

## Dynamic connection between macroeconomic variables and sectoral stock returns: Evidence from India

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**Abstract.** *The present study attempts to assess the impact of institutional investments, foreign direct investment, index of industrial production, interest rate, inflation rate, exchange rate, gold rates and oil prices on the sectoral indices of NSE using monthly data from 01/01/2009 to 30/12/2019. The study is covering four sectoral indices financial services, FMCG, IT and oil and gas which cover almost 78% of market capitalisation of NSE. An autoregressive distributed lag (ARDL) model is used to examine the short run and long run method co-integration between macroeconomic variables and stock market performance as the variables are integrated of different order. The outcomes of the study find that in the long run institutional investment and index of industrial production are the major determinants and in the short run, the major determinants are index of industrial production, wholesale price index and exchange rate. Government must focus on these areas to efficiently run the stock market.*

**Keywords:** co-integration, ARDL, financial services, FMCG, IT, oil and gas.

**JEL Classification:** C32, C53, C58, E44, G1.

## Introduction

Capital market plays an imperative role in the monetary intermediation of any economy of the world as it can lift the economic growth and prosperity by stabilising the financial sector and providing a vital investment channel that contributes in attracting domestic and foreign capital (Ahmad et al., 2015). Formerly a country was considered strong and capable if it demonstrated a sustained growth of Gross Domestic Product (GDP) and per capita income. But, of late it has been recognised that stock market exerts greater influence on national economy. Market capitalisation, savings, investment, performance of stock market, sound banking and insurance system are considered to be key indicators of economic growth (Tripathi and Seth, 2014).

Over the past few decades, the interaction of share returns and the macroeconomic variables has been a subject of interest among academics and practitioners (Gan et al., 2006; Zakaria and Shamsuddin, 2012). The theoretical motivation for this connection lies in dividend discount model (DDM), capital asset pricing model (CAPM) and arbitrage pricing theory (APT). These models provide the sound basis of associations between macroeconomic environment and stock prices (Ashwani and Sheera, 2018). Moreover, these models also helps in forecasting the changes in stock prices after the arrival of anticipated or unanticipated new information about expected future dividends, GDP, production, inflation, interest rates, and exchange rates etc.

For investors, ascertaining the macroeconomic variables volatility could help them to accurately forecast stock prices movements. If the volatility of macroeconomics variables can be used as reliable indicators for the stock market volatility, it can also help them in managing their investment portfolios. Meanwhile, from the macroeconomic point of view, it is crucial for policymakers to be able to recognize interactions between stock market volatility and macroeconomic volatility. If stock market volatility leads macroeconomic volatility, policymakers could use stock market volatility as a leading indicator to forecast future macroeconomic volatility. On the other hand, if stock market volatility does not lead macroeconomic volatility, it is not wise for a policy maker to focus on stock market volatility in order to reduce macroeconomic volatility. Therefore, it is worthwhile to determine whether macroeconomic volatility can explain stock market volatility, or vice versa (Zakaria and Shamsuddin, 2012).

Even though there are numerous studies available on the impact of macroeconomic fundamentals on stock market indices, but most of these studies usually focused on developed economies and also ignored the impact of these macroeconomic variables on sector specific stock market indices in developing Asian countries. The present study is going to consider the effect of major macroeconomic variables on the sectoral stock prices of Indian stock market. It is necessary for an investor to have a good knowledge on the relationship between the macroeconomic variables and sector specific stock market performance as it would enhance the ability of investors to make optimal decision in the diversification of their business investments.

### Literature review

A number of studies have shown the influence of macroeconomic variables on stock market performance and also on sectoral stock indices in different countries. In a study conducted by Wasserfallen (1989) revealed that changes in interest rates and price levels have negative impact on stock market returns.

Another study conducted by Maysami et al. (2004) on Singapore's stock market index (STI) and Singapore Exchange Sectoral indices clinched that stock market index and property index formed association interest rates, industrial production, price levels, money supply and exchange rate in long as well as in short run. Filis (2010) used Hodrick-Prescott (HP) and Baxter and King (BK) series filters to remove cyclical components of time series and found suggested Greek stock market is negatively influenced by oil prices and inflation whereas industrial production affects the stock market in a positive way and suggested Greece should pay more attention to oil price shocks as these shocks influence its stock market and also to inflation.

Another study on stock price movements in Cote d'Ivoire by Herve and Chanmalai (2011) confirmed the existence of strong bi-directional liaison between stock price index and domestic interest rate. The study also suggested that variations in the domestic interest rate might be used to predict the future stock price movement whereas other macroeconomic factors are not appropriate indicators to forecast the future behaviour of the stock index movements. Singh et al. (2011) also conducted a study on Taiwan stock market using stock portfolio consisting of market capitalisation, P/E ratio, Price to Book ratio, yield and five crucial macroeconomic variables employment rate, exchange rate, GDP, inflation rate and money supply and revealed that exchange rate and GDP had significant relationship with all the portfolios but inflation rate, exchange rate and money supply were having negative relationship with returns for portfolios of big and medium companies.

In a study conducted by Hosseini et al. (2011) on macroeconomic variables and stock market indices of India and China found that, in the long-run, increase in crude oil price and money supply has a positive impact in China but the effect is negative for India while in the short run, the effect of crude oil prices is positive in India but for China it is negative and insignificant. The effect of industrial production is negative in China and the impact of money supply and inflation is positive on Chinese market but for Indian market, the effect is negative. More so, Kibria et al. (2014) concluded that macroeconomic variables have significant positive impact on KSE 100 index of Pakistan.

Furthermore, Tripathi and Seth (2014) studied the casual relationship between macroeconomic variables and stock market indicators namely BSE India Sensex, BSE India market capitalization and BSE India market turnover and found significant correlation among the explanatory variable and also identified three principal factors through factor analysis viz Inflation, interest rate and exchange rate. The study finally concluded that it is not the real economic variables that precede stock market movements but stock market precedes the real economy more.

Wongbangpo and Sharma (2002) demonstrated the presence of long run and short run relationships between stock prices and macroeconomic variables. Tripathi et al. (2015) also found a long term relationship between FDI and six macroeconomic variables i.e. exchange rate, inflation, GDP/IIP, interest rate, trade openness and S&P CNX 500 equity index. Ahmad et al. (2015) found that foreign direct investment, consumer price index, interest rate and oil price have a significant positive influence on stock market development in the long-run while Money supply has a significant negative influence on the stock market development.

Adebayo (2016) in a study on Nigerian stock exchange negative effect of interest rate, inflation rate, lending rate and unemployment on market capitalization however there was positive but insignificant relationship between market capitalization and GDP. Mehrara et al. (2016) in a study Tehran's stock exchange found that inflation, exchange rate and GDP had significant impact on stock market volatility and also concluded that the effect of fiscal policies such as tax revenues and government expenditure is more than monetary policy factors on stock prices. Bahloul et al. (2017) examined the Islamic stock market return and volatility for twenty developed and emerging markets using Markov switching regression models and found that conventional stock returns and changes in money supply had significant impact on Islamic index returns in both low and high volatility regimes for developed and developing markets while the estimated coefficients of other variables were significant in low volatility regime.

Mohammad et al. (2017) examined the significance of macroeconomic variables in effecting the performance of selected SAARC using OLS multiple regression model and found that macroeconomic variables i.e. exchange rate, foreign currency reserve and interest rate are all statistically significant in affecting stock market performance of SAARC countries. But inflation rate and money supply do not have a significant relationship in affecting the stock market performance. Mwaanga and Njebele (2017) in a study on Zambia stock market found the existence of long-run integration and as a result of these co-integrating relationships, there are possibilities for investors to earn excess returns. But, if the markets are efficient, the investors would not be able to earn any abnormal returns because the security prices will adjust rapidly to the arrival of new information, then the current prices will reflect all information about the security.

Megaravalli and Sampagnaro (2018) examined the long-run and the short-run relationship between India, China and Japanese stock markets and key macroeconomic variables such as exchange rates and inflation by using pooled mean group estimates and showed that exchange rate had a positive and significant long-run effect on stock markets while the inflation had negative and insignificant long-run effect. In the short run, no statistically significant relationship exists between macroeconomic variables and stock markets returns. Ashwani and Sheera (2018) used ARDL model and MIDAS (Mixed Data Sampling) GARCH approach to examine the role of macroeconomic variables and concluded that all the variables had significant impact on stock market volatility. However, the level of exchange rate and inflation are negatively associated with the stock market volatility.

Natchimuthu and Chellaswamy (2018) investigated the dynamic relationship between foreign and domestic institutional investments with NIFTY returns in India and found that net FII investment in India is influencing the net DII investment but net DII investment was not influencing the net FII investment. NIFTY returns were influencing both DII and FII investment but both DII and FII were not causing NIFTY returns. So, the study finally concluded that NIFTY returns are the cause for FII and DII not the effect.

Amudha and Muthukamu (2018) examined the volatility and leverage effect among the Auto sectorial indices of NSE stocks. The study revealed that majority of the selected stocks experienced high volatility during the study period and leverage effect also exists in the Indian equity market where negative shock cause more volatility than the positive one of the same magnitude.

Sutrisno (2017) found that macroeconomic variables such as interest rate, inflation rate and exchange rate have significant impact on the sectorial indices in Indonesia. The interest rate had a significant but negative influence on all sectors except basic industry and chemical, finance, infrastructure, utilities, and transportation, and miscellaneous industry sectors. The inflation rate partially had no significant effect on the sectoral indices whereas exchange rate partially had a significant negative impact on all industries.

Jambotkar and Raju (2018) analyzed the impact of Macroeconomic variables on the selected NSE sectorial indices series and concluded that the relationship between banking sector and financial services sector is very high but it is moderate between other sectors. From the OLS method, it was revealed that exchange rate had a significant but negative impact on all the sectoral indices share prices. The value of R square was very less which means the other factors which bring changes in the sectorial share prices were not considered in the study.

Joshi and Giri (2015) examines the relationship of sectoral GDP by using manufacturing sector, electricity, gas and water supply sector and service sector with their sectoral stock indices by using various econometrics techniques and suggested sectoral indices are affected significantly by changes in sectoral GDP in the long run and in the short run all the indices are sensitive to the changes in crude oil price. The study also found long run causality running from manufacturing index and electricity, gas and water supply index but no such causality found from service sector index. The study also suggested crude oil price is a common variable which plays an important role in all the indices and reflect maximum information about all the indices.

Chandrashekar et al. (2018) explored the role of macroeconomic variables and stock market index of India and Brazil with the help of panel analysis and concluded that IIP and exchange rate have positive impact on the stock market whereas interest rate and inflation negatively affected the stock market index.

A study conducted by Menike (2006) on stock prices in Colombo stock exchange concluded that stock prices have negative relation with exchange rate, interest rate, money supply and direct relation with interest rate. Hunjra et al. (2014); Zakaria and Shamsuddin

(2012) examined the association between the stock market volatility and macroeconomic variables and found that there is no short run but a long run relationship exists between the stock prices and macroeconomic variables. In another study concluded by Ilahi et al. (2015) found exchange rate, inflation rate and interest rate have insignificant relation with stock market returns.

#### Data sources and estimation techniques

The present study has tried to appraise the impact of selected macroeconomic determinants on selected sectoral indices of NSE by using ARDL bound testing approach by using monthly time series data of 11 years from 01/01/2009 to 30/12/2019. The study is using four sectoral indices namely financial services, FMCG, IT and oil and gas which cover almost 78% of market capitalisation of NSE on March 2020. The macroeconomic determinants which are used in the study includes institutional investments (IINVs), foreign direct investment (FDI), index of industrial production (IIP), interest rate (INT), inflation rate (INF), exchange rate (EXR), gold rates (GOL) and oil prices (OIL).

All the variables are used in logarithmic form. Monthly returns of sectoral closing prices are computed using logarithmic price relatives:

$$R_t = \log\left(\frac{P_t}{P_{t-1}}\right),$$

where:

$R_t$  is the logarithmic monthly return at time  $t$ .

$P_{t-1}$  and  $P_t$  are monthly closing prices of the indices at two successive months.  $t-1$  and  $t$  respectively.

Data pertaining to all the indicators has been collected from secondary sources. The various sources used are official website of national stock exchange, official website of department for promotion of industry and internal trade, handbook of statistics on Indian economy, moneycontrol.com and indexmundi.com. Institutional investment includes net investment made by foreign institutional investors and domestic institutional investors. Index of industrial production is taken as a proxy of gross domestic product, which is a measure of economic growth. Interest rate represents 91 days Treasury bill rate. Wholesale price index is used as a measure of inflation. US dollar to Indian rupee is taken as exchange rate. Gold prices are taken as rupee per 10 grams rate. Crude oil price is Dated Brent Price (US Dollars per Barrel).

The study is using descriptive statistics tools like mean, median, standard deviation, Skewness, Kurtosis and Jarque-Bera values to get an initial impression from the data.

An essential feature of time series data is that they mostly contain a unit root. This means that the data is non-stationary. A series is said to be non-stationary if its mean, variance and auto co variances depend on the time factor and is said to be stationary if its mean, variance and auto-covariance remains the same over the entire series such that it satisfies

the mean reversion criterion. Therefore, present study applied Augmented Dickey-Fuller (1979) test to check the stationarity of comprised variables.

The dependent variable of time series model depends not only on the current value of the explanatory variable but also on its past or 'lagged' values. This kind of model which considers the effects of both current and past values of variables on the dependent variable are called distributed lag models. It is necessary to determine the appropriate lag length so as to avoid the problem of multicollinearity. For the selection of appropriate lag length, present study has used Akaike information criterion (Akaike, 1974). The guideline for this is to lower the AIC value, the better the model. So, the study uses 2 lag as directed by VAR lag length selection method.

In order to test the co-integration between the variables, Auto-Regressive Distributed Lag (ARDL) bounds testing approach is used. The Auto-Regressive Distributed Lag (ARDL) bounds testing approach was developed by (Pesaran et al., 2001). In this approach, all the variables are assumed to be endogenous and the long run and short run parameters of the model are estimated simultaneously. The Auto-Regressive Distributed Lag (ARDL) framework can be applied with the presence of a mixture of I(0) and I(1) regressors. But the procedure will crash in the presence of I(2) series. The implementation of the ARDL approach involves two stages. First, the presence of the long-run nexus (co-integration) among the variables under investigation is verified by computing the F-statistics. Secondly, if the co-integration between variables is recognised, then one can commence further analysis of long-run and short-run (error correction) association between the variables. The stability of ARDL model estimates is tested by applying cumulative sum (CUSUM) and cumulative sum of squares (CUSUMsq) tests. For further diagnoses, the study used Breusch-Godfrey serial correlation test, Breusch-Pagan-Godfrey heteroskedasticity test, Ramsey Reset test and Jarque Bera test for normality.

### Interpretation of results

This section deals with all the research techniques and tools that will be employed in this study. Before conducting co-integration test, the study firstly performs preliminary analysis using descriptive statistics, correlation analysis and ADF unit root test.

### Descriptive statistics

The preliminary analysis of the data using descriptive analysis is shown in Table 1. Mean returns are very low in case of oil and gas sector. Standard deviation is a measure of dispersion or spread in the series which reveals that variation is high in case of institutional investment. Skewness denotes the degree of departure of a distribution from symmetry (mean) and reveals the direction of scatterness of the items. Returns from IT sector and oil and gas sector, IINV, FDI and IIP are positively skewed whereas the values of returns of financial service sector, returns from FMCG, INT, WPI, EXR, GOL and OIL are negatively skewed. The kurtosis value reveals that IINV, INT and GOL are leptokurtic i.e. they are too much concentrated around the center whereas all the sectoral returns and other macroeconomic variables i.e. FDI, IIP, WPI, EXR and GOL are

platykurtic i.e. these items are less concentrated near the center. The outcomes of Jarque-Bera test indicates that except FMCG, IT and oil and gas sector returns all the variables are normally distributed.

**Table 1.** Descriptive statistics

	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability
R_FIN	0.013116	0.046938	-0.28222	2.202789	5.24778	0.07252*
R_FMCG	0.013849	0.033123	-0.12222	2.190422	3.933396	0.139918
R_IT	0.013822	0.093084	0.055289	2.270243	2.996254	0.223549
R_OIL	0.008688	0.041499	0.04226	2.40255	2.002497	0.36742
IINV	3134.446	4249.017	0.79745	3.138139	14.09533	0.000869*
FDI	9.582405	0.547546	0.012305	1.787448	8.089879	0.017511*
IIP	5.187336	0.104849	0.130041	2.082721	4.99974	0.082096*
INT	1.894582	0.260389	-1.16789	3.840037	33.88863	0*
WPI	5.129373	0.124968	-0.95255	2.605344	20.81847	0.00003*
EXR	4.0669	0.155367	-0.466	1.724351	13.72749	0.001045*
GOL	10.16543	0.22988	-1.25972	3.276258	35.33154	0*
OIL	4.306234	0.324582	-0.04701	1.623881	10.46399	0.005343*

The results of ADF unit root test are shown in Table 2. It is evident that all sectoral returns, IINV, FDI, INT and WPI are stationary at level, whereas the other variables like IIP, EXR, GOL and OIL are stationary at first difference. Hence, none of the variables is integrated of order second order.

**Table 2.** Augmented Dickey-Fuller unit root test

Variables	Null Hypothesis: Variable is non stationary			
	LEVEL		FIRST DIFFERENCE	
	Intercept	Trend and intercept	Intercept	Trend and intercept
R_FIN	-8.351270 (0.0000)*	-8.322202 (0.0000)*	-7.054288 (0.0000)*	-7.071252 (0.0000)*
R_FMCG	-10.36082 (0.0000)*	-10.67182 (0.0000)*	-8.442255 (0.0000)*	-8.415641 (0.0000)*
R_IT	-3.436367 (0.0115)*	-3.275334 (0.0754)*	-6.668912 (0.0000)*	-6.740749 (0.0000)*
R_OIL	-5.539706 (0.0000)*	-5.515613 (0.0000)*	-9.561179 (0.0000)*	-9.570542 (0.0000)*
IINV	-10.34014 (0.0000)*	-10.35173 (0.0000)*	-6.628549 (0.0000)*	-6.674696 (0.0000)*
FDI	-0.508425 (0.8847)	-9.265836 (0.0000)*	-7.832585 (0.0000)*	-7.839650 (0.0000)*
IIP	-0.541561 (0.8779)	-1.539470 (0.8104)	-3.540898 (0.0085)*	-3.525430 (0.0412)*
INT	-4.025363 (0.0018)*	-0.907182 (0.9513)	-2.879376 (0.0508)	-3.408642 (0.0551)*
WPI	-3.473291 (0.0103)*	-1.952860 (0.6208)	-3.481795 (0.0100)	-4.553972 (0.0019)*
EXR	-0.790992 (0.8181)	-2.439114 (0.3579)	-11.90322 (0.0000)*	-11.86544 (0.0000)*
GOL	-2.281545 (0.1795)	-1.745394 (0.7253)	-10.02115 (0.0000)*	-10.15362 (0.0000)*
OIL	-1.910185 (0.3268)	-2.748661 (0.2193)	-9.384476 (0.0000)*	-9.462419 (0.0000)*

When the variables are mixture of  $I(0)$  and  $I(1)$  and no variable is integrated of order 2, then the most appropriate statistical technique to test the co-integration between variables is ARDL approach. So, in order to test the co-integration between the variables, Auto-



Regressive Distributed Lag (ARDL) bound testing approach will be used. The results are depicted in the Table 3.

**Table 3.** Long-run bound test

F-Bounds Test		Null Hypothesis: No level relationship			
Test Statistic	Sector	Value	Significance level	I(0)	I(1)
Asymptotic n=1000					
F-statistic	r_FIN	15.27576	10%	1.95	3.06
	r_FMCG	14.55669	5%	2.22	3.39
	r_IT	15.14895	2.5%	2.48	3.7
	r_OIL	14.33449	1%	2.79	4.1
K = 8					
t-Bounds Test		Null Hypothesis: No level relationship			
Test Statistic	Sector	Value	Significance level	I(0)	I(1)
t-statistic	r_FIN	-11.36737	10%	-2.57	-4.4
	r_FMCG	-11.05325	5%	-2.86	-4.72
	r_IT	-11.47723	2.5%	-3.13	-5.02
	r_OIL	-10.33867	1%	-3.43	-5.37

The outcome of Table 3 reveals that the computed F-value of all sectoral indices is more than the upper bound critical value at 5% level of significance (Pesaran, Shin and Smith, 2001). Thus, the null hypothesis cannot be accepted, meaning that dependent variable has a long run relationship with the independent variables. Moreover, the absolute t value of all sectoral indices is also more than the upper bound critical value at 5% level of significance; it also specified the same result as depicted by F-value. So, there is long run association between variables which is depicted in the following Table 4.

**Table 4.** Long-run coefficients using ARDL bounds test

Variable	Coeff. (r_fin)	Coeff. (r_fmccg)	Coeff. (r_it)	Coeff. (r_oil)
IINV	3.88E-06***	1.78E-06***	-2.71E-07	2.18E-06***
FDI	-0.020271**	-0.002206	0.017680	-0.007187
IIP	-0.128968**	-0.081719	-0.038114	-0.184498***
INT	-0.041075*	-0.030074	-0.037019	-0.032301
WPI	0.222051	0.181194	-0.052819	0.182373
EXR	-0.013214	-0.109646	0.188942*	0.011168
GOL	-0.010363	-0.007216	-0.119651*	-0.006090
OIL	0.006014	0.001456	0.074136***	-0.005161

\*, \*\* and \*\*\* means significant at 10%, 5% level and 1% level respectively.

The outcomes of Table 4 show that institutional investment, index of industrial production, interest rates and inflation are the main determinants of stock market in the long run. Financial service sector returns are positively and significantly influences by IINV whereas negatively and significantly by FDI IIP and INT. FMCG sector returns are positively and significantly influenced by IINV. IT sector returns are positively and significantly influences by exchange rate and oil prices whereas it is negatively and significantly influenced by gold prices. Oil and gas sector returns are also positively and significantly influences by IINV whereas it is negatively and significantly influenced by IIP. WPI has no long run association with any of the sectoral stock returns.

The short run behaviour of the variables has been estimated by the error correction model. The results are depicted in following Table 5.

**Table 5.** Error correction representation – Dependent variable *D(NIFT)*

Variable	Coeff. (r_fin)	Coeff. (r_fmccg)	Coeff. (r_it)	Coeff. (r_oil)
C	0.004387	0.002423	-0.000441	0.003189
$\Delta(R\_SECTOR)_{t-1}$	0.116084	0.071542	-0.383328***	0.011890
$\Delta(FDI)_{t-1}$	-0.014027	-0.011026	0.010103	-0.016882*
$\Delta(IIP)_{t-1}$	-0.135456	-0.119644	-0.596445***	-0.169422*
$\Delta(IIP)_{t-2}$	-0.126865	-0.174233**	0.432756**	-0.183781**
$\Delta(INT)_{t-2}$	0.201335*	0.023101	-0.171780	0.076645
$\Delta(WPI)_{t-2}$	-1.063658*	-0.551855	0.849698	-1.365066***
$\Delta(EXR)_{t-1}$	-0.557572**	-0.270235*	-0.073563	-0.289505
$\Delta(EXR)_{t-2}$	0.749246***	0.511489***	0.264381	0.509015***
$\Delta(GOL)_{t-2}$	-0.157408	-0.201712*	0.349684	-0.168670
$\Delta(OIL)_{t-2}$	0.085215	0.119955**	0.006583	0.037270
$ECM_{t-1}$	-1.058868***	-1.035285***	-1.061505***	-0.911104***
R-squared	0.535770	0.564747	0.785088	0.573651
Adjusted R-squared	0.454849	0.488877	0.747626	0.499333
S.E. of regression	0.042680	0.032041	0.078394	0.037996
Durbin-Watson stat	1.925462	1.945843	1.961848	1.922490
F-statistic	6.620909	7.443621	20.95707	7.718901
Prob(F-statistic)	0.000000	0.000000	0.000000	0.000000

\*, \*\* and \*\*\* means significant at 10%, 5% level and 1% level respectively and  $\Delta$  means differenced variables.

Table 5 depicts the results of ECM by inspecting the short run relationship between Nifty sectoral returns and independent variables. Financial service returns are positively and significantly influenced interest rate and two month lagged exchange and negatively by one month lagged WPI and exchange rate. FMCG sector returns are positively and significantly influenced by two month lagged exchange rate and oil prices whereas negatively by two month lagged IIP, gold prices and one month lagged exchange rate. IT sector returns are positively and significantly influenced by two month lagged IIP whereas negatively by one month lagged IT returns and IIP. Oil and gas sector returns are positively and significantly influenced by two month lagged exchange rate and negatively by FDI, IIP, WPI and exchange rate.

Finally the speed of adjustment (ECT) exhibit a negative sign and is statistically significant at 1% level which indicates that there is convergence to long run equilibrium when there is any deviance from long run equilibrium in the short run which means any deviation in stock returns from the long run equilibrium level is corrected in the next month; inferring endogenous variable adjusts with a very high speed.

Coefficient of determination ( $R^2$ ) measures the proportion of variation in dependent variable that can be attributed to the independent variables. Its value ranges from 0 to 1. In the above model, the value of  $R^2$  is quite high which indicates that high amount of the variation in stock returns can be explained by independent variables, which is a good sign. The standard error of regression in all the sectors is quite low, which is desirable, it indicates that all the observed data points fall exactly on the regression line. The p-value of the F-test is significant at 1% level in all the cases which implies that model fit is good. The value of Durbin-Watson statistics is near to 2 in all the cases, implying there is no autocorrelation in residuals.

**Tests of stability**

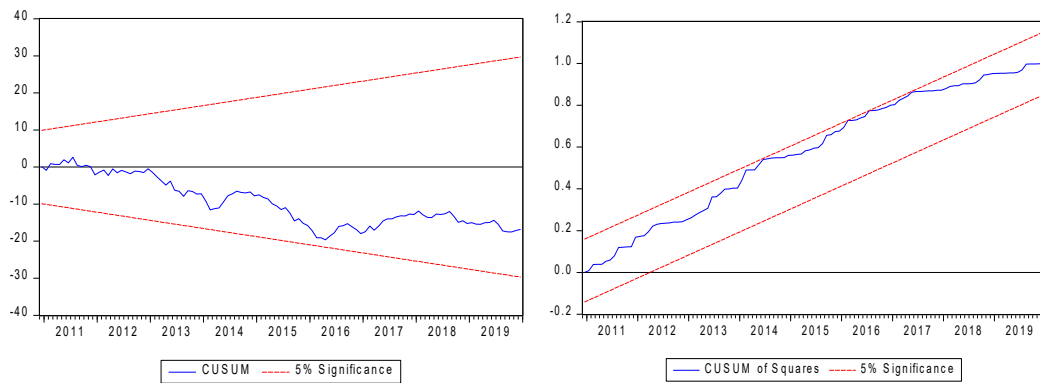
The robustness of the ARDL model is examined through the diagnostic tests and stability tests. Table 6 shows the result of Breusch-Godfrey Serial Correlation Langrage Multiplier test (BG test), Breusch-Pagan-Godfrey Heteroskedasticity Test, Jarque-Bera’s test and Ramsey RESET test.

**Table 6.** Other diagnostic tests after ARDL model

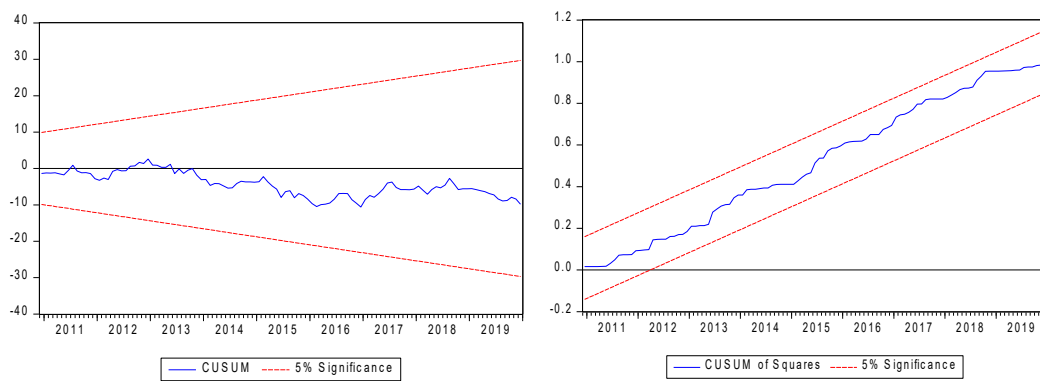
Test Statistics	R_fin	R_fmcg	R_it	R_oil	Interpretation
Breusch-Godfrey Serial Correlation LM test	0.4025	0.9193	0.4957	0.4015	No serial correlation
Breusch-Pagan-Godfrey Heteroskedasticity Test	0.1718	0.3890	0.0944	0.6364	No Heteroskedasticity
Jarque-Bera’s test	0.3106	0.2665	0.2373	0.6974	Normal distribution
Ramsey RESET test t-statistics (114)	0.0506	0.6811	0.2833	0.5356	Dependent and independent variables relationship is correctly specified.
F-statistics (1, 114)	0.0506	0.6811	0.2833	0.5356	

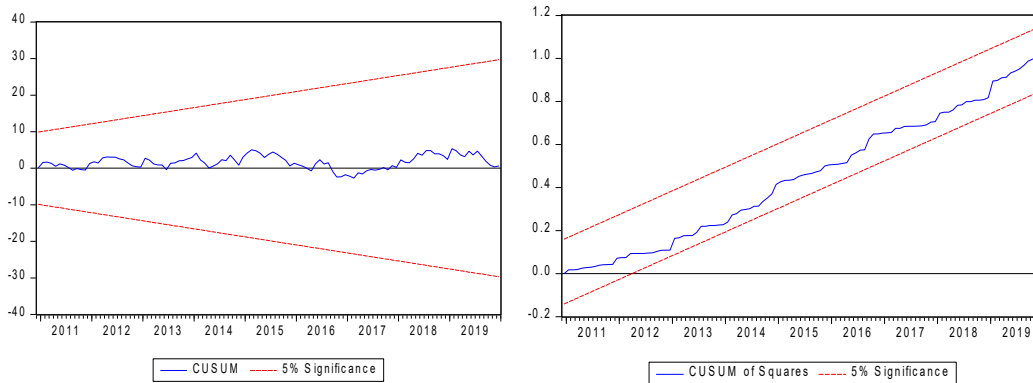
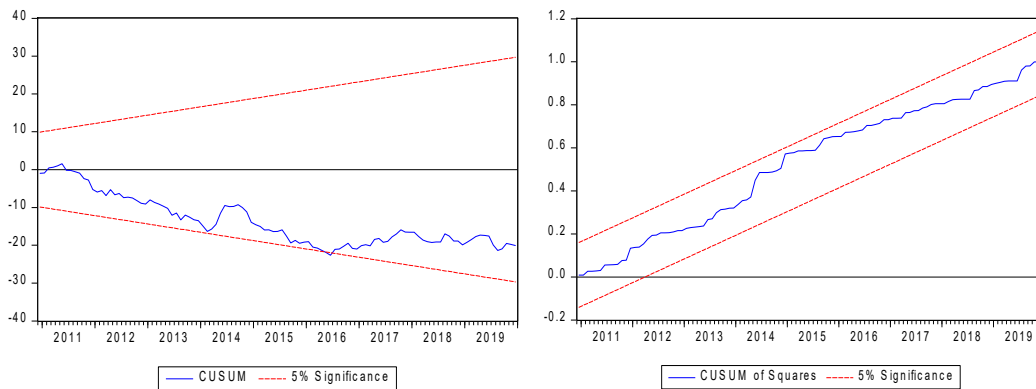
The outcomes of Table 6 suggest that there is no serial correlation, no heteroskedasticity and data is also normally distributed. The result of Ramsey’s RESET test also suggests that the relationship between dependent and independent variables is correctly specified.

**Figure 1.** Graphical representation of CUSUM and CUSUM of square test in case of financial services sector



**Figure 2.** Graphical representation of CUSUM and CUSUM of square test in case of FMCG sector



**Figure 3.** Graphical representation of CUSUM and CUSUM of square test in case of IT sector**Figure 4.** Graphical representation of CUSUM and CUSUM of square test in case of oil and gas sector

Thereafter, using CUSUM test, the long run stability in the parameters is confirmed. It is clear from the above figure of CUSUM and CUSUMQ test, that all the parameters together exhibit long run stability at 5% level of significance in all the cases. As the plots are between the critical boundaries of 5% level of significance, it implies that model is stable and well specified. It indicates that the long run and short run parameters have a significant impact on the sectoral stock returns in India.

## Conclusion

The results of ARDL model suggests that there exists a long run relationship between all sectoral indices and macroeconomic variables as indicated by bound test. It is found that institutional investment is having long run relationship with most of the sectoral indices such as financial services, FMCG sector and oil sector. Index of industrial production is also influencing financial services and oil sector. Foreign direct investment and interest rates are also affecting financial services in the long run. In case of IT sector, major

influential sectors are exchange rate, gold prices and oil prices. In the short run, financial service returns are influenced interest rate, exchange rate and by WPI. FMCG sector returns are positively and significantly influenced by exchange rate, oil prices, IIP, gold prices and exchange. IT sector returns are influenced by IIP.

Oil and gas sector returns are influenced by exchange rate, FDI, IIP and WPI. The diagnosis testing also reveals that there is no serial correlation, no heteroskedasticity and data is also normally distributed. Moreover, the relationship between dependent and independent variables is also correctly specified. Using CUSUM test, the long run stability in the parameters is confirmed which indicates that the long run and short run parameters have a significant impact on the sectoral stock returns in India.

So, in the long run, the major determinants are institutional investments and index of industrial production. Hence, government should design his policies in such a way to attract more institutional investment in stock market for the growth of respective sectors. In the short run, the major determinants are index of industrial production, wholesale price index and exchange rate.

So, government should focus more on industrial growth, inflation and exchange rate stability to efficiently run the stock market. Index of industrial production is the only sector which is influential in long as well as in short run so industry should be the key concern of the government and government should give more industrial benefits to industries in order to efficiently run the stock market.

#### Limitations for the study and scope for future research

Although the study provides better insights into various macroeconomic variables and their impact on various sectors but it definitely has some limitations.

Firstly, the study is based on monthly secondary data of only 11 years which is not appropriate for other periods.

Moreover, the results are based on the impact of eight macroeconomic variables; there can be some other key variables which can affect the stock market.

Furthermore, only four sectors are considered as dependent variables, other sectoral indices can also be used for further analysis.

So, longer time period, additional macroeconomic variables and more sectoral indices can be added to improve the model.

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