	Accepted
MS dnc S&P BSE PSU	0.683	0.636	Accepted

12. FMCG:

Null Hypothesis:	F-Statistic	Prob.	Decision
CMR dnc S&P BSE FMCG	0.763	0.467	Accepted
COP dnc S&P BSE FMCG	0.085	0.917	Accepted
ER dnc S&P BSE FMCG	0.806	0.447	Accepted
FII dnc S&P BSE FMCG	2.986*	0.052	Rejected
GP dnc S&P BSE FMCG	0.443	0.642	Accepted
IIP dnc S&P BSE FMCG	1.159	0.315	Accepted
IR dnc S&P BSE FMCG	2.059	0.129	Accepted
MS dnc S&P BSE FMCG	0.256	0.774	Accepted

Notes: ***implies significant at 1% level, **implies significant at 5% level, *implies significant at 10% level

dnc = do not Granger cause.

3.4. Volatility modelling:

In order to provide further evidence in support of the answers to the questions raised in the study and to account for these stylized facts the GARCH models were employed.

The fundamental contribution of the GARCH (p,q) model is the conditional variance equation which in the following form can be written.

$$\varepsilon_t = v_t \sigma_t \text{ where } \varepsilon_t | \Omega_{t-1} \sim N(0, h^2) \text{ and } v_t \sim N(0,1)$$
$$h^2_t = \alpha_0 + \sum_{i=1} \alpha_i \varepsilon^2_{t-i} + \sum_{j=1} \beta_j h^2_{t-j} \qquad (3.4.1)$$
$$\alpha_0 > 0, \alpha_i, \beta_j \geq 0 \rightarrow h^2_t \geq 0, i = 1, \ldots q, \text{ and } j = 1, \ldots \ldots p$$

where Ω_{t-1} is the set of all information available at time *t-1*.The GARCH (*p, q*) process defined above is stationary when $\sum_i \alpha_i + \sum_j \beta_j < 1$. A function of 3 terms, defined in equation (3.4.1), is the conditional variance of the GARCH model. The first term is the mean of yesterday's forecast ω. The second termis lag of the squared residuals obtained from the mean equation, ε^2 or the ARCH terms. The ARCH terms represent the news (information) about volatility from the previous period that has a weighted impact on the current conditional volatility; it declines gradually and never reaches zero. The third term is the GARCH term, h^2 ensuring the impact of last period's forecast variance. It is important to notice that these three parameters, namely, ω, α_i's and β_j's are restricted to be non-negative to ensure positive values for the conditionalvariance or $h^2 \geq 0$. Table 3.4.1. presented the results of the volatility modelling.

Table 3.4.1: GARCH (1,1)

Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Presample variance: backcast (parameter = 0.7)

1. Automobile.

Dependent Variable: S&P BSE AUTO
GARCH = C(9) + C(10)*RESID(-1)^2 + C(11)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CMR	0.038	0.043	0.890	0.373
OP	0.003	0.058	0.052	0.959
ER	-1.749***	0.361	-4.845	0.000
FII	0.069***	0.019	3.578	0.000

GP	0.228	0.156	1.464	0.143
IIP	-0.009	0.007	-1.287	0.198
IR	-0.021	0.197	-0.108	0.914
MS	-0.011	0.358	-0.032	0.975

2. Consumer Durables:

Dependent Variable: S&P BSE Consumer Durables

GARCH = C(9) + C(10)*RESID(-1)^2 + C(11)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CMR	0.073	0.044	1.638	0.101
OP	0.014	0.087	0.166	0.869
ER	-2.147***	0.446	-4.820	0.000
FII	0.093***	0.022	4.248	0.000
GP	0.143	0.167	0.853	0.394
IIP	0.000	0.008	-0.054	0.957
IR	-0.024	0.136	-0.177	0.859
MS	-0.246	0.429	-0.573	0.567

3. Healthcare

Dependent Variable: S&P BSE Healthcare

GARCH = C(9) + C(10)*RESID(-1)^2 + C(11)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CMR	0.039	0.020	1.931	0.054
OP	0.019	0.059	0.329	0.742
ER	-0.939***	0.327	-2.875	0.004
FII	0.065***	0.015	4.195	0.000
GP	0.030	0.117	0.261	0.794
IIP	0.010	0.006	1.710	0.087
IR	-0.024	0.060	-0.399	0.690
MS	-0.192	0.307	-0.626	0.532

4. Information Technology

Dependent Variable: S&P BSE Information Technology

GARCH = C(9) + C(10)*RESID(-1)^2 + C(11)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CMR	0.031	0.027	1.156	0.248
OP	0.125**	0.058	2.166	0.030
ER	-0.238	0.359	-0.661	0.508
FII	0.071***	0.015	4.754	0.000
GP	-0.166	0.128	-1.294	0.196

IIP	0.008	0.007	1.058	0.290
IR	-0.004	0.048	-0.087	0.931
MS	-0.028	0.350	-0.080	0.937

5. PSU

Dependent Variable: S&P BSE PSU

GARCH = C(9) + C(10)*RESID(-1)^2 + C(11)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CMR	0.046	0.039	1.191	0.234
OP	0.041	0.074	0.557	0.578
ER	-2.295***	0.379	-6.063	0.000
FII	0.108***	0.020	5.366	0.000
GP	0.232	0.142	1.636	0.102
IIP	-0.007	0.008	-0.916	0.360
IR	-0.010	0.262	-0.038	0.970
MS	-0.192	0.343	-0.560	0.576

6. Banking.

Dependent Variable: S&P BSE Bankex

GARCH = C(9) + C(10)*RESID(-1)^2 + C(11)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CMR	0.001	0.013	0.087	0.931
OP	0.000	0.001	-0.421	0.673
ER	-0.038***	0.008	-4.814	0.000
FIIS	0.000	0.000	1.199	0.231
GP	0.000	0.000	-0.238	0.812
IIP	-0.002	0.002	-1.362	0.173
IR	0.000	0.001	-0.810	0.418
MS	0.000	0.000	1.299	0.194

7. Energy.

Dependent Variable: S&P BSE ENERGY

GARCH = C(9) + C(10)*RESID(-1)^2 + C(11)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CMR	-0.002	0.007	-0.324	0.746
OP	0.003***	0.001	2.740	0.006
ER	-0.022***	0.006	-3.676	0.000
FIIS	0.000	0.000	1.001	0.317
GP	0.000	0.000	-0.277	0.782
IIP	-0.003	0.002	-1.464	0.143

IR	0.000	0.002	-0.067	0.947
MS	0.000	0.000	1.100	0.271

8. Industrials.

Dependent Variable: S&P BSE Industrials

GARCH = C(9) + C(10)*RESID(-1)^2 + C(11)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CMR	-0.001	0.010	-0.091	0.928
OP	0.001	0.001	1.109	0.268
ER	-0.037***	0.008	-4.844	0.000
FIIS	0.000	0.000	-1.549	0.121
GP	0.000	0.000	-0.514	0.607
IIP	-0.002	0.002	-1.194	0.233
IR	0.000	0.001	-0.175	0.861
MS	0.000	0.000	0.826	0.409

9. Power:

Dependent Variable: S&P BSE Power

GARCH = C(8) + C(9)*RESID(-1)^2 + C(10)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CMR	-0.007	0.005	-1.254	0.210
OP	0.000	0.001	0.355	0.723
ER	-0.034***	0.007	-5.061	0.000
FIIS	0.000	0.000	0.414	0.679
IIP	-0.001	0.002	-0.777	0.437
IR	0.000	0.001	-0.090	0.928
MS	0.000	0.000	-0.092	0.927

10. Realty.

Dependent Variable: S&P BSE Realty

GARCH = C(9) + C(10)*RESID(-1)^2 + C(11)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CMR	0.002	0.022	0.105	0.917
OP	0.001	0.002	0.796	0.426
ER	-0.051***	0.011	-4.762	0.000
FIIS	0.000	0.000	1.088	0.277
GP	0.000	0.000	0.147	0.883
IIP	-0.003	0.002	-1.187	0.235
IR	-0.001	0.001	-1.278	0.201
MS	0.000	0.000	0.561	0.575

11. TELECOM.

Dependent Variable: S&P BSE TELECOM

GARCH = C(9) + C(10)*RESID(-1)^2 + C(11)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CMR	0.001	0.010	0.108	0.914
OP	0.001	0.001	1.014	0.311
ER	-0.022***	0.009	-2.493	0.013
FIIS	0.000	0.000	1.010	0.312
GP	0.000	0.000	-0.526	0.599
IIP	-0.002	0.002	-0.761	0.447
IR	0.000	0.001	-0.190	0.849
MS	0.000	0.000	0.140	0.888

12. FMCG.

Dependent Variable: S&P BSE FMCG

GARCH = C(10) + C(11)*RESID(-1)^2 + C(12)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CMR	0.023	0.028	0.823	0.411
OP	-0.010	0.045	-0.228	0.820
ER	-0.729***	0.285	-2.559	0.011
FII	0.035	0.026	1.341	0.180
GP	-0.100	0.108	-0.922	0.357
IIP	-0.001	0.005	-0.200	0.842
IR	-0.053	0.059	-0.909	0.364
MS	0.220	0.280	0.785	0.433

Note: ***indicates significance at 1% level, **indicates significance at 5% level.

4. Analysis of the Empirical Tests:

4.1. Automobile sector: The automobile sector was one of the very few sectors the stock returns of which in the multivariate long-run analysis came to be not affected by the macroeconomic factors which clearly suggested that as compared to the stock returns of other sectors the stock returns of the automobile sector shared weak connection with the economic environment. Like most other sectors the factors related to money circulation and liquidity affected the stock returns of the sector in a significant manner. The influence of money supply and call money rate was seen in the bivariate long-run analysis. Weak connection of the economic environment with

the stock returns was also seen in the short-run granger causality tests, only one macroeconomic factor i.e. call money rate was seen as affecting the automobile sector stock returns.

4.2. Banking sector: the multivariate long-run analysis suggested a significant influence of the macroeconomic environment on the banking sector stock returns. Quite interestingly opposite to the expectation, the factors related with money did not show much influence on the stock returns of the sector, in the long-run, only FII found to be affecting the stock returns in the bivariate long-run analysis. The common factors which were affecting the returns of other sectors those factors only found to be affecting the banking sector returns as well in the short-run. Call money rate, oil prices, exchange rate and FII were found to be affecting the stock returns in granger causality analysis. Exchange rate affected the returns in the volatility modelling.

4.3. Consumer durables sector: the consumer durables sector was just another sector as far as the effect of the macroeconomic factors on the sectoral returns is concerned. Like most other sectors the stock returns of the sector seemed to be integrated with the economic environment of the country as the multivariate long-run analysis suggested a significant impact of the macroeconomic factors on the stock returns of the sector. Like many other sectors bivariate long-run analysis found only money supply to be making a significant on the stock returns, call money rate and FII influencing in the short-run as per Granger causality tests and exchange rate and FII showing their impact in the volatility modelling.

4.4. Healthcare sector: the healthcare sector returns as expected found to be having a weak relationship with the economic environment. The multivariate long-run analysis suggested no causality running from macroeconomic factors towards the stock returns of the sector. Money supply affected the returns of the sector in bivariate long-run analysis and in the short-run similar factors affected the sector's returns which affected the returns of other sectors. Call money rate, FII and exchange rate affected the returns in the granger causality tests and FII and exchange rate affected in the volatility modelling.

4.5. Industrials: the stock returns of this sector seemed to be most integrated with the economic environment of the country. Long-run causality was found to be running from economic factors towards the stock returns in the multivariate Johansen and VECM analysis and a range of macroeconomic factors were found to be affecting the returns in other tests. FII, oil prices and call money rate affected the stock returns in the bivariate long-run tests. Call money rate, oil prices, exchange rate and FII affected the sector returns in the granger causality tests. In volatility modelling exchange rate affected the sector's returns.

4.6. Information technology sector: the IT sector's returns were expected to be influenced more by the external factors rather than the domestic factors but the results of the tests did not come to this conclusion. Long-run causality was found to be running from the macroeconomic factors to the stock returns of the sector in the multivariate long-run analysis. Money supply and inflation rate affected the sector's returns, in the long-run, bivariate analysis. The granger causality estimation suggested the influence of the inflation rate in the short-run. This was the only sector the returns of which were found to be getting affected by the inflation rate so significantly. Oil prices and FII affected the returns in volatility modelling.

4.7. Energy: the energy sector returns were expected to be affected by the oil prices and the exchange rate the most. This expectation seemed to be getting fulfilled in the econometric analysis. The returns of the sector

were very much connected with the economic environment as suggested by the multivariate long -run analysis. Oil prices and call money rate affected the returns in the bivariate long-run analysis. In the short-run, granger causality estimation oil prices found to be the only variable affecting the stockreturns of the sector. Exchange rate and oil prices were the two variables affected the returns in the volatility modelling.

4.8. Power sector: the power sector returns were also expected to be influenced by the oil prices and the exchange rate the most. This expectation was also fulfilled by the econometric analysis. The multivariate long-run analysis suggested a significant effect of the macroeconomic environment on the stock returns of the sector. The bivariate long-run analysis suggested two factors oil prices and call money rate having a sign ificant impact on the returns. Short-run granger causality tests suggested 3 variables call money rate, oil prices and exchange rate as affecting the stock returns. The volatility modelling found the exchange rate's impact on the returns of the sector.

4.9. Reality sector: There was no special expectation from the stock returns of this sector as far as the effect of macroeconomic factors on the returns is concerned. Fulfilling the expectations the econometric analysis also did not show any speciality while examining the effect of macroeconomic factors on the sector's returns. Long-run causality was found to be running from macroeconomic factors to the returns of the sectors as suggested by the multivariate long-run analysis which showed the integration of the reality sector returns with the economic environment of the country. FII and callmoney rate affected the sector's returns in the long-run as per the findings of the bivariate Johansen Co-integration and VECM analysis. Call money rate, oil prices and FII affected the returns in the short-run Granger causality tests and exchange rate affected in the volatility modelling.

4.10. Telecom sector: the telecom sector's returns were also found to be integrated with the macroeconomic environment, multivariate long-run tests suggested long-run causality running from the macroeconomic factors to the Sensex. Gold prices and FII affected the returns in the bivariate long -run analysis. It was the only sectors which showed the influence of the gold prices on its returns in the long-run in the analysis. Call money rate, oil prices and FII affected the stock prices in the granger causality short-run tests. Only exchange rate affected the returns in the volatility modelling.

4.11. PSU: the major PSUs comprised of banks and power sector companies. The stock returns of the sector were expected to get moved by oil prices and the factors that affect the circulation of money and liquidity in the economy. This expectation got fulfilled in the analysis to some extent. The multivariate long-run analysis suggested the integration of stock returns of the sector with the economic environment. Money supply and call money rate affected the returns in the bivariate long-run analysis. Call money rate, exchange rate and FII affected in the granger causality short-run tests. The volatility modelling suggested exchange rate and FII be making an influence on the returns of the sector. The expectation of oil prices did not get fulfilled but the factors related to money did play a significant role in affecting the returns of the sector.

4.12. FMCG sector: The fast-moving goods sector was expected to be moving hand in hand with the economic environment. The sector involves goods for daily consumption and daily consumption goods are consumed by everyone in the economy may it be rich or poor. So any change in the economic environment of the country was expected to be making a significant impact on the sector's profits and stock returns. But the results of

econometric estimation came to a very different conclusion. The sector's returns seemed to be having a weak connection with the economy. The long-run multivariate tests indicated no causality running from the macroeconomic factors towards the sector's returns. The bivariate long-run tests indicated the role of only money supply in affecting the stock returns, granger causality short-run tests showed the influence of FII on the returns and volatility modelling like many other sectors pointed exchange rate as the only factor affecting the volatility of the returns of the sector.

5. Conclusion:

Quite similar macroeconomic factors were found to be affecting the stock market returns of all the sectors with a few exceptions. Money supply, call money rate and FII made the strongest impact on the returns of the sectors in the long-run. Call money rate, FII and oil prices were the factors which affected the sectors' returns in the short-run. Exchange rate and FII affected the volatility of the returns of the sectors. The stock returns of some of the sectors performed according to the expectation. According to the expectation healthcare sector returns showed weak integration with the economic environment, energy and power sectors returns were significantly influenced by the movement in prices of oiland the industrial sector returns were found to be most integrated with the economic environment of the country.

The sectors the returns of which did not perform according to the expectation were automobile and FMCG. The returns of both of these sectors showed weak integration with the economy which was not expected from them. In this analysis of sectoral returns we found money supply, call money rate and FII, all three making a significant impact on the stock returns of India at present in the long-run. The money supply and call money rate both are related with movement of money in the economy and thus it is quite clear that RBI (central bank of India) has a crucial role to play in ensuring the steady growth of the stock market of India by maintaining an adequate supply of money in the economy. Foreign investment also played a crucial role in the development of the stock market of India.

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