Impact of Macroeconomic Variables on Sectoral Indices in India

Dr. L.K. Tripathi
Course Coordinator, School of Commerce
& Coordinator Minority Cell
Devi Ahilya Vishwavidyalaya, Indore

Arpan Parashar
Junior Research Fellow Funded by UGC
New Delhi at School of Commerce

Swati Jaiswal
Research Scholar, School of Commerce
Devi Ahilya Vishwavidyalaya, Indore

Abstract

The key objective of this paper is to examine the long term relationship between selected external macroeconomic variables and different sectoral indices at National Stock Exchange (NSE). For the purpose of study five macro economic variables such as Exchange Rate (USD), Crude Oil prices, Foreign Institutional Investments, Current Account Balance and Foreign Exchange Reserves have been used to magnify the impact of external macroeconomic variables on different sectors of Indian economy represented by Sectoral Indices at National Stock Exchange (NSE) viz. CNX Auto, CNX Bank, CNX Energy, CNX FMCG and CNX IT. The monthly statistical data for above mentioned variables have been used for eight years covering the period from April 2005 to March 2013. In order to examine the relationship among these variables Multiple Regression equation model (Galton, 1877) has been employed using SPSS-16. The results so obtained reveal high correlation among the variables and suggest that amongst all macroeconomic variables only Foreign Institutional Investment (FII) affects all sectoral indices however rest of the macroeconomic variables selectively affect different sectoral indices in India.

Keywords:

Correlation, Indian Economy, Macroeconomic Variables, Multiple Regression, Sectoral Indices, Stock Price

Introduction

Stock market is an important segment of the financial system of any country as it reveals the true state of economy's health and financial stability and plays a pivotal role in channelizing funds from savers (investors) to the needy sectors. The significance of stock market can be well acknowledged in both industries and investor's perspectives. Stock market provides investors with alternative investment avenues to park their surplus funds and creates a pool of these funds to make it available to listed companies for their expansion requirements. The performance of stock markets can be easily judged by an investor by looking at its market index. The market index provides a yardstick to measure the performance of a particular stock and also provides investors for forecasting future trends in market's movements. The movement of stock indices is highly sensitive to the changes in macro economic factors. These factors play a very significant role in determining the performance of the stock market. However due to

adoption of financial liberalization and globalization way right back in 1990s which lead to further sophistication, Indian capital markets have become more prone to the changes in policies and trends in the world economy. The macro economic factors affecting the stock performance can be both domestic and global. The available literature suggests that the causal nexus between the stock market returns and these macroeconomic variables has received a lot of attention from the academic researchers and economists around the world. Preliminary research has been done using different approaches to examine such relationship between stock prices and macroeconomic variables. According to Efficient Market Hypothesis (EMH) propounded by FAMA in 1970, the stock prices in an efficient market reflect all information about changes in macroeconomic variables thus investor can't make abnormal profits in such markets. The conclusions drawn from Efficient Market Hypothesis were further critically examined & justified by subsequent studies again by Fama & Schwert (1977), Nelson (1977). Further the Arbitrage Pricing Theory (APT) of Ross (1976) justifies relationship between stock prices and certain macroeconomic variables. Researchers such as Cheung and Nag (1998), McMillan and Humpe (1997), Mukherjee and Naka (1995), Kwon and Shin (1999) and Mayasmai and Koh have employed Johansen's co-integration analysis to examine the relationships between stock returns and macroeconomic variables in developed countries like Japan, US, Australia, Canada and European countries. It is evidenced that due to the global integration of world economies, even a slightest change can have a significant influence on the domestic economy.

Being a globalized developing economy India can't remain insulated against the global developments. India has much dependence for crude oil, technology, foreign investment etc. on rest of the world to maintain its growth pace. The major source of foreign exchange inflow in India are export of IT services and automobile industries which were badly hit by global financial unrest on the other hand the major chunk of its hard earned foreign exchange is eaten up by import of much needed crude oil & less important items like gold etc. In 2008 the US Subprime Crisis which had its origin in United States housing finance sector, gradually extended over a period of time and eventually took the whole world under its grip. Initially it had a very little impact over Indian economy, but by the end of 2008 the US subprime crisis morphed into global financial crisis which resulted into huge withdrawal of funds by Foreign Institutional Investors, plunging exports, high cost of import due to depreciating rupee etc. Similarly, the Euro Zone crisis, which was surfaced in 2010-11 severely, affected Indian economy.

In light of the above facts, this study aims to analyse the impact of global macroeconomic factors viz. Exchange rate, Crude oil prices, FII, Current account balance, and Foreign Exchange Reserves on different sectors of Indian economy at NSE.

Objectives of The Study

1. To explore the different global factors affecting the different sectors of Indian economy.
2. To study the impact of changes in these global factors on the selected sectoral indices at NSE.

Literature Review

The relationship between stock performance and macro economic variables has been the cornerstone for economists and researchers since the inception of stock markets. It is believed that macroeconomic events always exert a certain amount of influence on the stock markets. Large number of studies has been conducted worldwide to find out the relationship between macroeconomic variables and the fluctuations in the stock prices and it has been found out that with the minor variation these macroeconomic variables there is a significant impact on stock prices. Some of the previous research works in this context are as follows:

Chen et al. (1986) explored a set of macroeconomic variables as systematic influence on stock market returns by modelling equity return as a function of macro variables and non-equity assets returns for US. They found that the macroeconomic variables such as industrial production anticipated and unanticipated inflation, yield spread between the long and short term government bond were significantly explained the stock returns. Their study showed that the economic state variables systematically affect the stock return via their effect on future dividends and discount rates.

Mukherjee and Naka (1995) applied Johansen's (1998) VECM to analyze the relationship between the Japanese Stock Market and exchange rate, inflation rate, money supply, real economic activity, long-term government bond rate, and call money rate. They explored that a co integrating relation indeed existed and that stock prices contributed to this relation.

Mookerjee and Yu (1997) examined the nexus between Singapore stock returns and four macroeconomic variables such as narrow money supply, broad money supply, exchange rates and foreign exchange reserves using monthly data from October 1984 to April 1993. Their analysis revealed that both narrow and broad money supply and foreign exchange reserves exhibited a long run relationship with stock prices whereas exchange rates did not.

Raj Kumar and Bhartendu Singh (1998) studied that the

joint impact of trading volume, rate of exchange and the rate of gold standard were highly significant on Sensex. The individual effect of rate of exchange and rate of gold standard on Sensex were found to be highly significant but the individual effect of trading volume was not found significant.

Pethe and Karnik (2000) using Indian data for April, 1992 to December, 1997, attempted to examine the way in which stock price indices were affected by and had affected other crucial macroeconomic variables in India. The study reported weak causality running from IIP to share price indices (i.e., Sensex and S&P CNX Nifty) but not the other way round. In other words, it holds the view that the state of economy had affected stock prices.

Naka, Mukherjee and Tufte (2001) analyzed long-term equilibrium relationships among selected macroeconomic variables and the BSE Sensex. The study used macroeconomic variables; namely, the Industrial production index, the consumer price index, a narrow measure of money supply, and the money market rate in the Bombay interbank market. They employed a VECM. The study found that the five variables were co integrated and there exists three long-term equilibrium relationships among these variables. The results of the study also suggested that domestic inflation was the most severe deterrent to Indian stock markets performance, and domestic output growth as its predominant driving force.

Ray and Vani (2003) employed a VAR model and an artificial neural network (ANN) to unravel the linkage between the stock market fluctuations and real economic factors in the Indian stock market using the monthly data from April 1994 to March 2003. The results showed that, interest rate, industrial production, money supply, inflation rate and exchange rate have a significant influence on equity prices, while there were significance discovered for fiscal deficit and foreign investment in explaining stock market movement.

Bhupender Singh (2005) examined the effect of significant macroeconomic variables, inflation and exchange rate on the inflows of FII in India, and also tried to develop a theoretical framework to analyze such inter-relationship.

Ratanapakorn and Sharma (2007) studied a long term and short term relationship between US stock index (S&P 500) and different other macroeconomic variables since April 1975 to March 1999. They found negative correlation between stock index and long term interest rate but concluded that there existed a positive correlation amongst IIP, money supply, exchange rate, inflation, and short term interest rates.

Ahmed (2008) examined and found the nature of the causal relationships between stock prices (i.e., Nifty and Sensex) and the key macroeconomic variables (i.e., IIP, FDI, exports, money supply, exchange rate, interest rate) representing real and financial sectors of India. Using quarterly data, Johansen`s approach of co-integration and Toda and Yamamoto (1995) Granger causality test have been applied to explore the long-run relationships while BVAR modelling for variance decomposition and impulse response functions has been applied to examine short run relationships. The study explores that stock prices in India lead economic activity except movement in interest rate which seems to lead the stock prices. The study also finds out that Indian stock market seems to be driven not only by actual performance but also by expected potential performances.

Sharma and Mahendru (2010) examined the impact of various macroeconomic variables comprising of exchange rate, forex reserves, gold price and inflation on stock market. The results of the study suggest that only gold and exchange rate have significant influence on the stock market performance, & found limited effect of inflation rate and foreign exchange reserves on stock prices.

Pal and Mittal (2011) investigated the relationship between the Indian stock markets and macroeconomic variables using quarterly data for the period January 1995 to December 2008 with the Johansen's co-integration framework. Their study revealed that there was a long-run relationship existed between the stock market index and the selected macroeconomic variables. Their analysis also showed that inflation and exchange rate have a significant impact on BSE Sensex but interest rate and gross domestic saving (GDS) were insignificant.

Mohapatra and Panda (2012) correlated top ten rises and top ten falls of Sensex with corresponding net flows of FIIs and also analysed the impact of other macroeconomic factors along with FIIs affecting Sensex for a period of 10 yrs and found that IIP and Exchange rate (USD/INR) have a higher influence than FIIs on the stock markets.

These studies give a strong subjective background to test for the existence of such relationship between the external macroeconomic variables and sectoral indices of NSE.

Research Methodology

Hypothesis

1. There is no significant relationship between different macroeconomic variables and sectoral indices in India.
2. Sectoral indices are not dependent on various macroeconomic variables.

Scope of The Study

- The scope of this study is confined to various macroeconomic variables namely Crude Oil price,

Exchange Rate, Foreign Institutional Investment, Current Account Balance and Foreign Exchange Reserves.

- During the period under study there might have some effect of contemporary economic, social, political situations prevailing in India & global economy, on the variables under study.

Data Description and Techniques

The study considers sectoral indices at NSE representing five different sectors of Indian economy viz. Auto, Bank, Energy, FMCG and IT. Different sectoral indices have been used as a proxy to the concerned sector of Indian economy. To magnify the impact of different external macroeconomic factor on Indian economy, five different macroeconomic variables such as Crude oil price, Dollar value (INR/USD), Foreign Institutional Investment, Foreign Exchange Reserves, and Current Account Balance have been taken as independent variables. All the variables under the study have been used covering the period of eight years from April 2005 to March 2013. For the purpose of study monthly time series data for abovementioned sectoral indices and macroeconomic variables have been used. The price of Crude Oil on USD per barrel basis, Exchange rate in terms of INR/USD, FII (Equity + Debt), Current Account Balance and Foreign Exchange Reserves has been used in terms of INR. Under this study Multiple Regression Analysis has been employed to analyse the impact of these macro economic variables on different sectors of Indian economy.

Research Methodology

For the purpose of study Multiple Regression Analysis, a statistical technique that simultaneously develop a mathematical relationship between single dependent and two of more independent variables, has been employed to evolve the dependency of different sectoral indices on abovementioned macroeconomic variables. The relationship is tested using following equation-

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + U$$

Where,

Y indicates Return on Sectoral Indices

α is the intercept

X_1 stands for the US Dollar (Exchange Rate) abbreviated as USD

X_2 stands for Crude Oil prices abbreviated as CROIL

X_3 stands for Foreign Institutional Investment abbreviated as FII

X_4 stands for Current Account Balance abbreviated as CAB

X_5 stands for Foreign Exchange Reserves abbreviated as FOREX

β_1, β_2, β_3, β_4 and β_5 are the regression coefficients or slopes of X_1, X_2, X_3, X_4 and X_5 respectively. They represent the rate of change in dependent variable as a function of change in the other. In essence they describe how one unit change in the dependent variable is accompanied by change in how many units in the independent variable.

The significance of these coefficients may be checked by t-values or p-values. The null hypothesis is rejected if the p-values obtained is less than, and accepted if it is greater than the significance level at which we are testing the hypothesis. This happens as a P-Value (or probability value) is the probability of getting a value of the sample test statistic that is *as least as extreme* as the one found from the sample data, assuming that the null hypothesis is true. By *extreme* we mean: far from what we would expect to observe if the null hypothesis is true. In other words, a small P-value indicates that observation of the test-statistic would be unlikely if the null hypothesis is true. The lower the P-value, the more evidence there is in favour of rejecting the null hypothesis.

Results, Analysis and Interpretation

Sectors

Table: 1(a) Descriptive Statistics

	N	Mean	Std. Deviation
CNXAUTO	96	2679.70	1078.63
CNXBANK	96	7763.09	2789.24
CNXENERGY	96	7417.13	1827.81
CNXFMCG	96	7478.013	3202.33
CNXIT	96	4971.89	1380.22
Valid N (listwise)	96		

The table 1 given above, shows volatility in different sectors of Indian economy represented by respective sectoral indices accordingly, taking the Deviations from Mean as criterion of measuring volatility the figures are; CNX Auto 40.25%, CNX Bank 35.92%, CNX Energy 24.64%, CNX FMCG 42.82% & CNX IT 27.76%. Thus, from the figures it can be concluded that Auto, Banking and FMCG shown high volatility while Energy and IT sector shown least volatility during the period under the study.

Table 2, given above shows volatility in different global factors taking again the criterion of Deviations from Mean all variables except Exchange rate (USD), shown high volatility during the same period.

Table: 1(b) Descriptive Statistics

	N	Mean	Std. Deviation
USD	96	46.51	4.24
CROIL	96	81.85	23.86
FII	96	32330.07	43604.59
CAB	96	-9521.98	4711.54
FOREX	96	250743.13	59864.57
Valid N (listwise)	96		

Correlation Study: In order to analyse the relationship between Sectoral Indices and different macroeconomic variables, Karl Pearson's Coefficient of Correlation has been employed which results are given below taking each macroeconomic variable as a benchmark.

Table: 2(a) Correlations

		CNXAUTO	USD	CROIL	FII	CAB	FOREX
CNXAUTO	Pearson Correlation	1	.535**	.666**	.442**	-.694**	.622**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	96	96	96	96	96	96

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table: 2(b) Correlations

		CNXBANK	USD	CROIL	FII	CAB	FOREX
CNXBANK	Pearson Correlation	1	.330**	.672**	.527**	-.674**	.764**
	Sig. (2-tailed)		.001	.000	.000	.000	.000
	N	96	96	96	96	96	96

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table: 2(c) Correlations

		CNXENERGY	USD	CROIL	FII	CAB	FOREX
CNXENERGY	Pearson Correlation	1	-.015	.538**	.530**	-.470**	.832**
	Sig. (2-tailed)		.881	.000	.000	.000	.000
	N	96	96	96	96	96	96

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table: 2(d) Correlations

		CNXFMCG	USD	CROIL	FII	CAB	FOREX
CNXFMCG	Pearson Correlation	1	.710**	.708**	.188	-.778**	.846**
	Sig. (2-tailed)		.000	.000	.067	.000	.000
	N	96	96	96	96	96	96

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table: 2(e) Correlations

		CNXIT	USD	CROIL	FII	CAB	FOREX
CNXIT	Pearson Correlation	1	.280**	.620**	.544**	-.552**	.529**
	Sig. (2-tailed)		.006	.000	.000	.000	.000
	N	96	96	96	96	96	96

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Exchange Rate (USD):- USD is found to be in high correlation with CNX FMCG, moderately correlated with CNX AUTO, low correlated with CNX IT and CNX Bank, whereas it is negatively correlated with CNX ENERGY.

Crude oil (CROIL): - Crude oil correlation with all the variables under the study at higher side while it is moderately correlated with CNX ENERGY.

Foreign Institutional Investment (FII):- FII is moderately correlated with all sectoral indices except for FMGC with which it is correlated at lower side.

Current Account Balance (CAB):- Current Account Balance is found to be in a high negative correlation with all the sectoral indices at NSE.

Foreign Exchange Reserves (FOREX):- FOREX is in high positive correlation with CNX FMCG, while it is moderately correlated with rest of the sectoral indices under the study.

CNXAUTO

Table: 3(a) Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.884[a]	.781	.769	518.26889

a. Predictors: (Constant), FOREX, FII, USD, CROIL, CAB

b. Dependent Variable: CNXAUTO

Table: 3(b) Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-3714.132	734.397		-5.057	.000		
	USD	99.104	15.444	.390	6.417	.000	.658	1.520
	CROIL	14.876	3.862	.329	3.852	.000	.333	3.003
	FII	.011	.001	.463	8.481	.000	.816	1.225
	CAB	-.071	.022	-.309	-3.211	.002	.262	3.813
	FOREX	-.002	.002	-.106	-1.224	.224	.327	3.061

a. Dependent Variable: CNXAUTO

CNX BANK

Table: 3(c) Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.878[a]	.771	.758	1371.23976

a. Predictors: (Constant), FOREX, FII, USD, CROIL, CAB

b. Dependent Variable: CNXBANK

Table: 3(d) Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-2887.017	1943.074		-1.486	.141		
	USD	75.058	40.862	.114	1.837	.070	.658	1.520
	CROIL	13.096	10.217	.112	1.282	.203	.333	3.003
	FII	.026	.004	.431	7.717	.000	.816	1.225
	CAB	-.177	.058	-.300	-3.044	.003	.262	3.813
	FOREX	.014	.004	.300	3.401	.001	.327	3.061

a. Dependent Variable: CNXBANK

CNX ENERGY

Table: 3(e) Model Summaryb

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.919[a]	.844	.835	741.96635

a. Predictors: (Constant), FOREX, FII, USD, CROIL, CAB

b. Dependent Variable: CNXENERGY

Table: 3(f) Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	5733.060	1051.381		5.453	.000		
	USD	-104.565	22.110	-.243	-4.729	.000	.658	1.520
	CROIL	-14.806	5.529	-.193	-2.678	.009	.333	3.003
	FII	.011	.002	.258	5.588	.000	.816	1.225
	CAB	-.016	.032	-.040	-.497	.620	.262	3.813
	FOREX	.029	.002	.948	13.016	.000	.327	3.061

a. Dependent Variable: CNXENERGY

CNX FMCG

Table: 3(i) Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.920[a]	.846	.838	1290.78188

a. Predictors: (Constant), FOREX, FII, USD, CROIL, CAB

b. Dependent Variable: CNXFMCG

Table: 3(i) Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-17098.576	1829.064		-9.348	.000		
	USD	404.183	38.465	.536	10.508	.000	.658	1.520
	CROIL	54.090	9.618	.403	5.624	.000	.333	3.003
	FII	.015	.003	.199	4.339	.000	.816	1.225
	CAB	-.147	.055	-.216	-2.680	.009	.262	3.813
	FOREX	-.002	.004	-.039	-.538	.592	.327	3.061

a. Dependent Variable: CNXFMCG

CNX IT

Table: 3(j) Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.807[a]	.651	.631	838.11317

a. Predictors: (Constant), FOREX, FII, USD, CROIL, CAB

b. Dependent Variable: CNXIT

Table: 3(k) Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	393.599	1187.623		.331	.741		
	USD	52.534	24.975	.162	2.103	.038	.658	1.520
	CROIL	23.199	6.245	.401	3.715	.000	.333	3.003
	FII	.017	.002	.544	7.887	.000	.816	1.225
	CAB	-.089	.036	-.305	-2.504	.014	.262	3.813
	FOREX	-.005	.003	-.202	-1.857	.067	.327	3.061

a. Dependent Variable: CNXIT

Hypothesis Testing & Conclusion

The ratio of estimated variations to total variables is explained by R-Square. In other words, it explains the change in dependent variables as a result of change in independent variable. The value of R-Square (R^2) for all dependent sectoral indices CNX AUTO, CNX BANK, CNX ENERGY, CNX FMCG and CNX IT are .884, .878, .919, .920 and .807 respectively. It explains that 88.4%, 87.8%, 91.9%, 92.0% and 80.7% variation in CNX AUTO, CNX BANK, CNX ENERGY, CNX FMGC and CNX IT indices respectively are explained by independent variables used in our model thus, our first Null Hypothesis (H0) that there is no significant relationship between different macroeconomic variables and sectoral indices in India stands rejected thus, alternatively it can be concluded that different macroeconomic variables significantly affect abovementioned sectoral indices.

Further, as reflected by respective Coefficient tables, VIF values of all independent variables are below 5 it indicates that our model is free from the problem of multi co-linearity between independent variables.

In order to test the second Null Hypothesis (H0), significance values or p-values given in Coefficient tables have been analysed and compared with our assumed level of significance i.e. 0.05 or 5% at which we are testing our Hypothesis, taking each macroeconomic variable as a benchmark.

For Exchange Rate (USD):- The significance values of USD for CNX AUTO, CNX ENERGY, CNX FMCG and CNX IT is well below our assumed level of significance however significance value of USD for CNX BANK is 0.07 which is above 0.05 thus, alternatively it can be concluded that all sectoral indices except CNX BANK are dependent on Exchange rate.

For Crude Oil (CROIL):- Again, the significance values of Crude Oil for CNX AUTO, CNX ENERGY, CNX FMCG and CNX IT is below our assumed level of significance on the other hand significance values of CNX BANK is above 5% thus again it is found that all sectoral indices except CNX BANK are dependent on Crude oil price.

For Foreign Institutional Investment (FII): - As p-values of FII for all sectoral indices are 0.000 i.e. below 5% thus, our stated second Null Hypothesis is rejected and alternative Hypothesis that different sectoral indices are dependent on FII is accepted.

For Current Account Balance (CAB):- The p-values of CAB for all sectoral indices except for CNX ENERGY is below 5% thus it can be concluded that CNX AUTO, CNX BANK, CNX FMGC and CNX IT are affected by Current Account balance.

For Foreign Exchange Reserves (FOREX):- The p-values of Foreign Exchange Reserves are below 5% in case of CNX BANK and CNX ENERGY whereas it is above 5% in respect of CNX AUTO, CNX FMCG and CNX IT thus, it can be concluded that among all the sectoral indices used under the study only CNX BANK and CNX ENERGY are affected by Foreign Exchange Reserves.

Under the present study impact of different macroeconomic variables on different sectoral indices is studied and found that all macroeconomic variables have significant relationship with sectoral indices in India. It was also found that different macroeconomic variables selectively affect sectoral indices. However, amongst all macroeconomic variables we found Foreign Institutional Investment as the only most significant macroeconomic indicator affecting all sectoral indices in India.

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