Chapter IX
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CONCLUSIONS

In the fast growing Indian economy today’s investors are mostly concerned about the protective environment for their investment. After the LPG (Liberalisation, Privatisation and Globalisation) of Indian economy in 1991, the Indian financial and commodities market, are facing strategic changes. In this respect Indian financial and commodities market investors / players, are concerned about global economic and political conditions.

Stock market is one of the important factor, which is considered as indicator of economic growth of a country. Stock markets are getting more integrated with financial markets as well as financial indices. Generally, stock markets are influenced by several interconnected economic, social and political factors and these factors interact with each other in a very intricate manner, that stock prices are determined by few macroeconomic variables like crude oil price, gold price and exchange rate. For example, precariousness of oil price sometimes has a serious impact on other economic variables\(^i\). The review of literatures have established significant effects of oil price changes on economic activity in several developed and developing countries\(^ii\). Similarly, international crude oil price and exchange rates are greatly influenced by the stock market. It is particularly true in the case of Indian stock market; number of studies (Amlendu Bhunia\(^iii\) and Vivek Sharma\(^iv\)) state that any significant change in the price of petroleum makes an impact on inflation numbers, which in turn have an impact on the stock market.

190
As the world economy is not steady due to various businesses, political, social and more importantly globalised economic environments, Indian economy also faces the same kind of problem, which in recent times has resulted in the decline of GDP growth and increasing inflation rate. In many developing countries like India, there has been a marked change in the principles of the government towards integration of Indian economy with the world economy. Volatility in gold price, international crude oil price, and US dollar exchange rate is likely to stimulate uncertainty in stock market condition. In this regard, the study of relationship between Indian stock market indices and gold, oil and exchange rate shall help investors in making adjustments in the organisation and management of their portfolios with a view to achieve optimum levels of return. Further the study of period-wise relationship shall help investors in diversifying their investment portfolios according to the nature of relationship between economic variables. Such a study at a macro level shall help the policy makers to evolve macro level policies to redress the various problems encountered by the Indian stock market and investors. Hence, the present study, ‘An Empirical study on the Influence of Gold, Crude Oil & US Dollar Rates on Stock Price Movement in India’ emerged.

The main objective of the study is to perform an in depth research that leads to the outcome of adding relevant empirical evidence to the analysis of financial and commodity market relationships. The initial hypothesis of this research postulates a lack of integration between financial markets and commodities in emerging economies. Hence, the present study has the objectives as

1. To examine the interrelationship between S&P BSE 100, Standard Gold price, Brent Crude oil and US Dollar rates.
2. To estimate the individual influence of these indices on BSE 100 index.

3. To examine the combined influence of Standard Gold price, Brent Crude Oil price and US Dollar on BSE 100 index.

9.1.1. Research Methodology

In line with this objective, the researcher has used both quantitative and qualitative methodology. For the qualitative analysis, the researcher has used the empirical evidences from literature review regarding the macroeconomic factors affecting the stock market. Theories and previous studies suggest that macroeconomic variables such as exchange rate, oil price and gold price influence each other. The exchange rate considered was the RBI reference rate of daily nominal spot rate i.e., rupee per US Dollar price as available for each foreign exchange market day under the study period. For oil price, OPEC countries prices are taken into consideration. The gold price taken for consideration is the monthly average price obtained from the World Gold Council. S&P BSE 100 index is considered as the benchmark index since this index is comprehensive and the data are available for analysis and is used to measure the market price movements of Indian securities.

This research approach differs in a number of aspects from previous studies in the existing literature. First, the data used for the study covers a longer period and further up to recent years (1990 to 2015) than existing studies in this area. Second, the research will focus on studying the inter relationship, inter dependence and volatility spillovers between equity, dollar, gold and oil markets in a combined manner which is a clear distinctive feature of this study. Third, the relationship between these economic variables will be analysed, with a particular emphasis on the emerging market i.e. India.
9.1.2 Period of the study

Indian economy has undergone the structural changes in the year 1991; hence in the present study the researcher has been taken the period from that year in total twenty five years i.e. from the period of financial reform process i.e. from 1990 to 2015. Further the analysis was made to check the shocks (unpredictable events) impact on the selected macroeconomic variables. The analysis is made in six periods which are considered to have impact on the economic variables. The selected periods for the study are post Liberalisation period (4/1990-7/1997), post Asian Financial Crisis period (8/1997-9/2001), post 9/11 attack period (10/2001-03/2003), post Iraq war period (04/2004-8/2007), post Global Financial Crisis period (9/2007-3/2015) and Long Period (1990-2015).

9.1.3 Sources of data

Since the present study relay on the economic variables, it required secondary data. Hence, the present data has been collected from various sources like, websites, journals, books and thesis. Monthly average closing value has been taken for representing the series of S&P BSE 100 index; data has been collected from the BSE website. The monthly average gold price data has been collected from Reserve Bank of India (RBI) website. The monthly average Brent oil price has been collected from the U.S. Energy Information Administration website. The monthly average of US Dollar exchange rate against Indian rupees has been collected from RBI website.

9.1.4 Tools for Analysis

To satisfy the objectives of the study, various time series econometric models were used. The analysis was carried out using the computer software EVIEWS 6 which is
made for econometric analysis. The following tools were used for the analysis of the study:

- Descriptive Statistics for checking normality of the data
- Augmented Dickey-Fuller Test for Unit-Root
- Johnson’s Co-integration test
- Granger Causality test
- VAR model selection
- Vector Error Correction model
- Impulse response functions
- Variance decomposition Analysis

9.2. Findings

9.2.1 Influence of Key Factors on BSE 100 during Post Liberalisation Era (1990-1997)

- It is found from the analysis that gold price recorded the highest price followed by stock price, oil price and exchange rate. Volatility is high in the case of gold price and stock price. Skewness was negative in the case of dollar exchange rate and gold price index and the kurtosis is more than 3 for oil price index but for BSE 100, US Dollar exchange rate and gold price it is close to 3.

- The study data considered for the analysis signifies that the distribution is leptokurtic since, the probability value of all the variables is less than 0.05 in the case of US Dollar exchange rate and oil price, it signifying that the distribution is
leptokurtic. In the case of gold price index also probability value is 0.058 it signifying that the distribution is leptokurtic at ten percent level.

- The Unit root test reveals that time series are non-stationary at levels, both intercept without trend and with trend, since ADF test statistics is less than the critical values at 5 % level of significance in all the time series.

- The study found that at their first difference the calculated [t] is more than the critical value and all the probability value is also less than 0.05. Hence, the null hypothesis is accepted, which indicates that in the first differenced form, and also at first differenced value both intercept without trend and with trend all the series are stationary. Therefore, each time series data is integrated in order one, or I (1).

- The Johansen Co integration test results gives surety of the long-term relationship among the selected variables. The analysis shows that the series is co integrated, as both the trace and the maximum Eigen value tests reject the null hypothesis of no co-integration, suggesting that there are three significant co-integrating vectors in the model.

- There is evidence of bi-directional causality from oil price and BSE 100 index and there is a unidirectional relationship between US Dollar exchange rate and oil price index, gold price index to oil price index and BSE 100 index to gold price which means in the short run there is interchangeable lead-lag relationship between the these variables.

- Variance Decomposition analysis reveals that innovations in BSE 100 can explain around 5.71% variations in oil price and all other innovations explain below one
percent of the variation in BSE 100 in short term. Similarly, innovations in BSE 100 explain around 19% variations in gold price index in long term. It is clear from this that both BSE 100 and gold price index explains each other and the percentage of variation is less.

- It is found from the analysis of Impulse-Response Functions that BSE 100 may react to independent variables changes. Interestingly, BSE 100 shows a negative reaction with a standard deviation in oil price, that means, oil market will have a negative effect on BSE 100 in a long time.

9.2.2 Influence of Key Factors on BSE 100 during Asian Financial Crisis Period (1997-2001)

- It can be observed from the analysis that gold price recorded the highest price followed by stock price, exchange rate and oil price. Volatility is high in the case of gold price and stock price. Skewness was negative in the case of Dollar exchange rate, Gold and oil price the kurtosis is more than 3 for BSE 100 and for gold price it was close to 3 but for oil and gold price it was lesser to 3. Further the probability value of BSE 100 is 0, signifying that the distribution is leptokurtic but for other time series it is more than 0.05, hence it concludes that selected time series other than BSE 100 are not normally distributed.

- It is clear that none of the values is more than McKinnon critical values in absolute terms and ‘p’ value more than 0.05 hence it concludes that unit root is present in the series intercept with and without trend series at level.
The unit root test with first difference shows that not all the index data series are stationary at the level, but stationary after the first difference. In other words, all the data series are I (1) which denotes that the time series with and without intercept is integrated at the first difference level.

The US Dollar Exchange rate index and gold price index are influenced by the BSE 100 index and US Dollar exchange rate index respectively. As well, oil price index granger cause US Dollar exchange rate index and gold price index. Oil price index and BSE 100 index has bi-directional relationship. This obviously implies the existence of causality among the variables and existence of volatility transmission or spillover between financial markets and stock markets but with asymmetric relationships.

The results of the multivariate co integration test do accept the null hypothesis i.e. BSE 100, US Dollar exchange rate, gold price and oil price indices are not associated in the long run. This test also established the number (three) of co integration vectors.

It is clear from this that both BSE 100 and oil price index explains each other and the percentage of variation is less. One of the interesting finding of Variance Decomposition is about BSE 100, which is largely explained by innovations in gold index (3.04%), oil price index (54.54%) and US Dollar exchange rate (3.42%).

One standard deviation shock change in residual oil price, in long run i.e. twelve months, 90.31% of change occurs in oil price, 6.23% change in BSE 100, 1.82 in
US Dollar exchange rate and 1.63% in gold price (total being 100). Further, it is clear from the analysis that, the level of influence of long run shock in oil price influences increasing in BSE 100 compared to short run shock in oil price.

- The US Dollar exchange rate index reaction to oil price is negative for a long run as well short run. In other words, oil price changes come along US Dollar substitution and more investment is accomplished in oil in a short run considering portfolio theory. Interestingly gold price have been influenced in long run by oil price indices, further oil prices itself showing negative growth in long run.

**9.2.3 Influence of Key Factors on BSE 100 during 9/11 Crisis (2001-2003)**

- It is found that the distributions of BSE 100 and gold price indices are positively skewed, and indices US Dollar exchange rate and oil price are negatively skewed in period III. There is high degree of inconsistency measured by the standard deviation for all selected time series except US Dollar exchange rate index. A Gaussian distribution has kurtosis of 3. The distributions of BSE 100, US Dollar exchange rate, gold price and oil price are platykurtic since kurtosis value is less than 3 during the study period. The JB statistics measures the departure of distribution from normality. It tests the null hypothesis $H_0$: distribution of time series is normally distributed. As $\chi^2$ calculated is more than $\chi^2$ tabulated for all the time series data; therefore, reject $H_0$. Thus, variables are not normally distributed during the study period. It can also be verified as the p-values are less than 0.05; therefore, reject Ho for all the selected variables distributions at 5% level of significance. This implies that the distributions of macroeconomic variables are non-symmetrical about their mean values during the study period.
- The ADF test statistics is less than the critical values at 5% level of significance in all the time series in both intercept, with and without trend. Further, the probability value is also more than 0.05 hence it concludes that all the time series are non-stationary at it levels.

- At the first-difference, the calculated $|t|$ is more than the critical value and all the probability values are also less than 0.05 except US Dollar exchange rate. Hence, the null hypothesis is accepted, which indicates that in the first differenced form, all the series are stationary except US Dollar exchange rate. Therefore, each time series data is integrated in order one, or I(1). Augmented Dickey Fuller unit root analysis test reveals that errors have constant variance and are statistically independent. Therefore, cointegration test can be applied on these variables.

- The analysis reveals that all other null hypotheses that are considered stands rejected. One important result is that gold price index does not granger cause any other time series during the Period III period. This obviously implies the existence of causality among the variables and existence of volatility transmission or spill-over between financial markets and stock markets but with asymmetric relationships.

- In the case of trace test, value is more than equation one and hence in this case hypothesis is rejected. But in the case of first equation, hypothesis is rejected it means selected times series has association in long run. But all other hypothesis, the results of the multivariate co integration test do accept the null hypothesis i.e. BSE 100, US Dollar exchange rate, Gold price and Oil price indices are not
associated in the long period. This test also established the number (three) of co
integration vectors. It is moreover indicating that three common stochastic trends
or a degree of market integration is present.

- It is clear from the analysis that, the level of influence of both long run and short
  run shock of BSE 100 index, is increasing gold price index and US Dollar
  exchange rate index.

- It found that, BSE 100 shows a negative reaction with a standard deviation in oil
  price, that means, oil market will have a negative effect on BSE 100 index in a
  long run. In addition, it appears that the US Dollar exchange rate index reaction to
  oil price is bumpy for a long run as well short run. In other words, oil price
  changes come along US Dollar substitution and more investment is accomplished
  in oil in a short run considering portfolio theory. Interestingly gold price was not
  influenced in long run by oil price indices, further oil price itself showing
  negative growth for first nine months.

9.2.4 Influence of Key Factors on BSE 100 during Iraq War Period (2003-2007)

- It is observed that gold price recorded the highest price followed by stock price,
  oil price and exchange rate. Volatility is high in the case of gold price and stock
  price. Regarding the normality, the value of Skewness, kurtosis and Jarque-Bera
  statistics are considered. Skewness was negative in the case of Dollar exchange
  rate and oil price index. The kurtosis value is greater than three in the case of US
  Dollar exchange rate index, hence implying that the series is sharp and other time
  series are lesser than three, which indicates that the series are flattened or
  depressed. The null hypothesis is rejected for the normality for these series,
indicating that the series are not normally distributed, which is confirmed by Jarque-Bera statistics. The variables are not distributed normally in full, but are distributed very close to normal distribution as the median values of variables are very close to average values.

- In the study calculated value of the test statistic ‘t’ is less than its critical value in all the selected variables and all the probability value also greater than 0.05, the null hypothesis is accepted, which means for the series BSE 100, Exchange rate of dollar and oil price, unit root exists and they are non-stationary at it levels in both intercept with and without trend.

- At their first difference time series data the calculated |t| is more than the critical value 3.989 and all the probability value also less than 0.05. Hence, the null hypothesis is rejected, which indicates that in the first differenced form, all the series are stationary. Therefore, each time series data is integrated in order one, or I (1). Therefore, the following is the result of residual based granger test, which strongly demands that all the variables must be in the same order.

- The results of the multivariate co integration test do accept the null hypothesis i.e. BSE 100, US Dollar exchange rate, gold price and oil price indices are not associated in the long period. This test also established the number (three) of co integration vectors. It is moreover indicating that three common stochastic trends or a degree of market integration is present there.

- Shows that BSE 100 index at the lag of one have an influence on the returns of gold price and BSE 100. However, with a lag of two it does not influence the
returns of each of the indices under the study. The index of US Dollar exchange rate at the lag of 1 and 2 had an influence on the returns of US Dollar and gold price indices

- It is found from the study that, if there are innovations in BSE 100 it explains around 11.58% variations in oil price index, 9.11% gold price index and 3.66% US Dollar exchange rate index in long term. It is clear from this that both BSE 100 and oil price index explains each other and the percentage of variation is lesser in short run but it has an increasing effect in long run. One of the interesting findings of Variance Decomposition is about BSE 100 which is largely explained by innovations in oil price index (11.58%), gold price index (9.11%) and US Dollar exchange rate (3.66%).

- Valid evidence resulted from Impulse-Response Functions indicates that BSE 100 may react to independent variable changes. Interestingly, BSE 100 shows a negative reaction with a standard deviation in oil price, that means, oil market will have a negative effect on BSE 100 in long run. In addition, it appears that the US Dollar exchange rate index reaction to oil price is negative for long run as well short run. In other words, oil price change come along US Dollar substitution and more investment is accomplished in oil in short run considering portfolio theory. Interestingly gold price have been influenced in long run by oil price indices, further oil price itself showing negative growth in the long run.
9.2.5 Influence of Key Factors on BSE 100 during Global Financial Crisis (2007 – 2015)

- The study found that gold price recorded the highest followed by stock, exchange rate and oil price. Volatility is high in the case of gold price and stock price. Skewness was negative in the case of gold price and oil price index and the kurtosis is more than 3 for BSE 100, for oil price it was close to 3. Further, the probability value of gold and oil price index is less than 0.05, it signifying that the distribution is leptokurtic. Further, other variable distributions are platykurtic since kurtosis is less than 3.

- It is found from the study that the calculated value of the test statistic ‘t’ is less than its critical value and all the probability values are also greater than 0.05, the null hypothesis is accepted. Which means for the series BSE 100, Exchange rate of dollar and oil price, unit root exists and they are non-stationary of the series at it levels both in intercept with and without constant.

- Even though at its level all the data has unit root, the unit root tests reject the same null hypothesis in the first differenced form of the series. At their first-difference the calculated $|t|$ value is more than the critical value and all the probability value is also less than 0.05. Hence, the null hypothesis is rejected, which indicates that in the first differenced form, all the series are stationary. Therefore, each time series data is integrated in order one, or I (1).

- Maximal Eigen statistic ($\lambda_{max}$) of 16.17 is less than the 5 % critical value of 27.58 and the trace test statistic ($\lambda_{trace}$) of 30.94 is less than the critical value of 47.856 and the corresponding p values less than 0.05. Therefore, the null hypothesis
of no co integration (ie. $r = 0$) will be accepted. Hence, the time series of the selected variables during this period are co-integrated. Further, it can trace any co-movement for the period.

- The null hypotheses of no causality are significant at 1% and therefore can be rejected. There is evidence of uni-directional causality from US Dollar exchange rate to BSE 100, from oil price index to US Dollar exchange rate which means in the short run there is interchangeable lead-lag relationship between the these variables.

- The analysis shows that BSE 100 index at the lag of 1 had influence on the returns of oil price index and BSE 100. However, with a lag of 2, it had influenced only on the returns of oil price index under the study. The index of US Dollar exchange rate at the lag of 1 and 2 had influenced on the returns of US Dollar index which means that dollar index movement does not influence other indices.

- It is found from the study that one standard deviation change in residual BSE 100 equation, in short term i.e. three months, 98.62% of change happens in BSE, and other indices has influenced only less than 1 percent. Likewise one standard deviation change in residual BSE 100, in long run i.e. twelve months, 65.22% of change occurs in BSE 100, 21.96% change in dollar, 0.93% in gold price and 11.89% in oil price (total being 100).

- Valid evidence resulted from Impulse-Response Functions indicates that BSE 100 may react to independent variable changes. Interestingly, BSE 100 shows a negative reaction with a standard deviation in oil price, that means, oil market will
have a negative effect on BSE 100 in long run. In addition, it appears that the US Dollar exchange rate index reaction to oil price is negative both in long run as well as in short run.

9.2.5 Influence of Key Factors on BSE 100 during Long Period (1990-2015)

- It can be observed from the analysis that gold price recorded the highest price followed by stock price, exchange rate and oil price. Volatility is high in the case of gold price and stock price. Skewness was negative in the case of dollar exchange rate and the kurtosis is more than 3 for stock price, gold price and oil price but for the dollar it was close to 3. Further, the probability value of all the commodities is 0, signifying that the distribution is leptokurtic. Hence, data has normality.

- It has been found from the analysis that except gold price, calculated value of the test statistic ‘t’ is less than its critical value (2.873) and the probability value is also greater than 0.05, the null hypothesis is accepted, which means for the series BSE 100, exchange rate of dollar and oil price, unit root exists and they are non-stationary at its levels. In first difference, the calculated |t| value is more than the critical value 2.873 and all the probability value is less than 0.05. Hence, the null hypothesis is accepted, which indicates that in the first differenced form, all the series are stationary.

- There is evidence of bi-directional causality from gold price to stock price, from stock price to gold price, stock price to oil price and gold price to oil price, which means in the short run there is interchangeable lead-lag relationship between these variables.
The analysis of co-integration test indicates the existence of long-run relationship among the series. Further the VAR analysis suggests that, one model can be considered representative to describe autoregressive connection between the selected series.

The percentage changes in the variable when a shock is introduced in the residual series shows that the researchers has used variance decomposition test and the test shows that the level of influence of long run shock in BSE 100, is increasing dollar exchange rate and oil price as compared with short run shock in BSE 100.

From the evaluation of the effect of a shock on variations in current and future values of the series it can be found that, the BSE series increases over the 12 month period and becomes highest positive in the long run. Where dollar rate increase from negative value to positive value in long run, gold price is starting with neutral value and increases to highest positive value in the fifth month and after that the value shows decreasing trend. Oil price indicates increasing trend but turned negative throughout the period.

9.3 Suggestions

- In general, investors are advised to take informed decisions by considering the global, economic and political environments for mitigating investment risks in their investment portfolio.
- Stake holders and Policy makers keep informing the investors about market information and other profitable investment avenues by hedging their portfolios so that shocks in a index will not affect their portfolio.
Legitimate risks return strategies help in controlling unpredictability, which needs to be guaranteed by the policy makers. In its absence, the informed and institutional financial specialists will move in the opposite direction of the capital markets. Regardless of the fact that they partake, they may fall back on unscrupulous methods for benefit making open doors prompting higher instability.

Numerous speculators maintain a strategic distance from securities exchanges because of data asymmetry. The controllers and approach producers need to make strides for proficiently scattering data about the market. The premise of benefit valuation must be entirely bound to the financial basics, so that speculators can't make strange additions.

With everything taken into account, keeping in view the nature and ramifications of unpredictability, it is fitting to consistently concentrate on available data to distinguish the components that have suggestions for its real market makers, the detail arrangements that will help to settle and to hold these variables under control.

It is likewise fitting that macroeconomic approaches in regards to these variables ought to, at all times, take perception of the conceivable impacts that such strategies will have an impact on stock value changes and the capital markets by and large. Such an all encompassing way to deal with approach plan will help guarantee and security in the capital business sector and accordingly diminish the likelihood of crashes in share prices, which may prompt disequilibrium in the capital business.
9.4 Conclusion

This study aims at investigating the relationship among the S&P BSE 100, US Dollar Exchange Rate, Crude Oil Price and Gold Price in India. The major conclusion of the study is that the selected time series exhibits non-stationary and therefore provides an indication of long-term co integration relationships. In short, selected time series variables are closely interlinked. US Dollar exchange rate and Oil price are essential unpredictable variables that operate as channel during which the stock prices are associated. The Granger causality test reveals that the US Dollar Exchange rate, Gold and Oil prices instability has an influence on each other. However, BSE 100 does not cause other series. Further, it is clear from the result that, the level of influence of long run shock in S&P BSE 100, is increasing dollar exchange rate and oil price compared to short run shock in BSE 100. This study has brought out the relationships between macro economic variables Gold Price, Crude Oil and US Dollar rates with S&P BSE 100 index. This study is of immense use for the policy makers to make appropriate decision for mitigating the problems faced by the investors while their investments by unpredictable shocks in the economy.

9.5 Scope for Future Research

Even though the research has accorded insight in the present study, still there is lot of scope in this field. Further research may be undertaken in these broad areas in India and other Global Markets which is always vulnerable to Global Economic and Political Environments. The research can also be diversified into Micro and Macroeconomic variables impact on Stock Market Movement, Comparative study on Micro and
Macroeconomic variables impact on Stock market, A study on the relationship between Financial Market Movements with Capital Market Movements and Commodity, Bond Markets and so on. It is recommended to apply other variables and advanced methods for further research.


ii Mohamed El HediArouri and JulienFouquau, ‘ On the short-term influence of oil price changes on stock markets in GCC countries: Linear and Nonlinear Analyses’,
