

Spillover Effects of Global Economy: Investigation of an Emerging Financial Market

Ankita Sharma

Masters of Business Administration, A.P.J. Abdul Kalam Technical University.

Abstract

In today's age of globalisation and financial integration, financial markets of the world are not just affected by the macroeconomic conditions of their respective countries but also by the global macroeconomic conditions. In the Indian context, the connection of the Indian stock market with the global economy has not been explored well. Most of the studies which have been done on this area have focused largely upon the macroeconomic conditions of the U.S. on the Indian financial market. Divided into three categories, major economies of the world, major oil exporting countries and the neighbouring countries, this study took into consideration the economic conditions of 10 countries and examined their impact on the Indian stock market. Bivariate and multivariate Johansen cointegration and VECM models have been used to explore the long-run impact, Granger Causality tests were used for finding the short-run connection and Garch (1, 1) was used for the volatility modelling. A very weak connection of Indian financial market was found with the global economy. The money supply in the US and China affected the Indian stock market in the long-run. Being the biggest exporters of oil for India, the economies of the UAE and Saudi Arabia affected the Indian stock market through the money supply and exchange rate in the long run. A close connection was found with the economy of Pakistan of the Indian stock market. The macroeconomic conditions of Bangladesh, France and Germany made a negligible impact on the Indian stock market. The economic conditions of the UK and Japan showed a marginal impact on the stock market of India.

Keywords: India, Global Economy, Stock Market, VECM, GARCH, Granger Causality, Johansen Cointegration, Financial Integration.

JEL classification: D81; F23; G22; G31.

1. Introduction:

For academic researchers, regulators and market participants the importance of investigating the extent of linkages between financial markets has been increased by the financial market integration within a rapidly expanding global financial system. An important consideration of policymakers and investors is now a clearer understanding of the nature of cross-market interactions and linkages. Thus, in the determination of regulatory

policy, hedging and pricing, knowledge of how markets and economies influence one another are important. Today, a domestic stock market is not just affected by the domestic macroeconomic environment but also by the macroeconomic environment of other countries. Foreign investment is one of the key drivers of the stock markets today, in the globalised world the economies for their growth depend on the trading relations with the other countries and economic growth is crucial for the growth of the stock market. Thus, it becomes very important to study the impact of the macroeconomic news of other countries on the domestic stock market. To do this examination we took the case of the Indian stock market and on it, the effect of macroeconomic news of other countries was explored.

The macroeconomic news of other countries was represented by the macroeconomic news of three categories of countries, neighbouring economies, major economies of the world and the oil-exporting economies. In the neighbouring economies, Pakistan and Bangladesh were taken. In the major economies of the world, China, France, Germany, Japan, USA and UK were taken. In the oil-exporting economies, we took Saudi Arabia and UAE which are major oil exporters for India. The effect of six macroeconomic indicators of these countries were taken into consideration to explore the impact of the macroeconomic shocks of other countries on the stock market of India. These indicators were CPI, Exchange Rate, IIP, Interest Rate, Money Supply and GDP. The main objectives of this part of the research were to find out the impact of macroeconomic news of 3 categories of countries on the Indian stock market, to examine what are those key macroeconomic indicators of other countries which are affecting the stock market of India in a significant manner amongst CPI, Exchange Rate, IIP, Interest Rate, Money Supply and GDP, to explore if the neighbouring countries are making more impact or the major economies of the world and the oil-exporting countries.

This part of the research is distributed in the following parts, the first part will discuss the literature review. The second part will look into the economic relationship which the selected countries have with India. The third part will be the empirical estimation part in which long-run and short-run tests will be run, the fourth part will be the part of doing the interpretation of the econometric tests run and the fifth part i.e. the conclusion part will discuss the findings.

2. Literature Review:

(Griffin, 2002) examined the usefulness of international, world and domestic versions of the Fama and French factors model for equity returns. The findings of the study suggested that extension of the Fama and French 3 factors model to a global context was not found to be beneficial. As compared to the international and the world versions, in explaining average stock returns country-specific 3 factor models were more useful.

Most of the studies have taken the macroeconomic factors of the U.S. to explore the impact of the global macro economy on the domestic stock markets. (Nguyen, 2011) examined the importance of the US macroeconomic news for the stock markets of Vietnam. On the first two moments of the stock returns of Vietnam, the strongest effect was found to be of the US real economic news. This implied that the notion of USA targeting real economic activities other than other variables was believed by the market participants of Vietnam's stock

market. (Esin and Gupta, 2017) investigated the impact on the South African stock markets of the US macroeconomic news. The findings demonstrate that positive developments in the US employment and the US economic growth make the South African stock market less volatile and more stable. (Gök and Topuz, 2017) investigated the impact of the US macroeconomic news on the stock market of Turkey. Except for US GDP news and US residential sale news, no other indicator out of the 13 US macroeconomic news indicators was found to be affecting the volatility of the Turkish stock market. This indicates that with respect to the US news announcements Turkish stock market is segmented.

There are some studies which took the macroeconomic conditions of the U.S. and other countries as well to explore their impact on the domestic stock market returns. (Vrugt, 2009) studied on the financial markets of Poland, Hungary and Czech Republic (CEEC-3), the impact of US and Euro area macroeconomic news was investigated. All the twelve markets investigated were found to be affected by the foreign news, typically by a combination of the US and the European shocks. Overall, the study came to the conclusion that on the CEEC-3 the importance of US shocks have reduced over time and euro area influence has deepened in these countries. (Hans Franses and Mees, 2010) found a very limited effect of the Chinese news as compared to the US news on the world stock markets. The relative size of the Chinese economy as compared to the US economy may be a plausible explanation for the fact that stock markets respond more often to US news (19.8%) than to Chinese news (12.5%). (Büttner, Hayo and Neuenkirch, 2011) studied the impact of Japan and the US macroeconomic announcements on the stock market volatility in Asia-Pacific region (Australia, South-Korea, Hong Kong and Japan) was studied. On conditional (GARCH) stock market volatility international macroeconomic news announcements have an economically large and a statistically significant impact. As compared to Japanese announcements, U.S. announcements are more important, even for Japan. On implied volatilities the impact of international macroeconomic announcements was found to be very weak, this conclusion was not altered by separating small from big surprises and bad from good news.

We found only one study which examined the impact of macroeconomic conditions of countries other than U.S. on the domestic stock market prices. (Fedorova, Wallenius and Collan, 2014) investigated the impact of macroeconomic announcements of the Euro area on CIVETS stock markets was studied. CIVETS stands for Colombia, Indonesia, Vietnam, Egypt, Turkey and South Africa. In response to the EA macroeconomic news all CIVETS stock markets reacted thus we can conclude that there exists market integration between the euro area and the CIVETS markets. Therefore, when investing in CIVETS, EU can be considered as a potential risk factor.

In the Indian context, the studies which examined the impact of domestic macro economy are many but very few studies have taken into countries the macroeconomic conditions of the other countries and studied their impact on the stock market of India. (Mukherjee and Roy, 2016) examined the role of international and domestic financial variables in driving the stock market returns in India. Not having significant impact before 2008, foreign institutional investors started to have significant impact on the returns of Indian stock market after 2008. The stock market returns of India were also affected by international interest rates, US equity market returns and the returns of the stock markets of emerging and major Asian economies. (Aggarwal and Saqib, 2017) examined the impact of the macroeconomic variables of US on the stock market of India. Interest rate of US, Gross Domestic Product of US and S&P 500 index, these were the variables taken as representing the economic condition of the US. All the three variables were found to be significantly affecting the Indian stock market, GDP US and S&P 500 were

found to be having a positive relationship with the Indian stock market whereas interest rate of the US was found to be having a negative relationship.

There are many studies which examined the impact of the global macroeconomic factors and studied their impact on the financial markets of BRICS, emerging economies and Asian financial markets. These studies gave some crucial insights about the Indian financial market as well in their findings. (Mensi, Hammoudeh, Reboredo and Nguyen, 2014) examined the relationship of the BRICS countries with the US stock market and oil price. The S&P 500 index was taken as representing the US stock market and WTI crude oil obtained from EIA (Energy Information Administration) was taken as representing the world Oil price. Special sensitivity was shown by India to higher oil prices. To the U.S. S&P 500 index, the economic risk of India was not found to be responsive. (Mens et. al., 2015) examined the dependence of the stock markets of the emerging markets of the BRICS on the global economic factors. The global economic factors were represented by the U.S. economic policy uncertainty index, the implied volatility of the S&P 500 index, the gold price, the WTI crude oil price and the S&P 500 stock returns. It was concluded that except with respect to the Oil prices, Indian stock market remained unaffected by the global financial crisis. (Dong and Yoon, 2019) spilled a dynamic model averaging (DMA) approach to investigate the impact on the emerging Asian stock market returns of the global economic factors. It was found that in the beginning period the information transmission running from developed stock markets to India was relatively weak as compared to other emerging Asian markets. Of all the global factors analysed in the study US exchange rate was found to be having second strongest relationship with Indian stock market and other emerging Asian stock markets.

The reasons to expand the current literature on this area in the Indian context are many. The studies which have been done till date are majorly concentrated on finding the impact of only the U.S's economy on the financial market of India, the impact of the economies of other major trading partners of India and the impact of the neighbouring economies have been completely overlooked. This study will try to fill this key gap in the literature in this area. The studies which have been done in this area in the context of India have explored the impact of global economy by taking financial markets of BRICS, Asian economies and emerging financial markets. The conclusion which these studies gave was not exclusive for the Indian financial market, this study by concentrating only on the Indian financial market will try to fill this another major gap in the literature. Volatility modelling is the technique which has been largely used by the studies in this area both in the context of Indian and other countries. The techniques which explore the long-run relationship between global macroeconomic factors and the domestic stock market have been overlooked by the researchers. By using multivariate and bivariate Johansen Cointegration and VECM models, this study tried to fill this gap in the literature.

3. Economic relationship of India with selected countries:

3.1. US:

Based on increasing convergence of interests on global, regional and bilateral issues and shared democratic values, India-U.S. bilateral relations have developed into a "global strategic partnership". In 2016,

bilateral trade in goods and services between India-US increased to USD 114 billion from USD 104 billion in 2014. A commitment has been made by both countries to facilitate actions necessary for increasing bilateral trade to USD 500 billion. Encouraging growth trajectory has been shown by bilateral merchandise in 2017. Making the US the fifth-largest source of foreign direct investments into India, from April 2000 to December 2015, the cumulative FDI inflows from the US constituted 6% of the total FDI in India with a value of about USD 17.94 billion.

3.2. UAE:

Based on age-old religious, cultural and economic ties, India and the United Arab Emirates (UAE) enjoy strong bonds of friendship. With the creation of UAE federation in 1971, the relationship flourished. Making India the largest trading partner of UAE in 2016-17, India-UAE trade was around USD 52 billion. While after China and US, UAE is the third-largest trading partner of India and the second-largest export destination.

During March 2016, an estimated USD 8 billion UAE investment was made in India of which in the form of foreign direct investment was made USD 4.03 billion and remaining was made in the form of portfolio investment. In terms of FDI, UAE is the tenth biggest investor in India.

3.3. Germany:

Marked by a high degree of mutual respect and trust, bilateral relations between Germany and India are founded on common democratic principles. After the Second World War, with the Federal Republic of Germany India was amongst the first countries to establish democratic ties. In Europe, Germany is India's largest trading partner. During 2016, in Germany's global trade India was ranked 24th. In 2016, €17.42 was the value of the total bilateral trade. Good potential for collaboration is held by knowledge-driven sectors apart from the traditional sectors. Since January 2000, in India Germany is the 7th largest foreign direct investor. USD 1.1 billion was the value of German FDI in 2016 in India. From April 2000 until September 2017, in India Germany's total FDI amounted to USD 10.63 billion.

For several decades, Germany has been an important development cooperation partner. €15.93 billion is the amount of total bilateral financial and technical cooperation since it began in 1958.

3.4. China:

With the People's Republic of China on 1 April 1950, to establish diplomatic relations India became the first non-socialist bloc country. In the last few years, between India and China, the trade and Economic relationship has seen rapid growth. As India's largest "Goods trading partner", China replaced the United States in 2008 as bilateral trade between the two countries reached USD 51.8 billion. In 2016, India was the 27th largest exporter to China and 7th largest export destination for Chinese products.

At US\$ 4.91 billion, until March 2017 stood the Chinese cumulative investment in India. To US\$ 705 million reached the Indian cumulative investment in China until March 2017.

3.5. Saudi Arabia:

Reflecting the centuries-old socio-cultural and economic ties, Saudi Arabia and India enjoy friendly and cordial relations. After China, USA and Japan, today Saudi Arabia is India's fourth-largest trade partner and is a major source of energy as around 17% of our crude oil requirement is fulfilled from the kingdom. Destination to 1.85% of global exports of India, Saudi Arabia is the 15th largest market for Indian exports in the world (2017-18). Of India's global imports, Saudi Arabia with a 4.74% share is the 3rd largest source (2017-18). Accounting for 8.88% of Saudi Arabia's global exports, India is the 4th largest market for Saudi Arabia's exports, as per 2017 data. Source of around 4.13% of Saudi Arabia's total imports, India ranks 7th in terms of imports by Saudi Arabia.

Till December 2017, according to SAGIA (Saudi Arabian General Investment Authority), in the kingdom, there are 322 Indian companies of worth USD 1.4 billion as joint ventures/100% owned entities.

3.6. Japan:

Rooted in spiritual affinity and strong civilizational and cultural ties, the friendship between Japan and India has a long history.

The largest bilateral donor for India, since 1958, Japan has been extending grant assistance and bilateral loan to India. With an increase of 80% over the last year, in the fiscal year 2016-17, Japanese FDI in India was USD 4.7 billion and Japan stood as a third-largest foreign investor in India. USD 25.7 billion since 2000, was Japan's cumulative investment in India. The highest in last few years, in 2015-16, out of a committed amount of JPY 400 billion ODA disbursed by Japan to India was JPY 390 billion. There has been a steady increase in the presence of Japanese companies in India. As compared to 1,229 in October 2015, there were 1,305 Japanese companies that are registered in India, as of October 2016, a 6% growth from last year with an increase of 76 companies.

3.7. UK:

Bound by strong historical ties the United Kingdom and India share a modern partnership. In the list of India's top 25 trading partners, UK ranked 15th during the year 2016-17 and is regarded as India's major trading partner.

Accounting for around 7% of all foreign direct investment into India, with a cumulative equity investment of USD 25.31 billion, after Mauritius, Singapore and Japan UK is the 4th largest inward investor in India (April 2000 to December 2017). Having created over 110,000 jobs in the UK by the Indian companies, India emerged as the second-largest international job creator in the UK and continued to be the third-largest investor in the UK. With chemical and pharmaceuticals sector mapping 24% of the India-tracker, technical and telecom sector accounting for 31% share, £47.5 billion is the total consolidated revenue of Indian companies in the UK. Almost 10% of the 800 India focused and Indian companies based in the UK are listed on the London stock exchange.

3.8. Pakistan:

Trade flourishes between nations in an environment free from violence and terrorism. India and Pakistan have failed to maintain peaceful relations with each other because of which there have been severely limited and disrupted initiatives taken from both sides to build a stable bilateral economic and trade relationship. Touched a peak of USD 2.7 billion in 2013-14, India-Pakistan bilateral trade dropped marginally in 2014-15 to USD 2.35 billion. Showed a slight increase in 2015-16 to USD 2.61, the bilateral trade in 2016-17 witnessed a slight drop to USD 2.28 billion, with imports from Pakistan to India of USD 456.33 million and exports from India of USD 1.83 billion. When it touched to USD 541.87 billion in 2012-13, since then the imports from Pakistan have shown a gradual declining trend.

In 2012, India took a decision to allow investment from Pakistan which was welcomed by Pakistan. On August 22, 2012, RBI notified the decision to allow investment from Pakistan in convertible debentures and shares. Restrictions on investment in Pakistan from India were removed by RBI in September 2012.

3.9. France:

Traditionally close and friendly relations have been enjoyed by India and France. Both France and India have important bilateral trade and investments and commercial cooperation. With a total turnover of USD 20 billion almost 1000 French companies are present in India. More than 25 R&D centres are there in India of the French companies. From April 2000 to October 2017 with a cumulative investment of USD 6.09 billion in India France is the ninth-largest foreign investor. With an estimated investment stock of 1 billion Euro, in France, about 120 Indian companies are present employing 7000 people. With an increase of 24.6% from previous year India France bilateral trade in goods stood at € 10.69 billion in 2017. Up by 14.49%, valued at € 5.35 billion were India's exports to France. During the same period, valued at €5.344 billion French exports to India increased by 36.69%. However, with India's exports to France being a meagre 0.99% of France total exports, the overall volume of bilateral trade remains low. For the year 2016 bilateral trade in services stood at € 3.14 billion with Indian exports standing at € 1.70 billion was in India's favour.

3.10. Bangladesh:

To recognize Bangladesh as an independent and separate state, India was the first country and after Bangladesh's independence in December 1971 diplomatic relations were established by India with the country immediately. Over the last decade, bilateral trade between Bangladesh and India has grown steadily. From USD 7 billion to USD 9 billion, India's exports to Bangladesh grew by 28.5% in the last three years, from 2015-16 to 2017-18. In 2017-18, bilateral trade stood at USD 9.14 billion. During the financial year, 2017-18 imports from Bangladesh stood at USD 0.68 billion and at USD 8.46 billion were India's exports to Bangladesh.

From USD 243.91 million in 2014 to USD 516.71 million in 2017, net FDI flow to Bangladesh was doubled in the last three years. Amounting to USD 8 billion, in the last 7 years, 3 lines of credit have been extended to Bangladesh by India making till date Bangladesh the biggest development partner of India.

4. Data and Methodology:

The period of analysis was according to the availability of data, for CPI 2011 October to 2018 December, for exchange rate 2005 February to 2019 January, for interest rate 2015 March to 2018 December, for money supply 2010 December to 2018 December and for IIP 2008 December to 2018 December. The research methodology used has been Bivariate and multivariate Johansen co-integration and VECM tests for the long-run analysis, Granger causality for the short-run and GARCH (1, 1) modelling for the volatility approach. All the data has been collected from data.worldbank.org.

5. Empirical Estimation:

5.1. Model Specification:

To investigate the impact of macroeconomic factors of other countries on the Indian stock market, following general specifications have been used:

$$LS\&PSENSEPP = \alpha_0 + \alpha_1 LCPIBANGLADESH + \alpha_2 LCPICHINA + \alpha_3 LCPIFRANCE + \alpha_4 LCPIGERMANY + \alpha_5 LCPIJAPAN + \alpha_6 LCPIPAKISTAN + \alpha_7 LCPIAUDIARABIA + \alpha_8 LCPIUAE + \alpha_9 LCPIUK + \alpha_{10} LCPIUSA + \varepsilon_t \quad (5.1.1)$$

Where, LCPIBANGLADESH is the log value of CPI Bangladesh.

LCPICHINA is the log value of CPI China.

LCPIFRANCE is the log value of CPI France.

LCPIGERMANY is the log value of CPI Germany.

LCPIJAPAN is the log value of CPI Japan.

LCPIPAKISTAN is the log value of CPI Pakistan.

LCPIAUDIARABIA is the log value of CPI Saudi Arabia.

LCPIUAE is the log value of CPI UAE.

LCPIUK is the log value of CPI UK.

LCPIUSA is the log value of CPI USA.

α_0 is the constant of the model.

ε_t is the error term.

$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7, \alpha_8, \alpha_9, \alpha_{10}$ denotes the coefficients of the independent variables.

$$LS\&PSENSEPP = \alpha_0 + \alpha_1 LERBANGLADESH + \alpha_2 LERCHINA + \alpha_3 LERJAPAN + \alpha_4 LERPAKISTAN + \alpha_5 LERSAUDIARABIA + \alpha_6 LERUAE + \alpha_7 LERUK + \varepsilon_t \quad (5.1.2)$$

Where, LERBANGLADESH is the log value of exchange rate of Bangladesh.

LERCHINA is the log value of exchange rate of China.

LERPAKISTAN is the log value of the exchange rate of Pakistan.

LERSAUDIARABIA is the log value of the exchange rate of Saudi Arabia.

LERUAE is the log value of the exchange rate of UAE.

LERUK is the log value of the exchange rate of the UK.

α_0 is the constant of the model.

ε_t is the error term.

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

$$LS\&PSENSEPP = \alpha_0 + \alpha_1 LIIPCHINA + \alpha_2 LIIPPAKISTAN + \alpha_3 LIIPUAE + \varepsilon_t \quad (5.1.3)$$

Where, LIIPCHINA is the log value of the IIP of China.

LIIPPAKISTAN is the log value of the IIP of Pakistan.

LIIPUAE is the log value of the IIP of the UAE.

α_0 is the constant of the model.

ε_t is the error term.

$\alpha_1, \alpha_2, \alpha_3$ denotes the coefficients of the independent variables.

$$LS\&PSENSEPP = \alpha_0 + \alpha_1 LIRBANGLADESH + \alpha_2 LIRFRANCE + \alpha_3 LIRGERMANY + \alpha_4 LIRJAPAN + \alpha_5 LIRUK + \varepsilon_t \quad (5.1.4)$$

Where, LIRBANGLADESH is the log value of the interest rate of Bangladesh.

LIRFRANCE is the log value of the interest rate of France.

LIRGERMANY is the log value of the interest rate of Germany.

LIRJAPAN is the log value of the interest rate of Japan.

LIRUK is the log value of the interest rate of the UK.

α_0 is the constant of the model.

ε_t is the error term.

$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ denotes the coefficients of the independent variables.

$$LS\&PSENSEPP = \alpha_0 + \alpha_1 LMSCHINA + \alpha_2 LMSFRANCE + \alpha_3 LMSGERMANY + \alpha_4 LMSJAPAN + \alpha_5 LMSPAKISTAN + \alpha_6 LMSSAUDIARABIA + \alpha_7 LMSUAE + \alpha_8 LMSUK + \alpha_9 LMSUSA + \varepsilon_t$$

(5.1.5)

Where, LMSCHINA is the log value of the money supply of China.

LMSFRANCE is the log value of the money supply of France.

LMSGERMANY is the log value of the money supply of Germany.

LMSJAPAN is the log value of the money supply of Japan.

LMSPAKISTAN is the log value of the money supply of Pakistan.

LMSSAUDIARABIA is the log value of the money supply of Saudi Arabia.

LMSUAE is the log value of the money supply of the UAE.

LMSUK is the log value of the money supply of the UK.

LMSUSA is the log value of the money supply of the USA.

α_0 is the constant of the model.

ε_t is the error term.

$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7, \alpha_8, \alpha_9$ denotes the coefficients of the independent variables.

$$LS\&PSENSEPP = \alpha_0 + \alpha_1 LGDPCHINA + \alpha_2 LGDPFRANCE + \alpha_3 LGDPJAPAN + \alpha_4 LGDPUK + \alpha_5 LGDPUS + \varepsilon_t$$

(5.1.6)

Where, LGDPCHINA is the log value of the GDP of China.

LGDPFRANCE is the log value of the GDP of France.

LGDPJAPAN is the log value of the GDP of Japan.

LGDPUK is the log value of the GDP of the UK.

LGDPUS is the log value of the GDP of the US.

α_0 is the constant of the model.

ε_t is the error term.

$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ denotes the coefficients of the independent variables.

5.2. Johansen Cointegration and VECM analysis:

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

$$y_t = \mu_t + \tilde{y}_t \quad (5.2.1)$$

where μ_t represents the deterministic part and \tilde{y}_t the stochastic part.

In this case, it is assumed that \tilde{y}_t has a VAR or VECM representation as in (5.2.1) and (5.2.2).

Further, to present the co-integration tests, let us assign $\mu_t = \mu_0 + \mu_1 t$ so that

$$y_t = \mu_0 + \mu_1 t + \tilde{y}_t \quad (5.2.2)$$

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

Case (1): $\mu_1 = 0$ arbitrary and $\mu_0 \neq 0$ i.e., there is no deterministic trend term, however a constant mean exists;

Case (2): A linear deterministic term in the DGP so that $\mu_1 \neq 0$

$$\mu_1 \neq 0;$$

Case (3): Both $\| \cdot \|_0$ and $\| \cdot \|_1$ are arbitrary.

First, case one is considered. In this demonstration, $y_t = \beta_0 + \bar{y}_t$, and hence $\Delta y_t = \Delta \bar{y}_t$. Consequently, taking into account the VECM of y_t , VECM of y_t take up the following two forms – the mean adjusted form attributable to (Saikkonen and Luukkonen, 1997) and (Saikkonen and Lutkepohl, 2000) (equation (5.2.3) below), and the Johansen (1995) intercept form (equation (5.2.4) below).

$$\Delta y_t = \mu^* + \Pi y_{t-1} + \sum_{ii=1}^{p-1} \Gamma_{ii} \Delta y_{t-ii} + u_t = \Pi^* y_{t-1} + \sum_{ii=1}^{p-1} \Gamma_{ii} \Delta y_{t-ii} + u_t \quad (5.2.3)$$

and
$$\Delta y_t = \Pi (y_{t-1} - \mu_0) + \sum_{ii=1}^{p-1} \Gamma_{ii} \Delta y_{t-ii} + u_t \quad (5.2.4)$$

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

It is obvious that both VECM versions can be used to test the rank of co-integration. Johansen (1995) considered the intercept version (5.2.4) and he and (Osterwald-Lenum, 1992) have presented the critical values for the LR test called the trace test. Table 3.2.1 gave the results of the multivariate Johansen Juselius Cointegration and VECM tests.

5.2.1. Multivariate Analysis:

Table 5.2.1 presented the results of the multivariate Johansen Cointegration and VECM tests. The CPI of other countries and Sensex were found to be sharing 5 long-run co-integrating equations with each other. Exchange rate of other countries and Sensex had 2 co-integrating equations with each other. 1 co-integrating equation was shared by Sensex and IIP of other countries. Sensex and interest rate of other countries too shared 1 co-integrating equation with each other. The money supply of other countries and Sensex shared 3 co-integrating equations and 6 long-run co-integrating equations were shared by the GDP of other countries and Sensex.

The long-run causality was found to be running to Sensex from the only GDP of other countries. Money supply, Interest rate, IIP, Exchange rate and CPI of other countries failed to show long-run causality towards Sensex. In other words, the only GDP of other countries found to be affecting the Sensex in the long-run, the money supply, interest rate, IIP, exchange rate and CPI of other countries failed to show any effect on the Sensex in the long-run.

Table 5.2.1. Multivariate Johansen Juselius Cointegration and VECM modelling.

1. CPI.

Series: SENSEX CPI BANGLADESH CPI CHINA CPI FRANCE CPI GERMANY CPI JAPAN CPI PAKISTAN
CPI SAUDIARABIA CPI UAE CPI UK CPI USA

Dependent Variable: D(SENSEX)

Lags interval (in first differences): 1 to 2

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) Statistic	t- (C1) Prob.
398.015***	0.000	5	0.024	1	0.32

2. Exchange Rate.

Series: SENSEX ER BANGLADESH ER CHINA ER FRANCE ER JAPAN ER PAKISTAN ER SAUDIARABIA
ER UAE ER UK

Dependent Variable: D(SENSEX)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) Statistic	t- (C1) Prob.
262.604***	0.000	2	-0.00222	-0.39	0.696

3. IIP.

Series: SENSEX IIP CHINA IIP PAKISTAN IIP USA

Dependent Variable: D(SENSEX)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) Statistic	t- (C1) Prob.
65.237***	0.000	6	0.000**	2.612	0.014

4. Interest Rate.

Series: SENSEX IR BANGLADESH IR FRANCE IR GERMANY IR JAPAN IR UK

Dependent Variable: D(SENSEX)

Lags interval (in first differences): 1 to 1.

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) Statistic	t- (C1) Prob.
110.160***	0.003	1	-0.003	-1.155	0.256

5. Money Supply.

Series: SENSEX MS CHINA MS FRANCE MS GERMANY MS JAPAN MS PAKISTAN MS SAUDIARABIA MS UAE MS UK

Dependent Variable: D(SENSEX)

Lags interval (in first differences): 1 to 2

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) Statistic	t- (C1) Prob.
246.546***	0.000	3	-0.024	-0.648	0.518

6. GDP.

Series: CLOSE GDP CHINA GDP FRANCE GDP JAPAN GDP UK GDP US

Dependent Variable: D(SENSEX)

Lags interval (in first differences): 1 to 4

A. JC			B. VECM		
(None) Trace Statistic	(None) Prob.	No. of CE(s)	C(1) Coefficient	(C1) Statistic	t- (C1) Prob.
132.588***	0.000	6	-0.061***	-2.699	0.008

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

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

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

5.2.2. Bivariate Analysis:

Table 5.2.2 presented the results of the Bivariate Johansen Cointegration and VECM modelling. Under bivariate Johansen co-integration analysis, the CPI of none of the country found to be sharing the long-run relationship with the Sensex. The exchange rate (with respect to the US dollar) of Germany, Pakistan, Saudi Arabia, UAE and UK were found to be sharing long-run co-integration with the Sensex. But the long-run causality was only found to be running from the exchange rate of Germany, Pakistan and UK towards the Sensex. The IIP of only Pakistan was found to be having a long-run co-integrating relationship with Sensex. But with even from IIP of Pakistan the long-run causality was failed to be running towards the Sensex.

When analysing the interest rate of other countries, only Japan's interest rate was found to be sharing long-run co-integrating relationship with Sensex. Long-run causality was also found to be running from Japan's interest rate towards Sensex in the bivariate VECM analysis. The money supply of China, Saudi Arabia and the US shared long-run co-integrating relationship with the Sensex. Long-run causality was found to be running from the money supply of China and the US towards the Sensex. GDP of none of the country was found to be sharing long-run relationship with the Sensex.

Table 5.2.2: Bivariate: Johansen Cointegration and Vector Error Correction Modelling (VECM).**1. CPI of other countries.****A. Non-Cointegrated Series.**

Series	(None) Trace Statistic	(None) Prob.
Sensex CPI Bangladesh	6.526	0.633
Sensex CPI China	9.690	0.305
Sensex CPI France	5.964	0.699
Sensex CPI Germany	6.553	0.630
Sensex CPI Japan	10.16	0.268
Sensex CPI Pakistan	11.202	0.199
Sensex CPI Saudi Arabia	4.153	0.890
Sensex CPI UAE	6.950	0.583
Sensex CPI UK	7.025	0.574
Sensex CPI USA	6.216	0.669

2. Exchange Rate (with respect to US dollar) of other countries.**A. Non-Cointegrated Series.**

Series	(None) Trace Statistic	(None) Prob.
Sensex ER Bangladesh	14.170	0.078
Sensex ER China	11.64	0.175
Sensex ER Japan	8.696	0.394

B. Cointegrated Series

Series	JC		VECM		
	(None) Trace Statistic	(None) Prob.	(C1) Coefficient	C(1) T-statistic	C(1) P value
Sensex ER Germany	15.739**	0.045	-0.030***	-3.562	0.000
Sensex ER Pakistan	16.099**	0.040	-0.052***	-2.958	0.003
Sensex ER Saudi Arabia	31.181***	0.000	-0.000	-0.632	0.527
Sensex ER UAE	18.111**	0.019	0.000	0.382	0.702
Sensex ER UK	17.082**	0.028	-0.048***	-3.816	0.000

3. IIP of other countries.**A. Non-Cointegrated Series.**

Series	(None) Trace Statistic	(None) Prob.
Sensex IIP China	8.876	0.376
Sensex IIP Japan	7.251	0.548

Sensex IIP USA	8.481	0.415
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B. Cointegrated Series

Series	JC		VECM		
	(None) Trace Statistic	(None) Prob.	(C1) Coefficient	C(1) T-statistic	C(1) P value
Sensex IIP Pakistan	19.024**	0.014	0.006	0.817	0.415

4. Interest Rate of other countries.**A. Non-Cointegrated Series.**

Series	(None) Trace Statistic	(None) Prob.
Sensex IR Bangladesh	7.982	0.467
Sensex IR France	11.107	0.205
Sensex IR Germany	9.472	0.323
Sensex IR UK	10.224	0.263

B. Cointegrated Series

Series	JC		VECM		
	(None) Trace Statistic	(None) Prob.	(C1) Coefficient	C(1) T-statistic	C(1) P value
Sensex IR Japan	22.178***	0.004	-0.058**	-2.067	0.045

5. Money Supply of other countries.**A. Non-Cointegrated Series.**

Series	(None) Trace Statistic	(None) Prob.
Sensex MS France	6.120	0.681
Sensex MS Germany	7.503	0.519
Sensex MS Japan	8.074	0.457
Sensex MS Pakistan	11.929	0.160
Sensex MS UAE	12.414	0.138
Sensex MS UK	5.604	0.741

B. Cointegrated Series

Series	JC		VECM		
	(None) Trace Statistic	(None) Prob.	(C1) Coefficient	C(1) T-statistic	C(1) P value
Sensex MS China	18.811**	0.015	-0.066**	-2.357	0.020
Sensex MS Saudi Arabia	20.541***	0.007	-0.027	-1.981	0.050
Sensex MS USA	16.277**	0.038	-0.091***	-2.730	0.007

6. GDP of other countries.**A. Non-Cointegrated Series.**

Series	(None) Trace Statistic	(None) Prob.
Sensex GDP China	9.250	0.342
Sensex GDP France	14.663	0.066
Sensex GDP Japan	8.735	0.390

Sensex UK	11.246	0.196
Sensex USA	8.983	0.366

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

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

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

5.3. Short-run Granger Causality Tests:

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

$$\begin{aligned} \Delta y_{1t} &= \alpha_{1ii} + \sum_{ii=1}^p \beta_{1ii} \Delta y_{1t-ii} + \sum_{ii=1}^p \gamma_{2ii} y_{2t-ii} + \varepsilon_{1t} \\ \Delta y_{2t} &= \alpha_{2ii} + \sum_{ii=1}^p \beta_{2ii} \Delta y_{2t-ii} + \sum_{ii=1}^p \gamma_{1ii} y_{1t-ii} + \varepsilon_{2t} \end{aligned} \tag{5.3.1}$$

Where Δy_{1t} and Δy_{2t} are the first differences of time series under investigation; $\alpha_{1ii}, \beta_{1ii}, \gamma_{2ii}, \alpha_{2ii}, \beta_{2ii}, \gamma_{1ii}$ and $\varepsilon_{1t}, \varepsilon_{2t}$ are parameters to be estimated and, ε_{1t} and ε_{2t} are white noise error terms.

Table 5.3.1 presented the results of the Granger Causality tests. Under the granger causality test, short-run causality was examined of the variables towards the Sensex. The CPI of none of the country was found to be granger causing the Sensex. The exchange rate (with respect to the US dollar) of the UK, Pakistan and Saudi Arabia were found to be affecting the Sensex in the short-run. The GDP, interest rate and IIP of none of the country showed any effect on the Sensex in the short-run. The money supply of only France was found to be affecting the Sensex in the short-run.

Table 5.3.1: Pairwise Granger Causality Tests.

1. CPI of other countries:

Null Hypothesis:	F-Statistic	Prob.	Decision
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CPI BANGLADESH dnc SENSEX	0.809	0.546	Accepted
CPI CHINA dnc SENSEX	0.635	0.673	Accepted
CPI FRANCE dnc SENSEX	0.943	0.458	Accepted
CPI GERMANY dnc SENSEX	0.374	0.864	Accepted
CPI JAPAN dnc SENSEX	0.737	0.597	Accepted
CPI PAKISTAN dnc SENSEX	0.667	0.649	Accepted
CPI SAUDIARABIA dnc SENSEX	0.703	0.622	Accepted
CPI UAE dnc SENSEX	0.411	0.839	Accepted
CPI UK dnc SENSEX	1.461	0.212	Accepted
CPI USA dnc SENSEX	0.634	0.674	Accepted

2. Exchange Rate (with respect to US dollar) of other countries:

Null Hypothesis:	F-Statistic	Prob.	Decision
ER BANGLADESH dnc SENSEX	0.841	0.522	Accepted
ER CHINA dnc SENSEX	0.356	0.877	Accepted
ER FRANCE dnc SENSEX	1.174	0.324	Accepted
ER GERMANY dnc SENSEX	1.174	0.324	Accepted
ER JAPAN dnc SENSEX	0.418	0.835	Accepted
ER PAKISTAN dnc SENSEX	2.663**	0.024	Rejected
ER SAUDIARABIA dnc SENSEX	4.504***	0.000	Rejected
ER UAE dnc SENSEX	1.286	0.272	Accepted
ER UK dnc SENSEX	2.211*	0.055	Rejected

3. IIP of other countries:

Null Hypothesis:	F-Statistic	Prob.	Decision
IIP CHINA dnc SENSEX	0.395	0.850	Accepted
IIP JAPAN dnc SENSEX	1.854	0.121	Accepted
IIP PAKISTAN dnc SENSEX	1.224	0.307	Accepted
IIP USA dnc SENSEX	1.499	0.196	Accepted

4. Interest Rate of other countries:

Null Hypothesis:	F-Statistic	Prob.	Decision
IR BANGLADESH dnc SENSEX	0.695	0.631	Accepted
IR FRANCE dnc SENSEX	0.345	0.880	Accepted
IR GERMANY dnc SENSEX	1.308	0.286	Accepted
IR JAPAN dnc SENSEX	0.377	0.860	Accepted
IR UK dnc SENSEX	0.560	0.729	Accepted

5. Money Supply of other countries:

Null Hypothesis:	F-Statistic	Prob.	Decision
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MS CHINA dnc SENSEX	1.183	0.324	Accepted
MS FRANCE dnc SENSEX	2.745**	0.024	Rejected
MS GERMANY dnc SENSEX	1.226	0.303	Accepted
MS JAPAN dnc SENSEX	0.574	0.719	Accepted
MS PAKISTAN dnc SENSEX	0.807	0.547	Accepted
MS SAUDIARABIA dnc SENSEX	1.157	0.337	Accepted
MS UAE dnc SENSEX	0.835	0.528	Accepted
MS UK dnc SENSEX	0.502	0.773	Accepted
MS USA dnc SENSEX	0.240	0.943	Accepted

6. GDP of other countries:

Null Hypothesis:	F-Statistic	Prob.	Decision
GDP CHINA dnc CLOSE	0.184	0.967	Accepted
GDP FRANCE dnc CLOSE	1.343	0.253	Accepted
GDP JAPAN dnc CLOSE	0.219	0.953	Accepted
GDP UK dnc CLOSE	0.227	0.949	Accepted
GDP US dnc CLOSE	0.353	0.879	Accepted

Notes: ***implies significant at 1% level, **implies significant at 5% level, *implies significant at 10% level
 dnc = do not Granger cause.

5.4. Volatility Modelling:

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

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

$$\begin{aligned}
 \varepsilon_t &= v_t \sqrt{h_t} \text{ where } \varepsilon_t | \Omega_{t-1} \sim N(0, h_t^2) \text{ and } v_t \sim N(0,1) \\
 h_t^2 &= \alpha_0 + \sum_{ii=1}^q \alpha_{ii} \varepsilon_{t-ii}^2 + \sum_{jj=1}^p \beta_{jj} h_{t-jj}^2 \tag{5.4.1} \\
 \alpha_0 > 0, \alpha_{ii}, \beta_{jj} &\geq 0 \rightarrow h_t^2 \geq 0, ii = 1, \dots, q, \text{ and } jj = 1, \dots, p
 \end{aligned}$$

where Ω_{t-1} is the set of all information available at time $t-1$. The GARCH (p, q) process defined above is stationary when $\sum_{ii} \alpha_{ii} + \sum_{jj} \beta_{jj} < 1$. A function of 3 terms, defined in equation (5.4.1), is the conditional variance of the GARCH model. The first term is the mean of yesterday's forecast ω . The second term is lag of the squared residuals obtained from the mean equation, ε_{t-ii}^2 or the ARCH terms. The ARCH terms represent the news (information) about volatility from the previous period that has a weighted impact on the current conditional volatility; it declines gradually and never reaches zero. The third term is the GARCH

term, h_{t-1}^2 ensuring the impact of last period's forecast variance. It is important to notice that these three parameters, namely, α_1 , α_2 and β_1 are restricted to be non-negative to ensure positive values for the conditional variance or $h_t^2 \geq 0$.

Table 5.4.1 presented the results of the volatility modelling. Quite similar to the results of the Granger causality tests, under Garch modelling too the CPI and interest rate of all the countries failed to show any effect on the volatility of the Sensex. The exchange rate of Germany, IIP of Japan and Pakistan, the money supply of France and UAE and the GDP of the US were found to be affecting the volatility of the Sensex.

Table 5.4.1 : GARCH (1,1)

Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)

Presample variance: backcast (parameter = 0.7)

1. CPI of other countries.

Dependent Variable: SENSEX

GARCH = C(12) + C(13)*RESID(-1)^2 + C(14)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CPI Bangladesh	-0.542	0.452	-1.200	0.230
CPI China	-1.003	1.474	-0.680	0.496
CPI France	-0.011	0.981	-0.011	0.991
CPI Germany	0.326	1.087	0.300	0.764
CPI Japan	1.216	1.214	1.001	0.317
CPI Pakistan	0.910	0.613	1.485	0.138
CPI Saudi Arabia	-0.087	0.954	-0.091	0.927
CPI UAE	1.472	0.958	1.537	0.124
CPI UK	-1.866	1.312	-1.422	0.155
CPI USA	-1.390	1.486	-0.936	0.349

2. Exchange Rate (with respect to US dollar) of other countries.

Dependent Variable: SENSEX

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

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ER Bangladesh	1.091	0.580	1.882	0.060
ER China	0.240	0.469	0.511	0.609
ER Germany	-0.580**	0.274	-2.119	0.034
ER Japan	0.340	0.187	1.815	0.070
ER Pakistan	0.215	0.261	0.821	0.412

ER Saudi Arabia	-16.893	9.390	-1.799	0.072
ER UAE	38.074	51.573	0.738	0.460
ER UK	0.088	0.296	0.298	0.766

3. IIP of other countries.

Dependent Variable: SENSEX

$$\text{GARCH} = \text{C}(5) + \text{C}(6) * \text{RESID}(-1)^2 + \text{C}(7) * \text{GARCH}(-1)$$

Variable	Coefficient	Std. Error	z-Statistic	Prob.
IIP China	0.036	0.059	0.609	0.543
IIP Japan	0.024***	0.000	2840.471	0.000
IIP Pakistan	0.021***	0.005	4.187	0.000
IIP USA	0.030	0.025	1.236	0.216

4. Interest Rate of other countries.

Dependent Variable: SENSEX

$$\text{GARCH} = \text{C}(6) + \text{C}(7) * \text{RESID}(-1)^2 + \text{C}(8) * \text{GARCH}(-1)$$

Variable	Coefficient	Std. Error	z-Statistic	Prob.
IR Bangladesh	-0.546	0.444	-1.231	0.218
IR France	-0.205	0.241	-0.850	0.395
IR Germany	0.046	0.033	1.384	0.167
IR Japan	-0.020	0.019	-1.076	0.282
IR UK	-0.013	0.068	-0.199	0.842

5. Money Supply of other countries.

Dependent Variable: SENSEX

$$\text{GARCH} = \text{C}(10) + \text{C}(11) * \text{RESID}(-1)^2 + \text{C}(12) * \text{GARCH}(-1)$$

Variable	Coefficient	Std. Error	z-Statistic	Prob.
MS China	0.251	0.395	0.636	0.525
MS France	0.805***	0.035	23.074	0.000
MS Germany	0.257	0.558	0.460	0.646
MS Japan	-0.925	0.868	-1.066	0.287
MS Pakistan	-0.250	0.224	-1.112	0.266
MS Saudi Arabia	-0.121	0.346	-0.350	0.727
MS UAE	0.977***	0.259	3.775	0.000
MS UK	-0.631	0.508	-1.243	0.214
MS USA	-0.375	0.687	-0.545	0.586

6. GDP of other countries.

Dependent Variable: CLOSE

$$\text{GARCH} = \text{C}(6) + \text{C}(7) * \text{RESID}(-1)^2 + \text{C}(8) * \text{GARCH}(-1)$$

Variable	Coefficient	Std. Error	z-Statistic	Prob.
GDP China	-0.128	0.098	-1.310	0.190
GDP France	-2.348	2.086	-1.125	0.260
GDP Japan	0.338	0.313	1.078	0.281
GDP UK	-0.404	0.661	-0.612	0.541
GDP US	4.275***	1.345	3.178	0.002

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

6. Analysis of the empirical estimation:

6.1. Bangladesh: a very weak or no influence was found of the economic environment of Bangladesh on the Indian stock market. None of the macroeconomic factors of Bangladesh was found to be making an impact on the stock returns of India both in the short-run and in the long-run.

6.2. China: the money supply in China was found to be making a long-run impact on the stock returns of India.

6.3. France: no long-run causality was found to be running from France's economic environment. But the money supply in France was found to be making a significant impact on the stock returns of India in the short-run as suggested by the short-run Granger causality tests and volatility modelling.

6.4. Germany: Germany's role in affecting the Indian stock returns was also found to be very weak like Bangladesh's economic environment. No economic factor of Germany was found to be making an impact on the Indian stock market both in the long-run and the short-run.

6.5. Japan: the inflation rate in Japan affected the Indian stock market in the long-run. The IIP in Japan showed an effect on the stock market of India in the volatility modelling.

6.6. Pakistan: the exchange rate of Pakistan showed a long-run impact on the Indian stock market. The IIP of Pakistan and Sensex found to be shared long-run co-integration but long-run causality was not found to be running from IIP of Pakistan to the stock market of India. The exchange rate of Pakistan showed its influence on the stock market of India in the short-run granger causality test as well. In the volatility modelling, Pakistan's IIP was found to be affecting the stock market of India.

6.7. Saudi Arabia: the money supply in Saudi Arabia and Sensex share long-run co-integration but long-run causality was not found to be running from money supply in Saudi Arabia to Indian stock market. The exchange rate of Saudi Arabia made its impact on the Indian stock market in the short-run granger causality tests.

6.8. UAE: no long-run impact UAE's economic environment was found to be making in the long-run but the money supply of UAE was found to be affecting the Indian stock market in the volatility modelling.

6.9. UK: the exchange rate of the UK affected the Indian stock market in the long-run. In the short-run, Granger causality tests as well UK's exchange rate's impact was seen on the stock market of India.

6.10. USA: the money supply in the US affected the Indian stock market in the long-run. The GDP of US showed its influence on the volatility of the stock returns and a significant impact of US's exchange rate (with respect of INR) on the Indian stock market was seen in the previous parts of the study.

7. Conclusion:

The two largest economies of the world USA's economy and China's economy made their long-run impact on the Indian stock market not through GDP but through money supply. The two European giants in terms of economy Germany and France showed a marginal impact on the stock market of India. The neighbourhood country Bangladesh also failed to affect the Indian stock market with its economic environment. Japan is today also a world leader in many sectors and its economic conditions do make a significant impact on the stock market of India. The UK is still a major driver of the world's economy and its effect was also seen on the Indian stock market to some extent.

UAE and Saudi Arabia are two big exporters of oil for India and thus their economic environment affected the Indian stock market through the money supply and exchange rate. Money supply affects the exchange rate and the exchange rate affects the prices of oil. Though India doesn't do much trade with Pakistan Pakistan's economic environment seems to be making a substantial impact on the stock market of India. The IIP and exchange rate of Pakistan both found to be integrated with the Sensex to some degree. Though in the long-run bivariate analysis money supply of the countries found to be making a significant impact in the long-run multivariate analysis only the GDP of other countries was found to be making an impact on the stock market of India and not any other variable. It was concluded that both GDP and money supply with the exchange rate of other countries were the variables found to be making a substantial impact on the stock returns of India.

The money supply in other countries was found to be making a substantial impact on the stock returns of India. Thus it is concluded that in today's age role of money supply is very crucial for the growth of the financial markets. The Indian government should be keeping a very careful eye on the money supply in the economy and should refrain itself from taking decisions like demonetisation which affected the money supply negatively, derailed the ongoing process of high growth of the economy and made a long-run negative impact on the stock market of the country.

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