Impact of COVID-19 on Bombay Stock Exchange indices: Evidence from Indian Stock Market

Dr.RAMACHANDRA C G
* Assistant Professor
UGC-Human Resource Development Centre,
Bharathiar University, Coimbatore
Tamil Nadu
India,
richardpaulv@buc.edu.in

* Corresponding authors

Impact of COVID-19 on Bombay Stock Exchange indices: Evidence from Indian Stock Market

Abstract

This research investigates the impact of coronavirus (COVID-19) on the Bombay Stock Exchange (BSE) in India. Using the exponential autoregressive conditional heteroscedasticity (EGARCH) model, seven sectoral indices: energy, finance, healthcare, infrastructure, manufacturing, information technology, and oil and gas, were examined. The study period was from January 14, 2020, to August 9, 2020, consisting of 207 days in all. The time is classified as phase I (pre lockdown), Phase II (during lockdown), and Phase II (post lockdown); each phase consists of 69 days. We used daily closing prices of sectoral indices of the BSE study used secondary data collected from the daily closing prices of sectoral indices of the BSE stock collected through the official website (www.bseindia.com). The findings indicate a significant impact of the global pandemic on manufacturing and information technology sectors in phase I and all sectors except healthcare and information technology in phase II. In addition, the result showed a significant impact on finance, infrastructure, and informational technology sectors in phase III. The practical and theoretical implications are discussed.

Keywords: lockdown, stock indices; COVID-19, EGARCH (1,1)

Impact of COVID-19 on Bombay Stock Exchange indices: Evidence from Indian Stock Market

1. Introduction

One of the greatest 'black swan' events of the present century is the unprecedented coronavirus disease (COVID – 19) in December 2019 which turned into a global pandemic by March 2020. As a result of the pandemic, the entire world's social, economic, and business life has come to a standstill. Several countries imposed a 'lockdown' to prevent people from getting exposed to the virus. Social distancing and virtual communicating have become the order of the day. After a brief lull, leaders of all the nations diverted their resources to fight the invisible enemy.
This global pandemic has changed the economic, business, and social life of almost all people worldwide (Chiu et al., 2021; Gerwe, 2021; Queiroz et al., 2020). The crisis brought a paradigmatic change in the functioning of both manufacturing and service sectors: retail, banks, educational institutions, real estate, IT, recreation, media, and healthcare. Most importantly, the periodical lockdowns by governments and social distancing have changed how economic and business transactions occur (Brewer and Sebby, 2021).

The global pandemic has resulted in a significant decrease in economic activities worldwide and has adversely affected income generation and consumption. The COVID-19 has resulted in colossal losses to almost all the countries, where some countries suffered the most while some were affected mildly (Tobias et al., 2020). Among all the sectors, the most challenging hit sector was the 'financial sector' as the financial transactions have come to a standstill. The global pandemic has harmed people's physical and financial health in various

countries. In addition, the pandemic has adversely affected the financial markets (Goodell, 2020).

Countries worldwide started some resilience strategies to revert to normalcy from the colossal losses suffered during the last twenty months. The researchers began analyzing the impact of COVID-19 on stock markets, identifying the reasons for setbacks, and finding out the ways of the reconstruction as a way to recover (Zhang, and Hamori,2021). The global financial market has suffered a prolonged period of stagnation because of the worldwide pandemic, and this stigma has significantly slowed down many countries in the world (Garg, 2021; Yoo, 2020). While some countries imposed lockdowns for more extended periods (examples: China, Italy, Spain, and the UK); whereas, in some countries, the governments imposed lockdowns only for a short period (Camera and Gioffre,2021; Pachetti.2020).

In India, the government announced a mandatory lockdown on March 25, 2020, until May 2020. This lockdown adversely impacted the Indian (Singh, 2020). Because of lockdown, the manufacturing sector of non-essential items in India is shut, resulting in the downsizing of the workforce, thus drastically reducing the gross domestic product and personal disposable income of many individuals and families. All these signaled a deflationary gap as there is a vast gulf between aggregate demand and output, and the chances that the economy may be under the grip of the recession were high (Joshi, 2020). Against this backdrop, the present study explores the impact of COVID on the Bombay Stock exchange to assess the extent of the damage created by the pandemic.

2. Literature review

Since the pandemic was hit roughly two and half years back, the literature was not rich in content. However, many researchers worldwide examined the impact of COVID-19 in different

countries. For example, Baker et al. (2020) investigated the effects of COVID-19 on the US stock market. They found that the influence was unprecedented and is comparable with the previous infectious disease outbreak, the Spanish Flu, which occurred nearly a century ago. Some of the fundamental reasons that accounted for a decline in financial transactions were: government restrictions on commercial activity and international trade due to the stoppage of foreign commerce. These results were confirmed by some other researchers who studied the US stock market using the Russell 3000 index (Ramelli and Wagner, 2020).

On the other hand, investors perceived US companies favorably compared to China, probably because the pandemic was born in China sometime at the end of 2019. Similar studies conducted in the US context produced almost identical results. For example, in their research on the Chinese stock market (Hang Seng index and Shanghai Stock Exchange), between 10th January 2020 and 16th March 2020, Al-Awadhi et al. (2020) found that a total number of deaths during the period had a significant negative impact on stock market returns of all the companies. On the parallel side, the reported deaths in the US did not have a substantial effect on the Dow Jones and Standard and Poor (S&P) indices of the US stock market, as reported by were Onali (2020), who applied a GARCH (1,1) model to calculate the volatility. However, it was reported that the number of deaths in Italy and France hurt US stock market returns but positively affected the VIX returns.

In a recent study conducted on three global markets (US, Japan, and Germany), it was found that the impact of the global pandemic has superseded the global financial crisis that occurred during 2008 (Zhang and Hamori, 2021). However, these researches reported that oil and stock markets are gradually returning to normal, and the oil prices and stock prices remained

unstable as the pandemic continues. A similar pattern was observed by Yousaf et al. (2020), who examined the market's return to normality among Bitcoin, Ethereum, and Litecoin.

Some of the other notable studies included examining the impact of the global pandemic on the portfolio of investments, i.e., transfer of risk between the stock market and bond market (Chen et al., 2020). It was found that the pandemic had a significant negative impact on the stock market, whereas it had a positive effect on the bond market. In a recent study conducted in the context of the Indian stock market, it was documented that firms were employing resilience strategies to revert to normalcy (Chakraborty, 2021). The main argument is that stock markets do not reflect the actual position because most of the companies that were not publicly traded were excluded from stock market analysis. In India, several tiny firms play a significant role in influencing the investors' behavior that the study of financial markets cannot capture.

Against the backdrop of existing studies on the impact of the global pandemic, the present study explores the effect, particularly concerning the Bombay Stock Exchange (BSE).

The rest of the paper is organized as follows. In the next section, we outline the objectives of the study. Then, we formulate hypotheses in the following section. Section 3 deals with methodology, and section 4 provides results. Finally, section 5 discusses the effects, contributions of the present study, limitations, and suggestions for future research.

2. Objectives of the study and statement of Hypotheses

Objectives

The study's primary objective is to examine the impact of covid-19 on stock Bombay Stock Exchange (BSE) indices in India. The sub-objectives are:

1. To empirically examine the impact of the global pandemic from 14th January 2020 to 9th August 2020 in India, divided into three phases: pre, during, and post-COVID-19.

2. To explore the reasons for the impact of the pandemic on indices and offer suggestions.

3. To provide directions for future research concerning the month-of-the-year effect

To achieve the above objectives, we first need to examine whether the stock market indices are stationary during the lockdown period. Second, we need to explore the descriptive statistics for BSE indicators during these three phases. Third, we need to perform a statistical check to see whether the BSE sectoral devices follow a normal distribution.

2.2. Hypotheses

H_0 : BSE stock market indices are not impacted by pre, during, and post-COVID-19 period (Null Hypothesis)

H_1: BSE stock market indices are impacted by pre, during, and post-COVID-19 period. (Alternative Hypothesis)

3. Methodology

In this research, we started with identifying the problem, followed by outlining the study's objectives and hypotheses. Then, selection of sample and collection of data followed by the explaining appropriate econometric tools to test the hypotheses are provided. Finally, the methodology was explained in Flowchart 1, as shown below.

[insert Flowchart 1 about here]

Sample

The researchers in the stock market analysis consider BSE as the most important in the Indian context because the entire country echoes the reverberations from BSE. The stock exchange indices consist of information from various sectors: energy, finance, healthcare, infrastructure, manufacturing, information technology, and oil and gas. The study sample includes 987 observations from January 14, 2020, to August 9, 2020, with daily closing prices of seven sectoral indices data BSE. As mentioned before, we subdivided the period into three phases: (i) Phase I, pre-COVID-19 phase [Pre-lockdown period from January 14, 2020, to March 23, 2020,

69 days (43 working days)], (ii) Phase II, lockdown period [from March 24, 2020, to May 31, 2020, 69 days (42 working days)] and (iii) Phase III, post-COVID-19 period (69 days from June 1, 2020, to August 9, 2020, with 50 trading days). All phases equally divided 69 days include the lockdown period. We collected the data for 207 days.

Data Collection

We collected the data from the official websites of BSE (i.e., www.bseindia.com). The data collected for this study included daily closing prices of sectoral indices of the BSE.

Econometric Tools used in the study

For analyzing the data, we used the Eviews-7 software. The econometric tools used in this study are: Augmented Dickey-Fuller (ADF) test and Jarque-Bera (PP) tests to detect the unit root of the daily indices prices series; and GARCH model, and EGARCH model for estimating the volatility of returns in multiple financial markets.

As we recall the history, it was Engle (1982) who proposed the autoregressive conditional heteroscedasticity (ARCH) to better describe the stylized characteristics of financial time series, which include excessed kurtosis, heavy tail, volatility clustering, correlated sequence, and leverage effects. Later on it was Bollerslev (1986) who extended the ARCH model to generalized autoregressive conditional heteroscedasticity (GARCH) model to suit more general situations. Later on, Bollerslev et al., (1988) extended GARCH model to multivariate generalized autoregressive conditional heteroscedasticity (MGARCH) model to add more variables into the analysis structure, which help to estimate the volatility of returns in multiple financial markets. The Exponential GARCH (EGARCH) introduced by Nelson (1991) suggests that the negative relationship between volatility and stock prices can be understood by the fact that an increase in unexpected volatility will increase expected future volatility, assuming persistence. The

exponential generalized autoregressive conditional heteroskedastic (EGARCH) model by Nelson,(1991) is another form of the GARCH model. Formally, an EGARCH (p,q):

$$Lk(\sigma_t^2) = \omega + \beta \ln(\sigma_{t-1}^2) + \gamma \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha(\mathrm{L}u_{t-1}])$$

This model differs from the GARCH variance structure because of the log of the variance. The following specification also has been used in the financial literature (Dhamija and Bhalla, 2010). There are two steps of the parameter estimation of EGARCH model: first, we estimate the exponential GARCH model for each sectoral index to obtain the standardized residuals; and then the coefficients of the model are estimated with the standard residuals.

4. Results

The descriptive statistics: means, standard deviations, skewness, kurtosis, Jarque-Bera, ADF were presented in Table 1.

[insert Table 1 about here]

As shown in Table 1, in Phase- I, the information technology index displayed the largest mean (15324.38) whereas infrastructure index displayed the smallest mean (162.39). During the phase-II period the health care index displayed the largest mean (15223.97), and infrastructure index displayed the smallest mean (124.68). One of the primary reasons for this drastic change is the impact of COVID-19 on healthcare sector. Further, the infrastructure sector has come too lagged among the all indices. When the country was locked down, decrease in floating population resulted in partial paralysis of industrial sector that was heavily dependent on migrating labor force. During the Phase-III, the health care index displayed the largest mean (17099.3) whereas infrastructure index displayed the smallest mean (137.65). These results signify some progress due to partial opening up of the economy after lockdown.

Across all sectors, the value of negative skewness distribution is shown in the phase-I. The descriptive statistics displayed varying levels of positive skewness during Phase-II, with the only exception of energy and information technology indices. The descriptive statistics during the Phase-III, displayed the varying levels of positive skewness, with the only exception finance and manufacturing indices. Also, the Jarque-Bera test rejects the null hypothesis of normality at the1% level for all sector indices. Finally, the results of the ADF test show that no sectors contains a unit root, thus the following results are not distorted by the usage of non-stationary time series.

Table 2 captures the correlations, along with the significance levels of p-values for each pair of the variables, during the three phases during January 14, 2020 to August 9, 2020. The results reveal a high unconditional correlation for Phase I and low correlation for the phase-II and III.

[Insert Table 2 about here]

We used GARCH model in this study as most of the researchers in the literature follow. The ARCH, which is the most frequently used volatility models by the researchers in the field of finance, consists of equations: (i) conditional mean, and (ii) conditional variance of the error term (of conditional mean).

The conditional variance equation is:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2$$

where σ^2= conditional variance of the error term

ε_{t-1}^2 = lagged error square term

The Generalized Auto Regressive Conditionally Heteroskedastic (GARCH) is used (called GARCH (1,1) is employed where the conditional variance is expressed in the following equation:

$$\sigma_t^2 = \omega_0 + \omega_1 \sigma_{t-1}^2 + \alpha_{t-1}^2$$

It can be observed that the lagged value of the error term and its own lagged value determine the conditional variance of the error term. A higher order GARCH (p,q) which includes 'p' terms of squared own lags, and 'q' terms of squared error terms, is rarely used in the finance literature (Brooks, 2019).

The EGARCH model is the exponential version of the GARCH model and was first suggested by Nelson (1991). There are various ways to express this exponential conditional variance; one possible way is given by Brooks (2008):

$$Lk(\sigma_t^2) = \omega + \beta \ln(\sigma_{t-1}^2) + \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha \left[\frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}}\right] + u$$

The results of EGARCH Model in impact of Covid-19 on BSE sectoral indices for effect were presented in Table-3.

[Insert Table 3 about here]

To analyze the return and volatility spillovers among energy, finance, healthcare, infrastructure, manufacturing, information technology, and oil& gas sector use EGARCH model. Regarding the mean equation, the results show that all the coefficients are significant at 1%, 5% and 10% level. We can therefore employ a multivariate EGARCH model in our analysis. As shown in Table 3, during the pre COVID-19, there are significant autocorrelation and ARCH effects for the returns of all indices except infrastructure and manufacturing sector indices. During the

covid-19 period, healthcare and manufacturing sector indices are significant. In contrast, ARCH effects for the entire sector has significant except manufacturing and information technology for the post covid-19 period. During the COVID-19 period, volatility transmission is positive and significant healthcare and manufacturing sector indices. The investor disinclined to all sector apart from health care sector. The highly negatively affected sectors are energy, finance, infrastructure, information technology and oil and gas sectors indices. These sectors witnessed the highest negative impact of COVID-19 with an evident of EGARCH model.

The daily closing prices of these seven indices during these three phases were presented in the Figures 1-21.

[insert Figures 1 to Figures 21 about here]

5. Discussion

The global pandemic - COVID-19 has adversely affected the financial sectors worldwide. Against this backdrop, the present study aimed to explore the effect of COVID-19, particularly in the Indian stock market (BSE). The study revealed interesting findings.

First, the findings reveal that the ADF and JB test confirms the unit root of the return series of BSE indices in seven sectors. These results are consistent with the previous findings from the literature (Chen et al., 2021). Second, the results support that the skewness test confirms the lack of status of the series of indices. Moreover, the graphical analysis and correlation of the study also demonstrate the lack of quality of the return series of indices. Third, the most important finding from this study is that the maximum average or mean occurred in the health care sector index during phase-II, whereas the lowest average or mean occurred in the infrastructure sector indices during phase-II. These results indicate that the mean for all the indices showed some impact during phase-II among the trading phase-II. Finally, the standard

deviation was highest for health sector indices suggesting that the most volatility occurred during phase II (the lockdown period). These results are expected and consistent with what we can perceive during the lockdown period in the healthcare sector.

The fifth significant finding from this study is the insignificant coefficient value of the Jarque-Bera test statistic for all the months of the year except phase-I. The results showed that the average returns during phase-II followed a normal distribution. Furthermore, the regression coefficients for phase-II were positive and significant for all indices. It is exciting to note that the regression coefficient was positive and significant for some indices even during phase II, which is the crucial lockdown phase. Overall, the results provide compelling evidence of the impact of the COVID-19 on the healthcare sector during phase II.

Theoretical and practical implications

The objective of the present study is to empirically examine the evidence of impact in the Indian Bombay stock market indices during the lockdown period. We tested the descriptive statistics testing the stationarity, kurtosis, and volatility clustering- and found that the returns showed high volatility during the lockdown period. These findings contradict the results from one study by Chakraborty (2021), who reported that COVID-19 did not impact the stock market. However, some other researchers said a negative correlation between the confirmed cases of death due to COVID-19 and stock market returns (Al-Awadhi et al., 2020; Goodell, 2020).

From practitioners' standpoint, the investors were advised to avoid investing during the pandemic period (Garg et al., 2021) as increasing the number of affected cases has shown a downward shift in the financial transactions in the stock market (Yousaf and Ali, 2020). In sum, the impact of the global pandemic was more severe than that was experienced during the Spanish flu that has affected the planet precisely a century ago. Furthermore, the adverse effects could

also be compared to the scenario of 1957-58 and 1968, where the stock market showed significant volatility (Baker et al., 2020). In addition, the lockdown affects the economy and social welfare following the contagion process (Camera and Gioffre, 2021). Finally, the positive impact of COVID-19 in the bond market and negative impact on the stock market signifies that the investors' preferences shifted to fixed earning securities rather than volatility-driven stocks during the global pandemic (Chen et al., 2021).

Contributions and future research

The results from the present study contribute to the vast literature on finance, particularly concerning the stock market. Though several studies were conducted by various scholars (see Table for other studies), Despite several studies conducted about the impact of the lockdown period by multiple scholars, the present study was conducted to analyze the stock market spillover during the pandemic. The results from the study have several contributions to both the literature on finance and investors. First, the study highlights the importance of studying the sectoral indices effect during the indefensible period that has changed economic and political power, which may profoundly influence the stock market. Though we did not examine the impact of change in political power, we wanted to see any effect during this crucial period.

The present study provides several avenues for future research. First, future researchers may study the impact of the global pandemic on India's entire stock market, including BSE. Future researchers also see the effects of insider information about the lockdown announcements on stock market indices. Second, future researchers can compare the impact of a global pandemic in international markets and the comparable markets in developing countries. Though in developed countries, the effect of the global pandemic was as severe as in developing countries because of the inherent cushion against these crises the developed countries have. Third, future

researchers also can study whether the March effect in 2020 was present in the year 2020. . Fourth, future research can explore the differences between developed and developing countries concerning the stock market volatility due to the global pandemic. As the financial sector experienced a deep dip during March 2020, the differences in the drop in different countries can be examined.

Conclusion

We made a modest attempt to examine the impact of the global pandemic on seven indices listed in BSE and explained the stock market volatility. As the pandemic is slowly receding, with the vaccine being administered worldwide, the impact of the pandemic on the stock market is expected to vanish gradually. Despite this, the researchers may concur that the research in financial markets can be bifurcated into two phases: pre-COVID and post-COVID because this pandemic was the primary hallmark of the present century. Therefore, studying the impact of the global pandemic on the stock market and investors' behavior continues to be on the agenda of scholars in the field of finance.

References

Al-Awadhi, A.M., Khaled, A., Al-Awadhi, A., and Alhammadi. S. (2020) Death and contagious infectious diseases: Impact of the COVID-19 virus on stock market returns. *Journal of Behavioral and Experimental Finance*, 27, 1-5.

Baker, S.R., Bloom. N., Davis. S,J., Kost, K., Sammon, M., and Viratyosin, T. (2020) The unprecedented stock market reaction to COVID-19. *Becker Friedman Institute*. 1-22.

Bollerslev, T., Engle. R,F, and Wooldridge, J.M. (1988) A capital asset pricing model with time varying covariances. *Journal of Political Economy*. 96(1), 116-131.

Bollerslev, T. (1986) Generalized autoregressive conditional heteroscedasticity. *Journal of Economics*. 31(3), 307-327.

Brewer, P., and Sebby, A.G. (2021) The effect of online restaurant menus on consumers' purchase intentions during the COVID-19 pandemic. *International Journal of Hospitality Management*, 94, 1-9.

Camera, G., and Gioffre, A. (2021) The Economic Impact of Lockdowns: a Theoretical Assessment. *Journal of Mathematical Economics*. 97(1),1-15.

Chakraborty, I. (2021) The Impact of COVID-19 on the Stock Market and Corporate Firms, *Economic Political Weekly.* 56, (47), 50-57.

Chatterjee, S., and Hubble, A. (2016). Day-Of-The-Week Effect In Us Biotechnology Stocks: An Application of the GARCH process.1-19.

Chen, X., Wang, Z., Li, X., Liu, Z., and Li, K. (2021) The Impact of Covid-19 on the Securities Market: Evidence from Chinese Stock and Bond Markets. *Procedia Computer Science* 187, 294-299.

Chiu, W., Oh, G-E., and Cho, H. (2021) Impact of COVID-19 on consumers' impulse buying behavior of fitness products: A moderated mediation model. *Journal of Consumer Behavior*, 1–14.

Dhamija, A.K., and Bhalla, V. K. (2010) Financial Time Series Forecasting: Comparison of Neural Networks and ARCH models, International Research. *Journal of Finance and Management.* 49, 194-212.

Engle, R. F., (1982) Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation. *Econometrica*. 50(4), 987-1008.

Garg, K. D., Gupta, M., and Kumar, M. (2021) The Impact of COVID-19 Epidemic on Indian Economy Unleashed By Machine Learning. *IOP Conference Series: Materials Science and Engineering*. 1022, 1-11.

Gerwe, O. (2021) The Covid-19 pandemic and the accommodation sharing sector: Effects and prospects for recovery, *Technological Forecasting & Social Change*. 167, 1-8.

Goodell, J.W. (2020) COVID-19 and finance: Agendas for future research. *Finance Research Letters.* 35, 1-5.

Joshi, A., Bhaskar, P., and Gupta, P.M. (2020) Indian Economy Amid COVID-19 Lockdown: A Perspective. *Journal of Pure and Applied Microbiology.* 14(1), 957-961, www.microbiologyjournal.org

Nelson, D. (1991) Conditional Heteroscedasticity in Asset Returns: a new approach. *Econometrica – The Econometric Society*. 59(2), 347–370.

Onali, E. (2020). COVID-19 and Stock Market Volatility. 1-24. SSRN: https://ssrn.com/abstract=3571453 or http://dx.doi.org/10.2139/ssrn.3571453

Pachetti, M., Marini, B., Giudici, F., Benedetti, F., Angeletti, S., Ciccozzi, M., Masciovecchio, C., Ippodrino, R., and Zella, D. (2020). Impact of lockdown on Covid-19 case fatality rate and viral mutations spread in 7 countries in Europe and North America. *Journal of Translational Medicine.* 18, 1-7.

Queiroz, M.M., Ivanov, D., Dolgui, A., and Fosso Wamba, S. (2020) Impacts of epidemic outbreaks on supply chains: mapping a research agenda amid the COVID-19 pandemic through a structured literature review. *Annals of Operations Research*. 1-38.

Ramelli, S., and Wagner. A.F. (2020) Feverish Stock Price Reactions to COVID-19. *Oxford University Press on behalf of The Society for Financial Studies*, 1-49.

Singh, S.K., Patel, V., Chaudhary, A., and Mishra. N. (2020) Reverse Migration of Labourers amidst COVID-19, *Economic and Political Weekly*. 4(32, 33).25-29.

Tobias, A., Carnerero, C., Reche, C., Messague, J., Via, M., Minguillon, M.C., Alastuey, A., and Querol, X. (2020) Changes in air quality during the lockdown in Barcelona (Spain) one month into the SARS-CoV-2 epidemic: *Science Total Environment.* 726, 1-4.

Yoo, J.H. (2020) The fight against the 2019-Covid-19 outbreak: an arduous march has just begun. *Journal of Korean Medical Science.* 35(4), 1-3.

Yousaf, I., and Ali, S. (2020) The COVID-19 outbreak and high frequency information transmission between major crypto currencies: Evidence from the VAR-DCC-GARCH approach, *Borsa Istanbul Review.* 20, S1-S10.

Zhang,W., and Hamori, S. (2021) Crude oil market and stock markets during the COVID-19 pandemic: Evidence from the US, Japan, and Germany. *International Review of Financial Analysis.* 74, 1-13.

Table 1
Descriptive Statistics

Phase-I: Pre-lockdown period from January 14, 2020 to March 23. 2020 69 days (43 working days)							
	Sectoral Indices						
	Energy	Finance	Health Care	Infrastructure	Manufacturing	Information Technology	Oil and Gas
mean	4588.53	6434.81	13686.57	162.39	421.94	15324.38	13165.72
SD	607.90	788.56	858.99	22.90	43.16	1519.70	1654.18
Minimum	3030.50	3860.32	11007.36	105.80	296.09	11202.70	8944.96
Maximum	5286.34	7046.57	14535.10	185.75	459.32	16469.98	14776.05
Skewness	-1.21	-1.82	-1.76	-1.11	-1.42	-1.73	-1.18
Kurtosis	0.31	2.43	2.21	0.05	1.04	1.65	0.19
Observation	43	43	43	43	43	43	43
Jarque-Bera	10.69	34.39	30.92	8.81	16.42	26.37	9.97
p-value	0.00	0.00	0.00	0.01	0.00	0.00	0.01
ADF	2.385	2.201	1.999	1.907	1.739	1.477	1.272
observation	49	49	49	49	49	49	49
Phase-II, During lockdown period from March 24, 2020 to May 31.2020 69 days (42 working days)							
mean	4441.1	4390.55	15223.97	124.68	370.94	13470.04	11312.59
SD	380.346	204.364	1119.878	4.549	16.988	602.088	614.422
Minimum	3384.620	3956.510	11628.780	111.890	318.070	11780.880	9217.020
Maximum	4776.400	4892.570	15656.670	129.750	390.860	14235.040	12066.360
Skewness	-0.855	0.085	-1.924	-0.911	-1.365	-0.275	-1.496
Kurtosis	-0.430	0.293	2.455	0.517	1.626	-0.573	2.387
Observation	42	42	42	42	42	42	42
Jarque-Bera	5.443	0.200	36.455	6.283	17.673	1.104	25.638
p-value	0.066	0.905	0.000	0.043	0.000	0.576	0.000
ADF	0.551	0.932	0.457	1.221	0.487	-0.070	0.643
Observation	42	42	42	42	42	42	42
Phase-III, Post lockdown period from June 1, 2020 to August 9, 2020 69 days (50 working days)							
mean	5845.93	5108.868	17099.3	137.6597	432.9117	16821.35	13134.11
SD	426.696	164.416	795.599	3.015	15.713	1428.890	375.293
Minimum	5009.330	4598.530	16135.230	133.440	397.650	14346.500	12441.500
Maximum	6406.340	5320.690	18821.240	144.570	450.430	18373.810	13758.530
Skewness	0.201	-0.674	1.332	0.353	-0.109	0.127	0.437
Kurtosis	-1.220	0.719	0.702	-0.965	-1.039	-1.593	-0.634
Observation	50	50	50	50	50	50	50
Jarque-Bera	3.439	4.862	15.802	2.978	2.348	5.421	2.427
p-value	0.179	0.088	0.000	0.226	0.309	0.066	0.297
ADF	0.298	0.185	-0.418	0.011	0.021	-0.004	-0.518
Observation	50	50	50	50	50	50	50

Table 2
Correlation matrix

Phase-I							
	1	2	3	4	5	6	7
1.Energy	1						
2.Finance	.967**	1					
3.Health Care	.908**	.956**	1				
4.Infrastructure	.988**	.957**	.889**	1			
5.Manufacturing	.988**	.981**	.932**	.989**	1		
6.Information Technology	.954**	.979**	.972**	.940**	.966**	1	
7.Oil & Gas	.993**	.964**	.905**	.997**	.994**	.948**	1
Phase-II							
1.Energy	1						
2.Finance	-.078	1					
3.Health Care	.924**	-.097	1				
4.Infrastructure	.750**	.382**	.806**	1			
5.Manufacturing	.808**	.234	.910**	.910**	1		
6.Information Technology	.891**	-.007	.776**	.712**	.717**	1	
7.Oil & Gas	.910**	.159	.932**	.893**	.944**	.783**	1
Phase-III							
1.Energy	1						
2.Finance	.733**	1					
3.Health Care	.811**	.380**	1				
4.Infrastructure	-.159	.367**	-.307*	1			
5.Manufacturing	.972**	.752**	.824**	-.112	1		
6.Information Technology	.929**	.603**	.849**	-.360*	.943**	1	
7.Oil & Gas	.872**	.787**	.572**	.154	.892**	.758**	1

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

Table 3 Coefficients of the EGARCH parameters

Phase-I	Energy	Finance	Health Care	Infrastructure	Manufacturing	IT	Oil & Gas
AR(1)	0.2726	0.1989	0.2149	1.3618***	0.5915***	0.3312	-0.0305
p	0.1283	0.8975	0.3462	0	0.0003	0.2072	0.8413
AR(2)	0.2692	0.1910	0.2631	0.1523	-0.0941	0.4443	0.9286***
p	0.1489	0.9176	0.2122	0.6124	0.5246	0.2527	0
AR(3)	0.3224	0.1901	0.4118***	-0.5345	0.1455	0.1785	0.4538***
p	0.196	0.9182	0.0466	0.2717	0.3534	0.4926	0.0011
AR(4)	0.1149	0.5686	0.1044	0.0195	0.3390***	0.0379	-0.3577***
p	0.486	0.6423	0.5828	0.936	0.0191	0.9098	0.0644
Ma(1)	0.4309***	0.5517	0.8575***	-0.2239	0.4688	0.4284	0.9767***
p	0	0.7361	0	0.2616	0	0.1175	0
Ma(2)	0.9216***	0.1989	0.8495***	-0.6718***	0.9043***	-0.3606***	0.9464***
p	0	0.8975	0	0.0039	0	0.0542	0
Variation equation parameters- EGARCH (1,1)							
ω	17.6342***	17.3753***	1.4538	0.5227	4.6196***	15.6202***	21.4622***
p	0	0	0.1926	0.2528	0.0362	0	0
α	-0.3467	-1.7525	-0.4964	-0.4866	1.0089***	-1.9091***	0.4896
p	0.2516	0.6271	0.3587	0.3971	0.0262	0.0002	0.4761
ϒ	0.05161	-0.7138	-0.4118	-0.5542	0.4232***	-1.1098***	-0.5526***
p	0.761	0.8358	0.1254	0.2165	0.0685	0.0061	0.0734
β	-0.8685***	-0.1293***	0.9044***	0.9393***	-0.2903	-0.2052	-0.9805***
p	0	0	0	0	0.5435	0.5078	0
Phase-II							
AR(1)	0.4608***	0.2455***	1.4396***	0.3182***	0.6783	-0.1760	0.2663***
p	0	0.0038	0	0	0.176	0.7882	0.0001
AR(2)	0.5269***	0.0984	-0.9010***	0.1784***	0.3706	0.4668***	0.0790***
p	0	0.2008	0.0019	0	0.2347	0.0119	0.08
AR(3)	0.1065***	0.7216***	0.6341***	0.2359***	0.099	0.5046	0.7928***
p	0	0	0	0	0.8178	0.2014	0
AR(4)	-0.0834***	-0.0737	-0.1652***	0.2612***	-0.1435	0.2134	-0.1258***
p	0	0.4387	0.0638	0	0.1362	0.6001	0.0344
Ma(1)	0.3787***	0.8476***	0.1893***	0.5458***	0.3431	0.7845	0.7491***
p	0	0	0.0366	0	0.4954	0.216	0
Ma(2)	-0.2009***	0.6011***	0.8916***	0.4469***	-0.1215	-0.0244	0.9365***
p	0	0	0	0	0.8045	0.9597	0
Variation equation parameters- EGARCH (1,1)							
ω	11.9524***	13.7374***	7.4437***	2.8006***	1.4317***	17.1621	9.8354***
p	0	0	0	0	0	0.2887	0.0001
α	-2.7729***	-1.8312***	0.2681	-2.6627***	-0.7194***	0.1693	-1.7719***
p	0	0.0284	0.6942	0	0	0.7882	0.0033
ϒ	0.3931	1.2874***	0.1048	1.5395***	0.3023	0.0912	0.7102***
p	0.1071	0.0025	0.8422	0	0.1069	0.8571	0.0713
β	-0.0628	-0.2836	0.3160***	0.1835	0.7580***	-0.5160	0.1831
p	0.811	0.2498	0.0116	0.3613	0	0.7112	0.407
Phase-III							
AR(1)	0.8670***	0.8342***	0.2288***	0.3283	0.6811	0.3178	0.3103
p	0.0003	0.0028	0.0014	0.9188	0.4513	0.7255	0.7247
AR(2)	0.2681	-0.0006	0.1408***	0.7874	-0.0717	0.6616***	0.2486
p	0.2554	0.9988	0.0413	0.5693	0.9478	0.0008	0.8053
AR(3)	-0.1992	0.1392	0.8432***	-0.1186	0.2697	0.0160	0.3853
p	0.469	0.6544	0	0.9627	0.5881	0.9817	0.4245
AR(4)	0.0700	0.0300	-0.2045***	0.0014	0.1256	0.0100	0.0559
p	0.769	0.87	0.0054	0.9984	0.4844	0.9787	0.7066
Ma(1)	0.1379	0.0641	1.1878***	1.0073	0.3559	0.5176	0.7308
p	0.4998	0.8169	0	0.7554	0.6886	0.5479	0.4008
Ma(2)	-0.7891***	0.4871	0.9645***	0.0898	0.4419	-0.3232	0.4461
p	0	0.1019	0	0.976	0.3466	0.681	0.2941
Variation equation parameters- EGARCH (1,1)							
ω	0.4884	4.5834***	1.3789	1.0399***	2.9203	5.9915	20.1906***
p	0.7311	0.0172	0.5973	0.0574	0.1844	0.1608	0
α	-0.3063	-0.9627***	0.3119	-1.0967***	0.0631	1.3984***	-0.3179
p	0.5196	0.0145	0.5459	0.0841	0.9066	0.0203	0.4533
ϒ	0.1530	-0.0721	0.5737	0.1977	0.3759	-0.2861	0.3300

	0.5343	0.7951	0.1447	0.5013	0.3228	0.4195	0.2311
β	0.9742***	0.5640***	0.8308***	0.7051***	-0.1030	0.3438	-0.9263***
	0	0.0028	0.0019	0	0.9017	0.3692	0

Note: *, **, *** Statistically significant at the 10%, 5% and 1% significant level.

ISSN NO: 2249-3034

Table A
A summary of the impact of covid-19 in the Indian context

Year	Study	Sample	Result
1982	Engle	Estimate the means and variance of inflation in the U.K. Time limit not mentioned.	The ARCH effect is found to be significance and the estimated variances increase substantially during the chaotic seventies.
2020	Al-Awadhi et al	Hang Seng Index and Shanghai Stock Exchange Composite Index over the period from January 10 to March 16, 2020.	market returns start to increase as the growth of both daily active cases and confirmed deaths starts to decline
2020	Joshi et al	Not applicable	Not applicable
2020	Goodell	impacts of COVID-19 on financial markets and institutions, A theoretical assessment	impacts of other past events that in some ways roughly parallel COVID-19, points toward avenues of future investigation
2020	Yousaf. and Ali	The pre COVID-19 period (January 1 to December 31, 2019) and the COVID-19 period (January 1 to April 22, 2020). The data of cryptocurrency prices are taken from Bittrex, and the prices are listed in US dollars.	Based on optimal weights, investors are advised to decrease their investments during the COVID-19 period
2020	Garg et al	The Sensex rate for five months (March 01, 2020, to July 31, 2020) has been obtained from the stock exchange website	The increasing number of COVID-19 cases directly impacted the stock market.
2020	Onli	US stock market, data from April 8, 2019 to April 9, 2020	the negative impact of the VIX on stock market returns increased threefold
2020	Pachetti et al	From January 2020 to April 2020 in Italy, Spain, Germany, France, Sweden, UK and USA. SARS-CoV-	Strict lockdown strategies together with a wide diagnostic PCR testing of the population were

		2 reference genome was obtained from the GenBank database (NC_045512.2)	correlated with a relevant decline of the case fatality rate in different Countries
2020	Ramelli and Wagner	daily stock prices for common shares from December 31, 2018 through April 3, 2020, from the Compustat Capital IQ North America Daily database (	The results illustrate how anticipated real effects from the health crisis, a rare disaster, were amplified through financial channels.
2020	Baker et al	daily stock market moves back to 1900 and with respect to overall stock market volatility back to 1985	much more forcefully to COVID-19 than to previous pandemics in 1918-19, 1957-58 and 1968
2020	Singh	A theoretical assessment	Ensure social security schemes to protect them under any socio-economic or health emergency.
2020	Tobias et al	Daily averages (24 h) have been calculated for the periods before (February 16th to March 13th) and during the lockdown (March 14th to March 30th)	Total lockdown resulted that the PM10 levels were much less reduced than BC and NO2 and the pollution directly related to the lockdown.
2021	Camera and Gioffre	A theoretical assessment	How lockdowns impact the contagion process and social welfare
2021	Chen et al	The observation period is from January 1, 2019, to April 30, 2020.	study confirms that the COVID-19 had a significant negative impact on the stock market and a significant positive impact on the bond market
2021	Chakarborty	between 31 December 2019 and 31 March 2020, the Nifty 50, India	we reiterate that the stock market does not represent the real economy
2021	Wenting and Shigeyuki	the data set from 4 January, 2006 to compare the impact of the 2008 global financial crisis with that of the 2020 COVID-19 on the US stock index, the Japanese stock market, and the German stock market.	financial markets is uncertain in both the short and long terms

ISSN NO: 2249-3034

Flowchart -1
Methodology

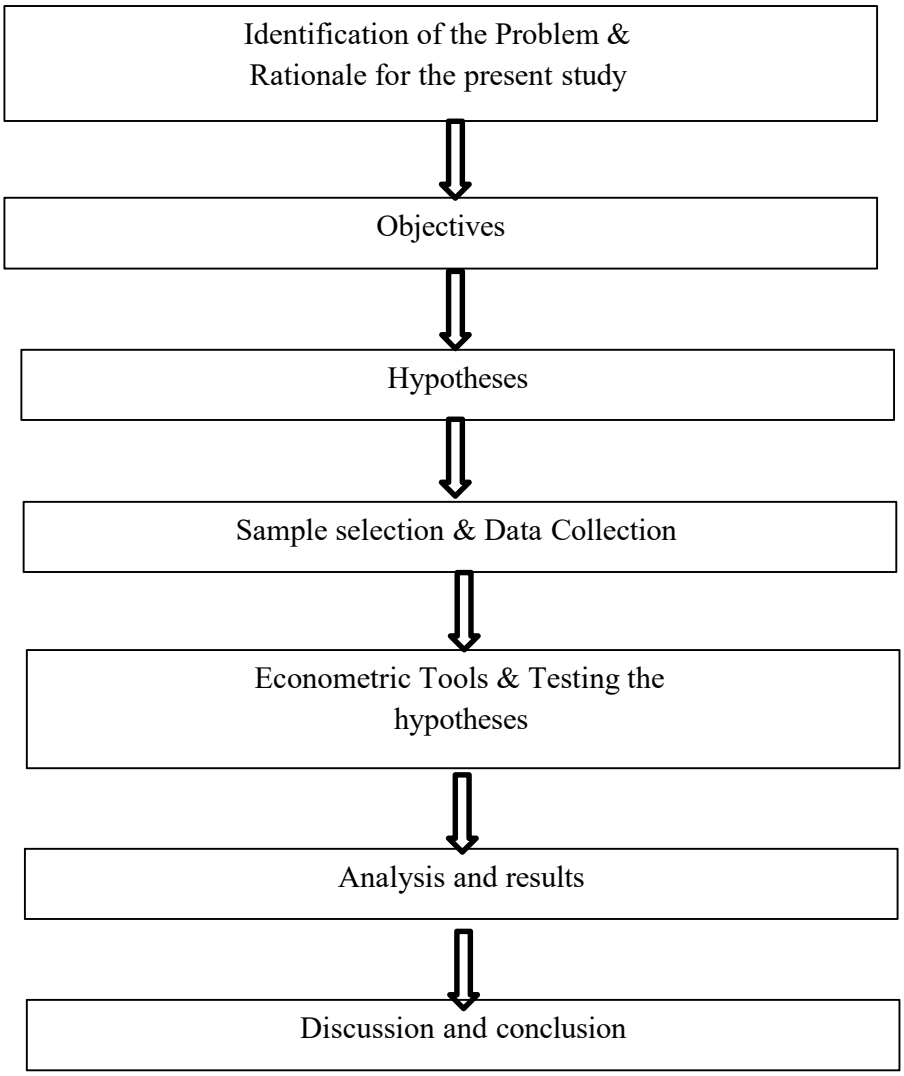
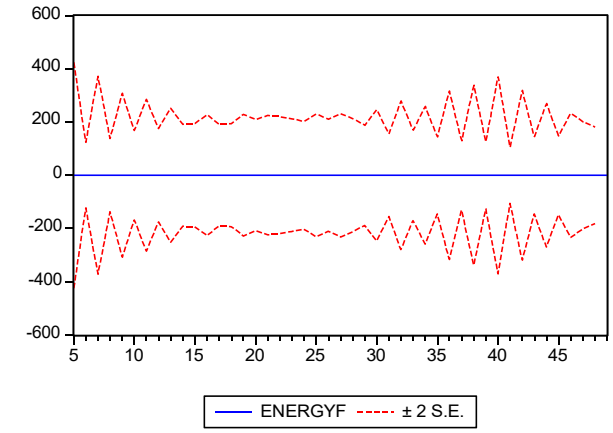
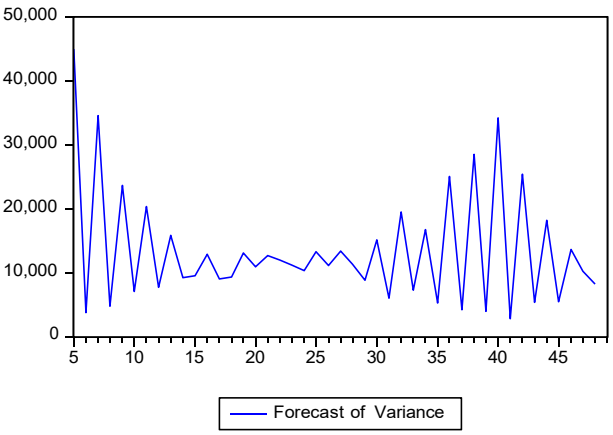


Figure 1
Daily closing price of Energy sector index in phase –I

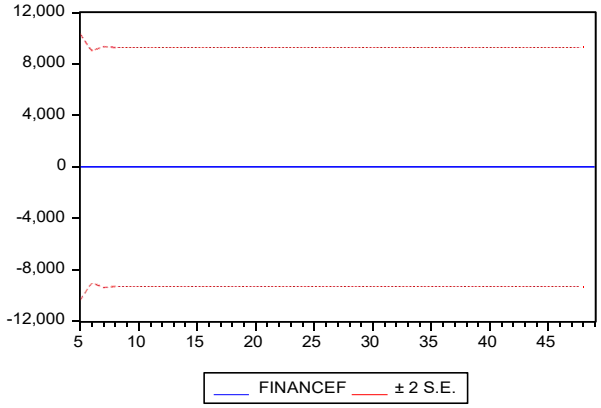


Forecast: ENERGYF	
Actual: ENERGY	
Forecast sample: 1 49	
Adjusted sample: 5 49	
Included observations: 45	
Root Mean Squared Error	4572.346
Mean Absolute Error	4533.195
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.982948
Variance Proportion	NA
Covariance Proportion	NA

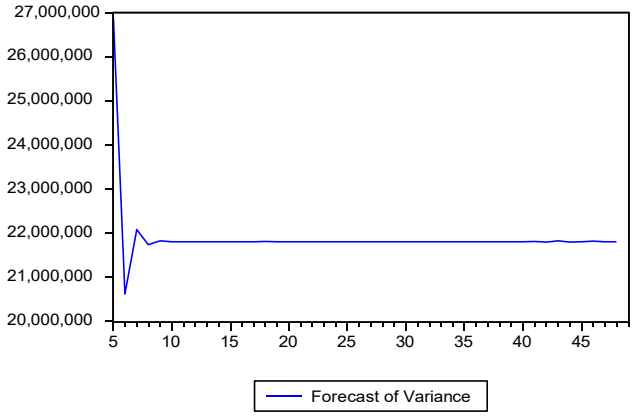


Source: compiled from Eviews7

Figure 2
Daily closing price of Finance sector index in phase -I

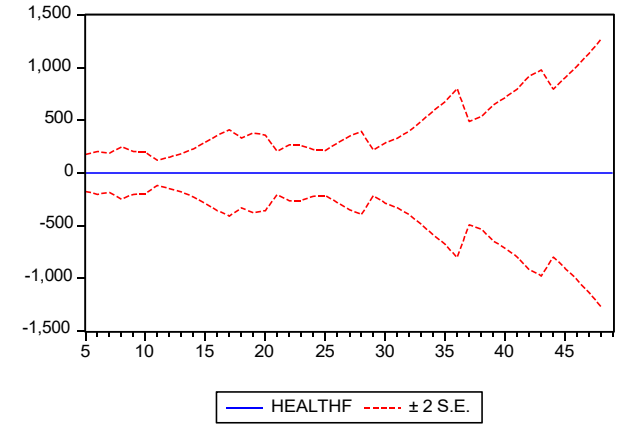


Forecast: FINANCEF	
Actual: FINANCE	
Forecast sample: 1 49	
Adjusted sample: 5 49	
Included observations: 45	
Root Mean Squared Error	6431.832
Mean Absolute Error	6382.674
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.984773
Variance Proportion	NA
Covariance Proportion	NA

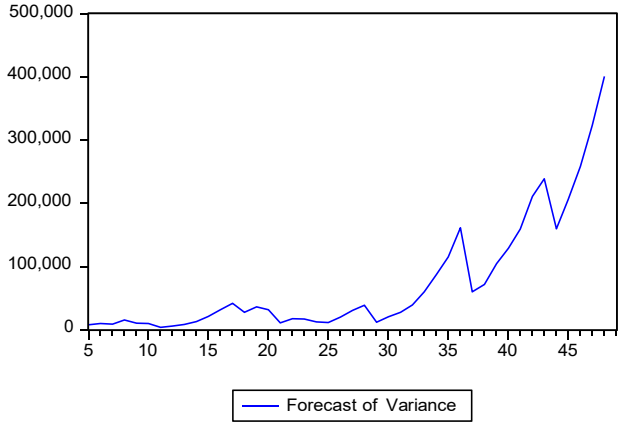


Source: compiled from Eviews7

Figure 3
Daily closing price of Health sector index in phase -I

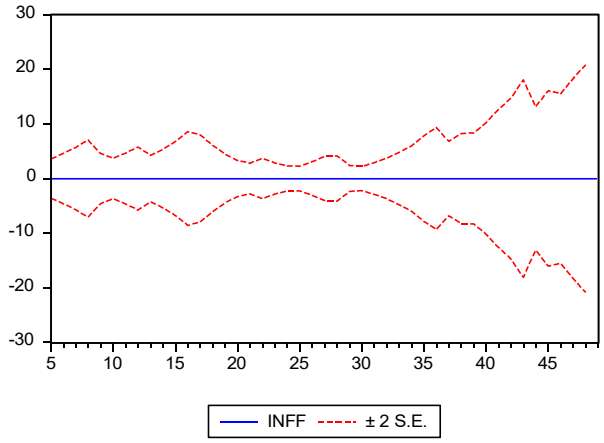


Forecast: HEALTHF	
Actual: HEALTH	
Forecast sample: 1 49	
Adjusted sample: 5 49	
Included observations: 45	
Root Mean Squared Error	13700.20
Mean Absolute Error	13671.60
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.995829
Variance Proportion	NA
Covariance Proportion	NA

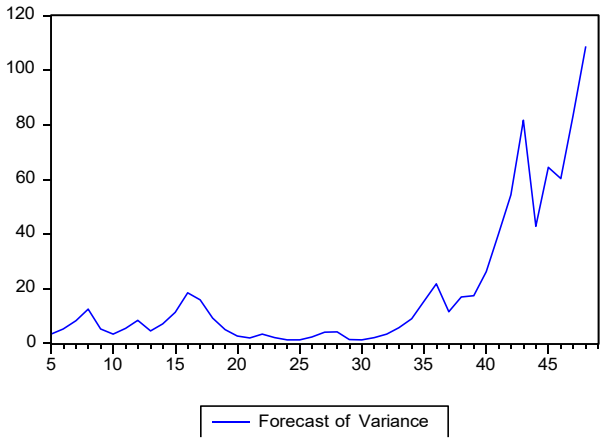


Source: compiled from Eviews7

Figure 4
Daily closing price of Infrastructure sector index in phase –I

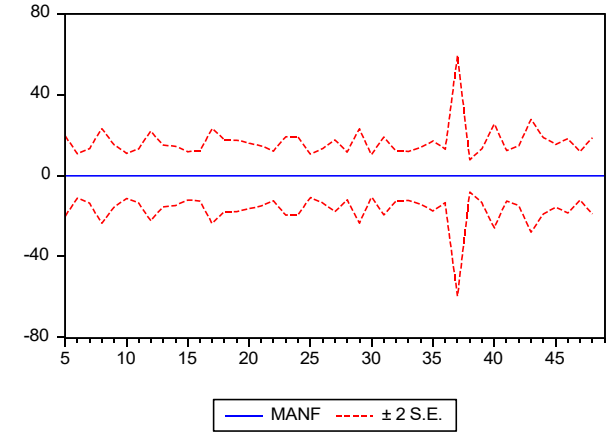


Forecast: INFF	
Actual: INF	
Forecast sample: 1 49	
Adjusted sample: 5 49	
Included observations: 45	
Root Mean Squared Error	161.9448
Mean Absolute Error	160.3651
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.980586
Variance Proportion	NA
Covariance Proportion	NA

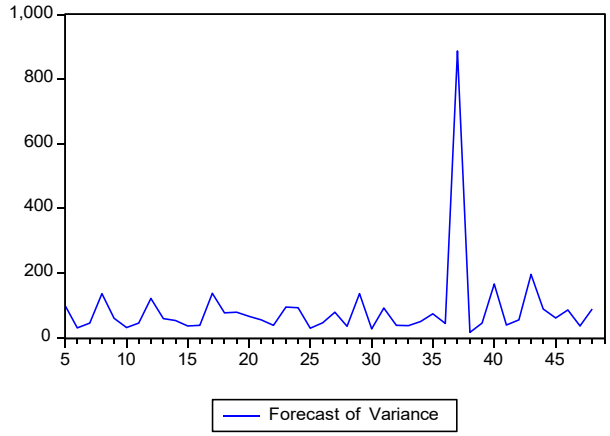


Source: compiled from Eviews7

Figure 5
Daily closing price of manufacturing sector index in phase –I

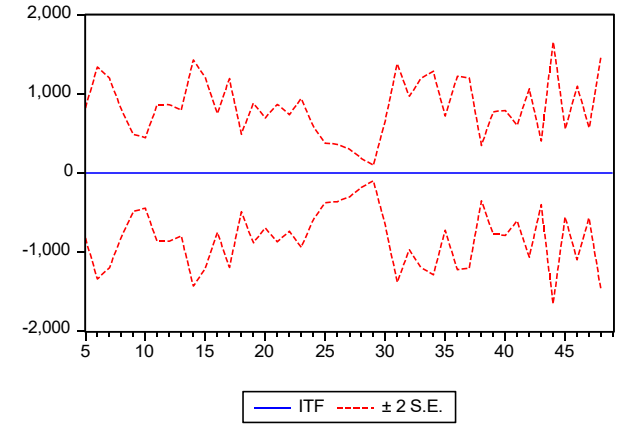


Forecast: MANF	
Actual: MAN	
Forecast sample: 1 49	
Adjusted sample: 5 49	
Included observations: 45	
Root Mean Squared Error	420.9020
Mean Absolute Error	418.6900
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.989517
Variance Proportion	NA
Covariance Proportion	NA

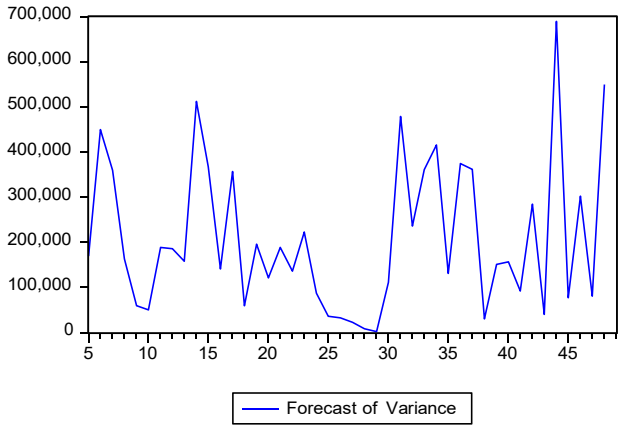


Source: compiled from Eviews7

Figure 6
Daily closing price of information technology sector index in phase –I

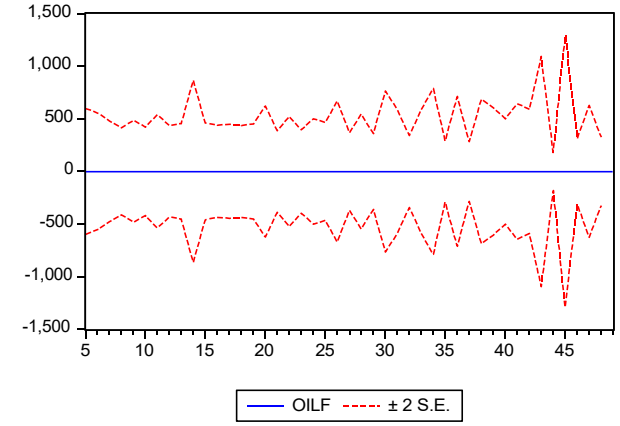


Forecast: ITF	
Actual: IT	
Forecast sample: 1 49	
Adjusted sample: 5 49	
Included observations: 45	
Root Mean Squared Error	15330.02
Mean Absolute Error	15251.59
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.989794
Variance Proportion	NA
Covariance Proportion	NA

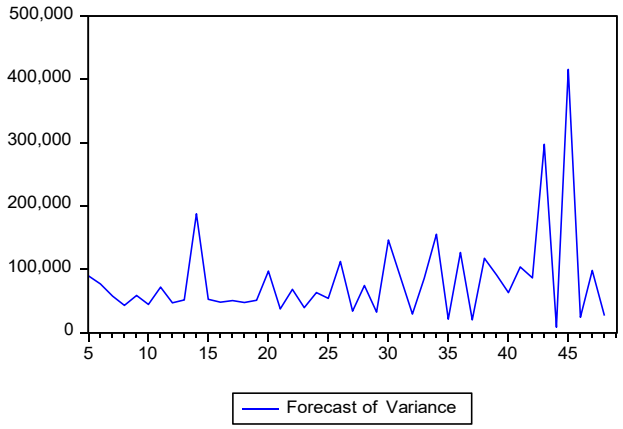


Source: compiled from Eviews7

Figure 7
Daily closing price of oil and Gas sector index in Phase-I

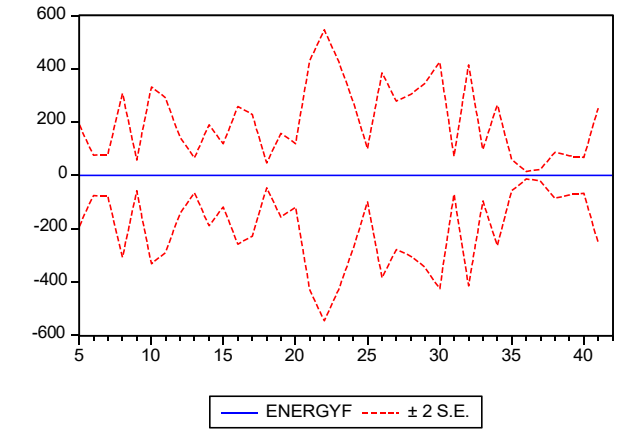


Forecast: OILF	
Actual: OIL	
Forecast sample: 1 49	
Adjusted sample: 5 49	
Included observations: 45	
Root Mean Squared Error	13127.63
Mean Absolute Error	13025.27
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.984466
Variance Proportion	NA
Covariance Proportion	NA

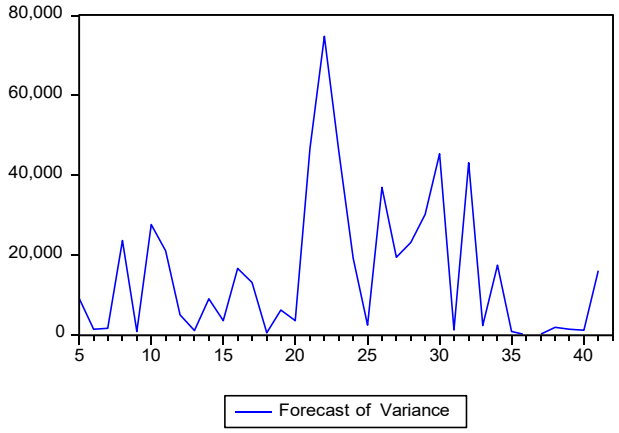


Source: compiled from Eviews7

Figure 8
Daily closing price of Energy sector index in phase II

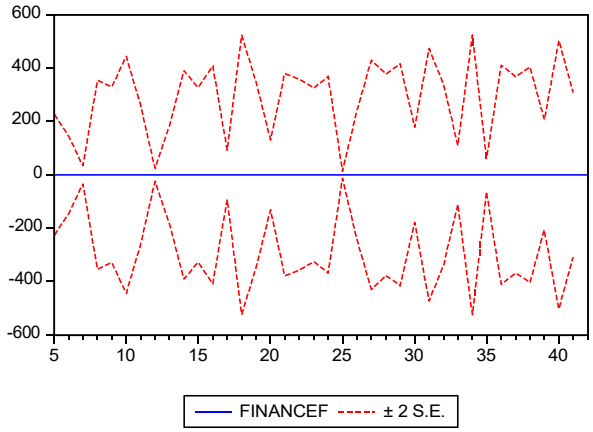


Forecast: ENERGYF	
Actual: ENERGY	
Forecast sample: 1 42	
Adjusted sample: 5 42	
Included observations: 38	
Root Mean Squared Error	4316.322
Mean Absolute Error	4303.553
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.994092
Variance Proportion	NA
Covariance Proportion	NA

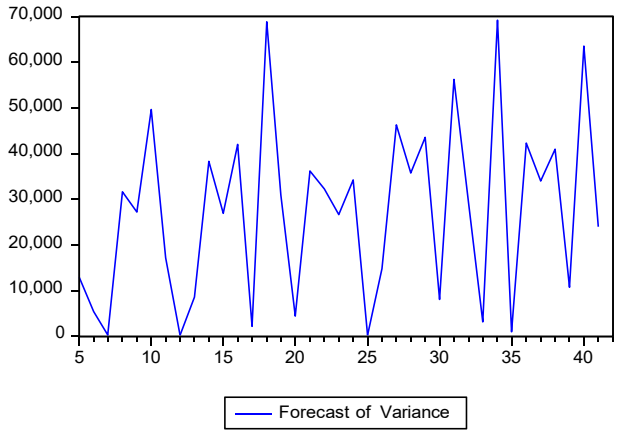


Source: compiled from Eviews7

Figure 9
Daily closing price of finance sector index in phase II

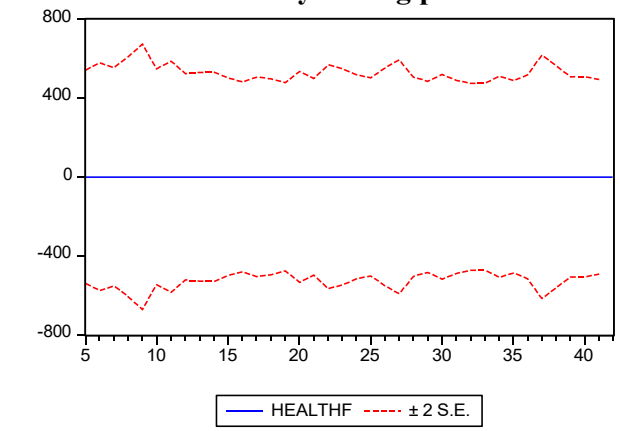


Forecast: FINANCEF	
Actual: FINANCE	
Forecast sample: 1 42	
Adjusted sample: 5 42	
Included observations: 38	
Root Mean Squared Error	4369.749
Mean Absolute Error	4364.991
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.997823
Variance Proportion	NA
Covariance Proportion	NA

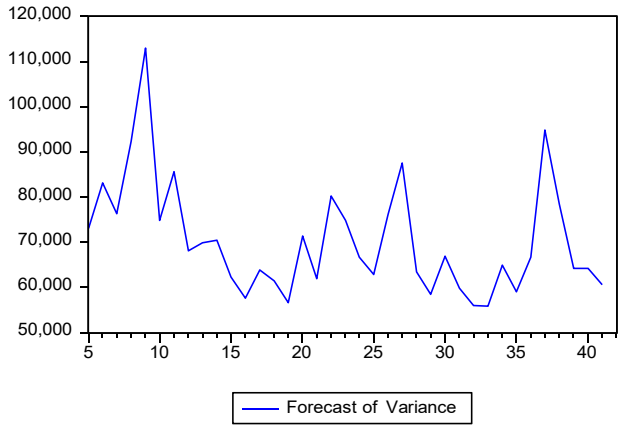


Source: compiled from Eviews7

Figure 10
Daily closing price of health care sector index in phase II

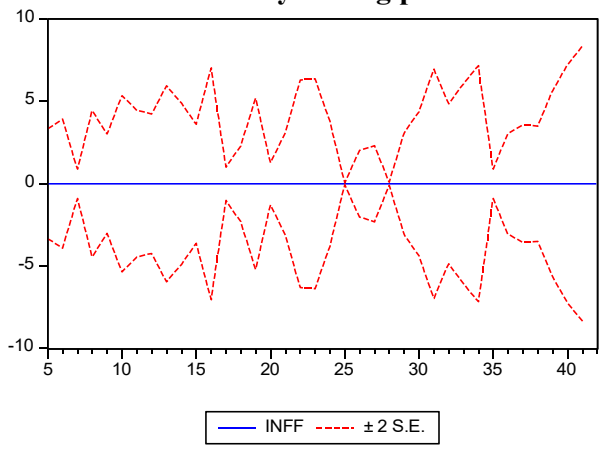


Forecast: HEALTHF	
Actual: HEALTH	
Forecast sample: 1 42	
Adjusted sample: 5 42	
Included observations: 38	
Root Mean Squared Error	14890.58
Mean Absolute Error	14864.25
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.996467
Variance Proportion	NA
Covariance Proportion	NA

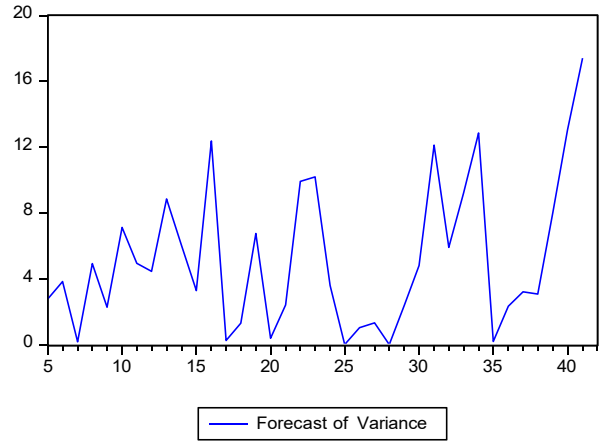


Source: compiled from Eviews7

Figure 11
Daily closing price of infrastructure sector index in phase II

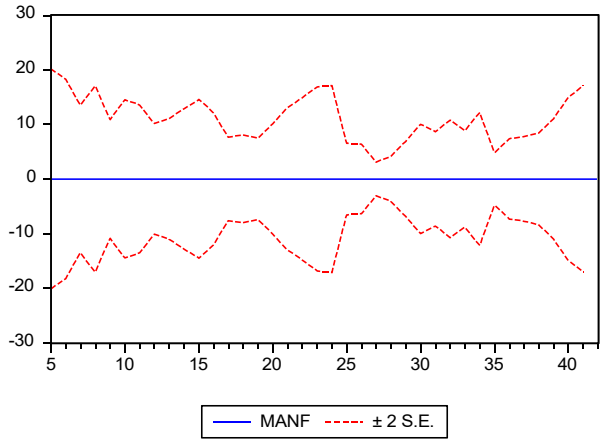


Forecast: INFF	
Actual: INF	
Forecast sample: 1 42	
Adjusted sample: 5 42	
Included observations: 38	
Root Mean Squared Error	123.3019
Mean Absolute Error	123.2387
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.998975
Variance Proportion	NA
Covariance Proportion	NA

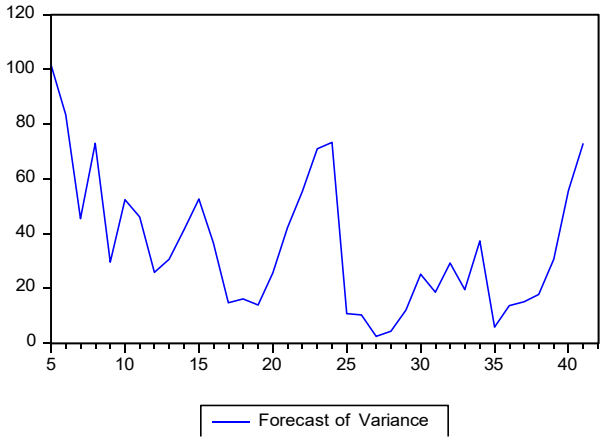


Source: compiled from Eviews7

Figure 12
Daily closing price of manufacturing sector index in phase II

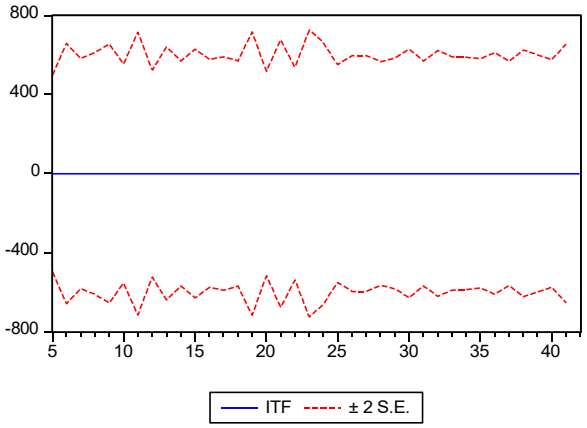


Forecast: MANF	
Actual: MAN	
Forecast sample: 1 42	
Adjusted sample: 5 42	
Included observations: 38	
Root Mean Squared Error	367.1626
Mean Absolute Error	366.9053
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.998599
Variance Proportion	NA
Covariance Proportion	NA

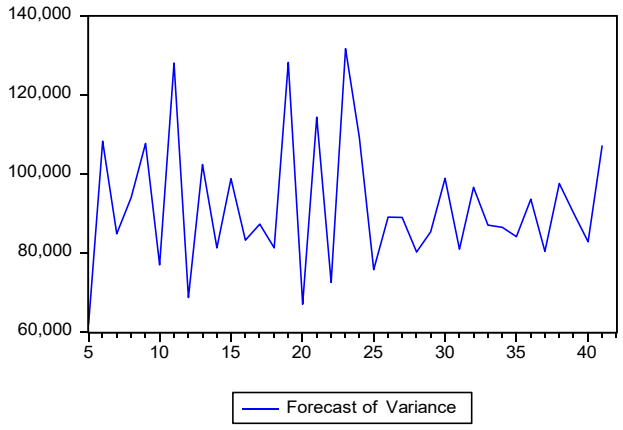


Source: compiled from Eviews7

Figure-13
Daily closing price of information technology sector index in phase II

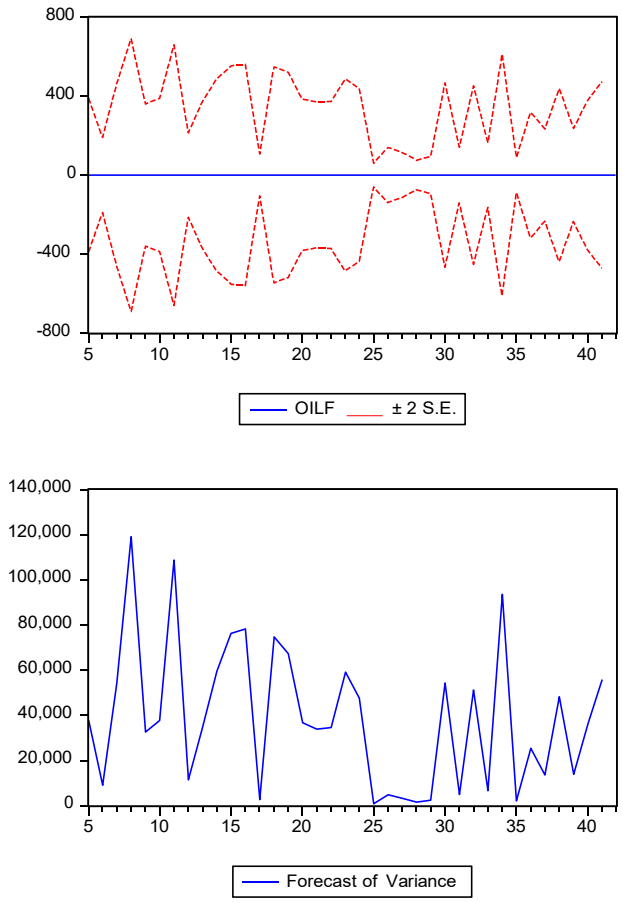


Forecast: ITF	
Actual: IT	
Forecast sample: 1 42	
Adjusted sample: 5 42	
Included observations: 38	
Root Mean Squared Error	13282.30
Mean Absolute Error	13269.11
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.998014
Variance Proportion	NA
Covariance Proportion	NA



Source: compiled from Eviews7

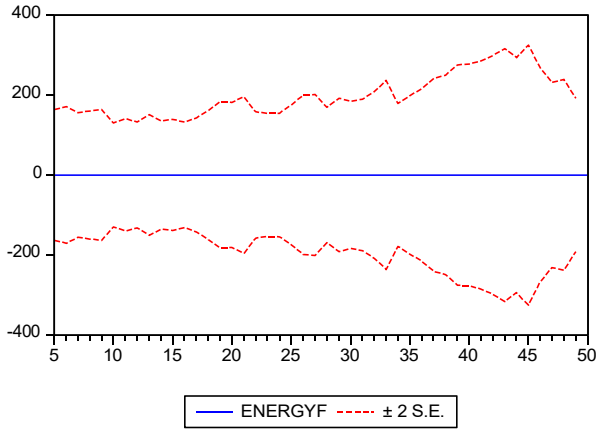
Figure 14
Daily closing price of oil & gas sector index in phase II



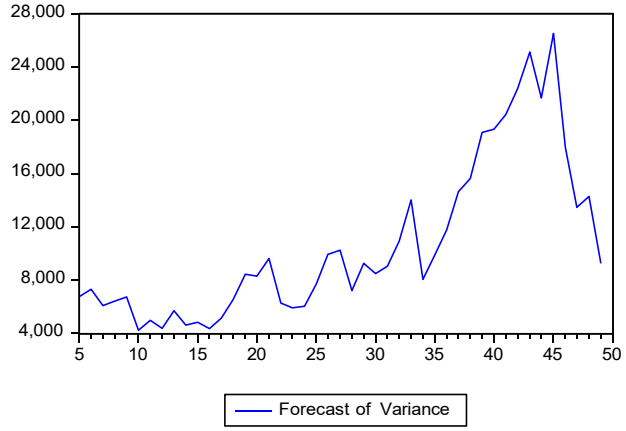
Forecast: OILF	
Actual: OIL	
Forecast sample: 1 42	
Adjusted sample: 5 42	
Included observations: 38	
Root Mean Squared Error	11157.57
Mean Absolute Error	11148.05
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.998293
Variance Proportion	NA
Covariance Proportion	NA

Source: compiled from Eviews7

Figure 15
Daily closing price of energy sector index in phase III

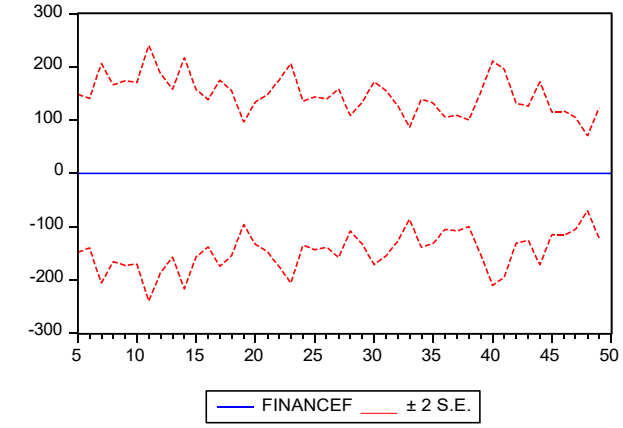


Forecast: ENERGYF	
Actual: ENERGY	
Forecast sample: 1 50	
Adjusted sample: 5 50	
Included observations: 46	
Root Mean Squared Error	5611.537
Mean Absolute Error	5591.881
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.993007
Variance Proportion	NA
Covariance Proportion	NA

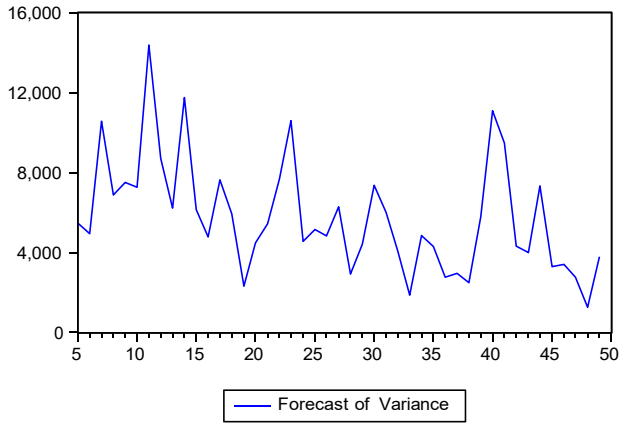


Source: compiled from Eviews7

Figure 16
Daily closing price of finance sector index in phase III

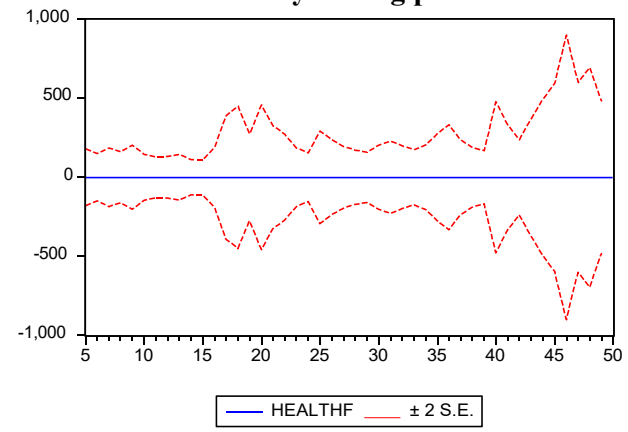


Forecast: FINANCEF	
Actual: FINANCE	
Forecast sample: 1 50	
Adjusted sample: 5 50	
Included observations: 46	
Root Mean Squared Error	5015.272
Mean Absolute Error	5012.022
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.998705
Variance Proportion	NA
Covariance Proportion	NA

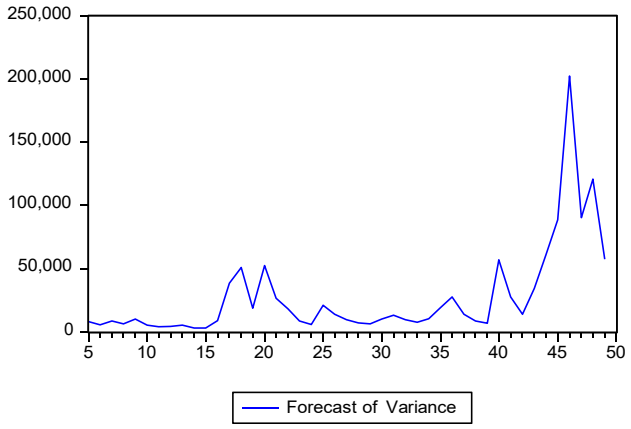


Source: compiled from Eviews7

Figure 17
Daily closing price of health care sector index in phase III

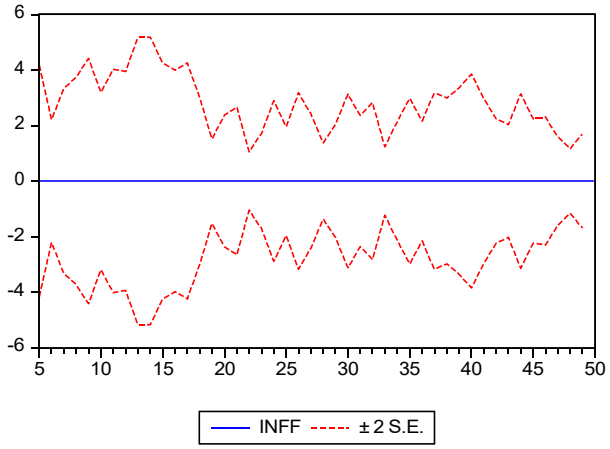


Forecast: HEALTHF	
Actual: HEALTH	
Forecast sample: 1 50	
Adjusted sample: 5 50	
Included observations: 46	
Root Mean Squared Error	16835.62
Mean Absolute Error	16817.62
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.997863
Variance Proportion	NA
Covariance Proportion	NA

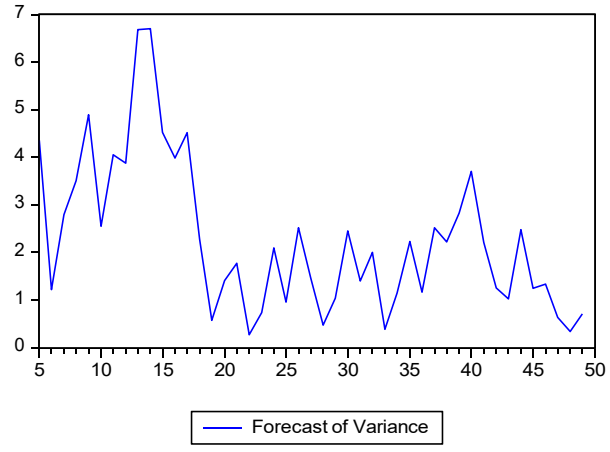


Source: compiled from Eviews7

Figure 18
Daily closing price of information technology sector index in phase III

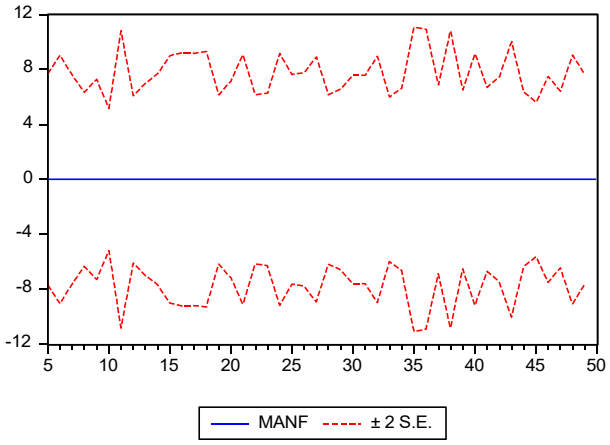


Forecast: INFF	
Actual: INF	
Forecast sample: 1 50	
Adjusted sample: 5 50	
Included observations: 46	
Root Mean Squared Error	138.3138
Mean Absolute Error	138.2852
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.999586
Variance Proportion	NA
Covariance Proportion	NA

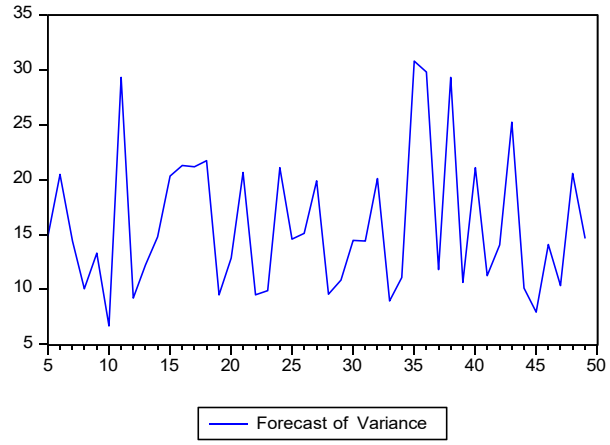


Source: compiled from Eviews7

Figure 19
Daily closing price of manufacturing sector index in phase III

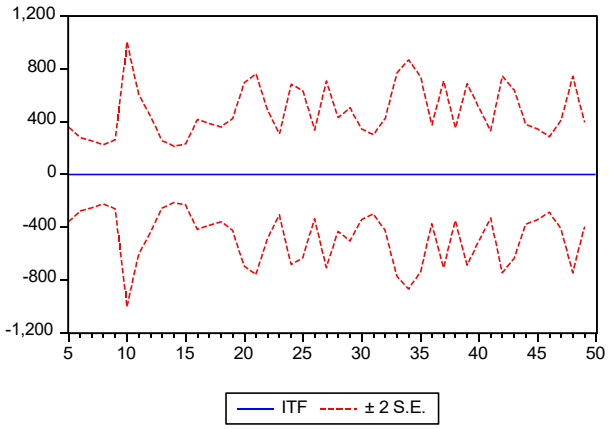


Forecast: MANF	
Actual: MAN	
Forecast sample: 1 50	
Adjusted sample: 5 50	
Included observations: 46	
Root Mean Squared Error	424.3871
Mean Absolute Error	424.0709
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.998510
Variance Proportion	NA
Covariance Proportion	NA

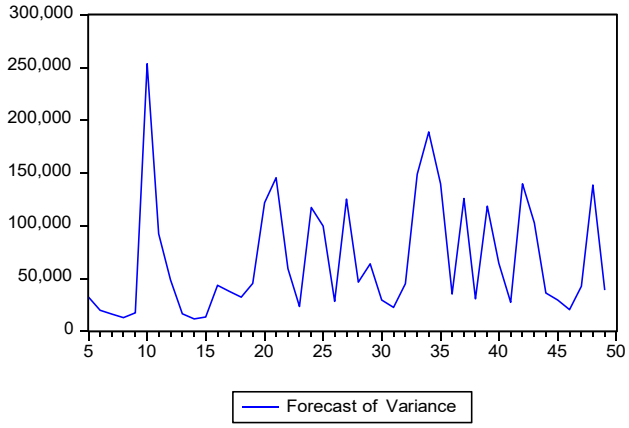


Source: compiled from Eviews7

Figure 20
Daily closing price of information technology sector index in phase III

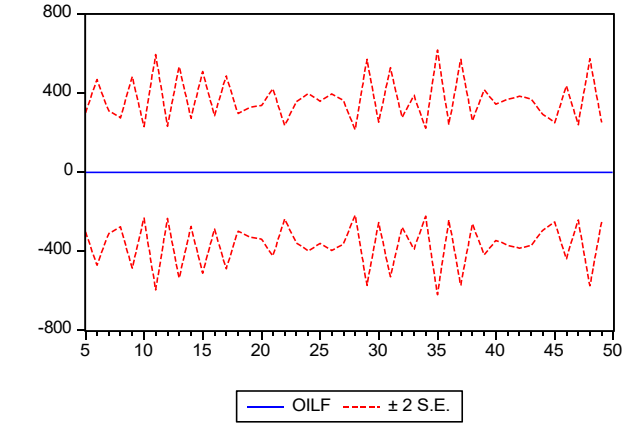


Forecast: ITF	
Actual: IT	
Forecast sample: 1 50	
Adjusted sample: 5 50	
Included observations: 46	
Root Mean Squared Error	16115.29
Mean Absolute Error	16052.27
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.992194
Variance Proportion	NA
Covariance Proportion	NA

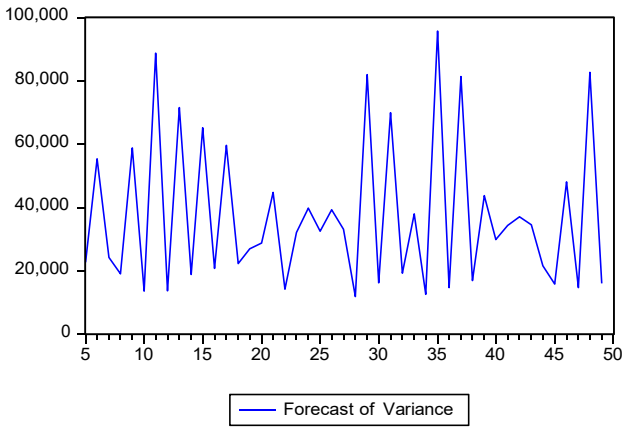


Source: compiled from Eviews7

Figure 21
Daily closing price of oil & gas sector index in phase III



Forecast: OILF	
Actual: OIL	
Forecast sample: 1 50	
Adjusted sample: 5 50	
Included observations: 46	
Root Mean Squared Error	12986.32
Mean Absolute Error	12980.76
Mean Abs. Percent Error	100.0000
Theil Inequality Coefficient	1.000000
Bias Proportion	0.999143
Variance Proportion	NA
Covariance Proportion	NA



Source: compiled from Eviews7