Chapter II
CHAPTER II

LITERATURE REVIEW

The current chapter will present major studies that have been undertaken to-date, on the relationship between stock prices, foreign exchange rates and gold prices. This analysis is of interest to academics and practitioners equally because; these variables play crucial roles in influencing the development of a country’s economy. This review is essential so as to obtain a clear picture of studies that have been conducted in these areas till date, and where it is possible to identify gaps in the existing research. There is a lack of analysis regarding the interlink of stock prices and exchange rates in developing economies, since most of the research that has been done has paid attention to developed markets. Likewise there is insufficient research done on the role of gold markets in the world economies. The expectation of relative currency values generates influences on the levels of domestic and foreign interest rates, which in turn affects the present value of a firm's assets, and subsequently impact on world economies. For this reason, exchange rates play a considerable role in the movements of stock prices, especially for international investors deciding to hold on to their financial assets. Taking all these facts into account, this research will pay close attention to the analysis of Indian economy, stock prices, exchange rates and gold prices.

2. Equity Market and US Dollar

2.1 Developed Economies

Solnik (1987)\(^1\) employing OLS regression analysis on monthly and quarterly data from 1973 to 1983 for eight industrialized countries found a negative relationship between
real domestic stock returns and real exchange rate movements. However, for monthly data over 1979-83, he observed a weak but positive relation between the two variables.

The approach that involves measuring the foreign exchange exposure and the return of the stock was studied by Jorion. Jorion (1990)\(^2\) estimates currency sensitivities for the universe of U.S. multinationals over the period 1971 to 1987. He found that only 5% of the total numbers of firms in his sample had a significant currency exposure.

Oskooe, B.M. and Sohrabian, A. (1992)\(^3\) tried to test the causality as well as cointegration between stock prices and effective exchange rate using monthly observations over the period July 1973 to December 1988 for a total of 186 observations from the U.S. economy. They found that there was a bi-directional causality between stock prices and the effective exchange rate of the dollar at least in the short run. The co-integration analysis revealed that there was no long run relationship between two variables.

Smith, C.E. (1992)\(^4\) attempted to derive an estimable exchange rate equation by considering the portfolio balance model. The model considered values of equities, bonds and money as important determinants of exchange rates, which were then applied to the German Mark vis-à-vis the US Dollar and the Japanese Yen vis-à-vis the US Dollar exchange rate by using a general model of optimal choice over risky assets. He has considered the study period spanning from January 1974 to March 1988. The study found that equity value has a significant influence on exchange rates, but the stock, money and bond has little impact on exchange rates. These results imply not only that equities are an important additional factor to be included in the portfolio balance models of the exchange rate, but also suggest that the impact of equities is more important than the impact of government bonds and money.
Choi (1995)\textsuperscript{5} covered the period from October 1, 1993 to February 15, 1996 of daily closing stock market indices and foreign exchange rates for the G-7 countries (Canada, France, Italy, Japan, Germany, the UK, and the US). The methodology used consisted of the Engle-Granger (EG) two steps and the Johansen Co-Integration Test as well as the Vector Error Correction Model (VECM). The study rejected the existence of a significant relationship between stock prices and exchange rates. His analysis concludes that these two financial variables do not have predictive capabilities for more than two consecutive trading days. He found different results among G-7 countries which might be due to deeper causes, not merely to the observed financial factors. The results might be influenced by each country’s differences in economic development, government policy, differences in the degree of internationalisation and liberalisation, and the degree of capital controls from country to country. Therefore, there is a need to homogenize the countries under analysis and to filter the data set by considering economies that share similar characteristics, as this would allow one to get more robust results.

Bailey and Chung (1995)\textsuperscript{6} studied the importance of exchange rate fluctuations and political risk for stock prices. They explored the impact of exposure to exchange rate fluctuations and political risk factors, and measured the extent to which exposure to these factors explained cross-sections of returns on individual securities and industry portfolios. The sample covered the period from January 1986 to June 1994. They found no evidence of unconditional equity market premiums for the currency and political risks present in the variables that they selected. They found some evidence consistent with time-varying equity market premiums for exposure to changes in the free market dollar premium and Mexican sovereign default risk. There were significant associations
between expected equity market premiums for these risks and related premiums from the currency and sovereign debt markets. They found no evidence of either unconditional or conditional risk premiums for exposure to changes in the official exchange rate.


Ayayi, A. and Mougoue (1996) examined the intertemporal relation between stock indices for a sample of eight advanced countries during the period 1985:4 to 1991:6. By employing the co-integration and causality tests on daily closing stock market indices and exchange rates, the study found that (i) an increase in aggregate domestic stock price has a negative short-run effect on domestic currency values, (ii) sustained increase in domestic stock prices will induce domestic currency appreciation in the long run and (iii) currency depreciation has negative short-run and long-run effects on the stock market.

A number of studies however have examined the extent to which volatility from one stock market spills over into other stock markets or between different assets. The study by Kanas (2000) was one of the first studies which analysed volatility spillovers from stock returns to exchange rate changes in the US, the UK, Japan, Germany, France and Canada. The author found evidence of spillovers from stock returns
to exchange rate changes for all countries except Germany, suggesting that the asset approach to exchange rate determination is valid when formulated in terms of the second moments of the exchange rate distribution for the countries included in his analysis. Volatility spillovers from exchange rate fluctuations to stock returns that were insignificant for all countries.

Morley and Pentecost (2000)\textsuperscript{12}, in their study on G-7 countries argued that the reason for the lack of strong relationships between exchange rates and stock prices may be due to the exchange controls that were in effect in the 1980s. By employing the co-integration and co-dependence method [developed by Engel and Kozicki (1993), Engel and Vahid (1993)] the study found that stock markets and exchange rates are linked through a common cyclical pattern rather than a common trend.

Wu (2000)\textsuperscript{13} used an error correction model to explore the asymmetric effects of four different exchange rates on Singapore stock prices, and their effects on economic volatility. The methodology consisted in a p-dimensional vector autoregressive model with Gaussian errors that was formulated into a VECM\textsuperscript{14}. The model consisted of six variables: the Strait Times price index of Singapore, Dow Jones Industrial Average Index, four bilateral exchange rates that linked the Singapore Dollar with the Malaysian ringgit, Indonesia rupiah, US Dollar and Japanese Yen. The study divides the weekly data of the 1990s into four sub-periods: (04/03/1991-01/25/1995), pre-crisis period (02/01/1995-05/25/1997), crisis period (07/02/1997-12/30/1998) and recovery period (01/06/1999- 05/31/2000). The results suggest that there is asymmetry in terms of the equilibrium between the stock price and exchange rate relationship with respect to the different countries. It appears that Granger causality runs only in one way from exchange
ratings to stock prices. The co-integration analysis suggested that for most of the selected periods in the 1990s, both the Singaporean currency appreciation against the US Dollar, and the Malaysian ringgit depreciation against both the Japanese yen and the Indonesian rupiah, had positive long-term effects on stock prices. These results were quite interesting, as they did not follow the pattern that was found when analyzing developed markets, where the main influence is from stock markets to exchange rates. But there is no evidence with regard to a reverse influence.

Griffin and Stulz (2001)\textsuperscript{15} examined the importance of exchange rate movements and industry competition for stock returns. They studied the stock price impact of competition between similar industries located in different countries, using a unique dataset of industry indices from the United States, Canada, the United Kingdom, France, Germany and Japan from 1975 to 1997. Their results showed that the impacts of exchange rate shocks are trivial in explaining the relative performance of US industries, even in the countries where international trade is much more important than in the US. Industry effects were more important than exchange rate effects. They concluded that exchange rate shocks have a negligible impact on the value of industries across the world. Given that their study was limited to a few countries and also that their time period was quite long, their conclusions were to be taken carefully as they were not subject to generalisation. It is clear that the sample is not representative of the world economy, and also that the time period is subject to different economic impacts that should be taken into account in order to filter the data set, as structural breaks affecting the data are a major source of inaccurate estimators.
Nieh and Lee (2001)\textsuperscript{16} found no long-term significant relationship between stock prices and exchange rates in the G-7 countries. Their analysis covered the period from October 1, 1993 to February 15, 1996 using daily closing stock market indices and foreign exchange rates for the G-7 countries (Canada, France, Italy, Japan, the UK, Germany, and the US). The methodology used consisted of the Engle-Granger (EG) two steps and the Johansen maximum likelihood co-integration test. They studied the dynamic relationships between the stock prices and the exchange rates for each of the G-7 countries; their results went against most of the previous studies that suggested a significant relationship between stock prices and exchange rates as they rejected the existence of a significant relationship between these two variables\textsuperscript{17}. These results were quite surprising, and needed a major discussion and investigation in order to explain why this kind of output was obtained. Again, there could be issues related to the sample under analysis, and also to the techniques employed to investigate these markets interlinkages, in particular the lag length selection criteria used in the analysis were to be considered carefully, as the results are quite sensitive to the number of lags used.

Hatemi, J.A. and Irandoust, M. (2002)\textsuperscript{18} examined a new Granger non-causality testing procedure developed by Toda and Yamamoto (1995) to contribute to the debate on exchange rates and stock prices in Sweden. The study also examined the possible causal relation between these variables in a Vector Auto Regression model. The results of the study found that Granger causality is unidirectional running from stock prices to effective exchange rates. The results also revealed that an increase in Swedish stock prices was associated with an appreciation of the Swedish Krona.
Billio and Pelizzon (2003)\textsuperscript{19} analysed whether deregulation, globalization, the financial crisis, the convergence in European economies and the introduction of the Euro had produced some effects: (i) on the return distribution of the world market index, (ii) on the volatility spillovers from the world index to European stock markets. They used a Switching Regime Beta model\textsuperscript{20} to analyse the implications of the introduction of the Euro on the link between the world index and respectively Germany, France, Italy, Spain and the UK, which are the most capitalized stock markets in Europe. The sampling period was January 1988 to February 2001. Their main findings suggested that the world index volatility and the German market DAX 30 had increased after EMU\textsuperscript{21} for most European stock markets. However, they did not observe an increase in the linkages (integration) between European capital markets. As was mentioned in the introductory chapter, the integration of markets is a time varying process that needed a lot of effort and time to be achieved, and at the moment it could not be ascertained that markets around the world remained integrated. There is consequently a need to be more precise look at the markets on an individual basis.

Grambovas (2003)\textsuperscript{22} is one of the few studies which analysed this issue and includes certain Eastern European countries, analysing the interaction between exchange rate fluctuations and equity prices for Greece, the Czech Republic, and Hungary. His data set consisted of weekly observations – Friday closing values of the general stock exchange indices of stock exchanges for Athens (CI), Budapest (BUX), Prague (PX-50), New York (Dow Jones Industrial) and Frankfurt (DAX-30) and spot foreign exchange rates for Greece in relation to the British pound (GBP), Hungary and the Czech Republic in relation to the Deutsche mark (DEM). The data period covers January 1, 1994, to
February 28, 2000. He used a trivariate model that included an additional variable as a proxy for the international financial environment based on the rationale that changes in international stock markets can lead to changes in the relevant domestic stock exchange due to issues of international investors’ sentiment. The article studies the long-term and short-term dynamics between stock prices and exchange rates, and the results indicate that there is a relationship between Hungarian exchange rates and stock prices, as well as in the case of Greece. He concluded that these results illustrate that changes in the stock markets may affect exchange rates.

Shamsuddin and Kim (2003) investigated the integration of the Australian stock market with its two leading partners, the US and Japan, taking into account the interdependence between foreign exchange rates and stock prices. The data used was the end-of-week closing stock price indices for Australia, Japan and the US, and the Australian Dollar value of the Japanese yen and US Dollar. The national stock indices used were the Standard and Poor’s 500 Composite Index for the US, the Tokyo Stock price Index (TOPIX) for Japan and the All Ordinaries Index (AOI) for Australia. They analysed the pre-Asian crisis period that covers two sub-periods: January 1991 to December 1993, and January 1994 to July 1997. The post-Asian crisis period spans over the period January 1999 to May 2001. Their methodology consisted of VAR models and multivariate time series models for each period. They found a cointegrating relationship among the variables prior to the Asian crisis, but such a relationship did not exist in the post-Asian crisis period. The multivariate models indicated that in the pre-crisis period, the Australian stock market was primarily led by the US stock markets (as opposed to Japan); however, in the post-crisis period, the Australian stock markets have become
more dependent upon their own past and less on the US market. They also found that stock returns are led by foreign exchange rates but that the former do not significantly influence the latter.

Syriopoulos (2004)\textsuperscript{24} analysed the presence of short- and long-term linkages among major emerging Central European stock markets (Poland, the Czech Republic, Hungary and Slovakia), as well as developed markets (Germany and the USA). The sample period is from 1 January 1997 to 20 September 2003. He used an error correction vector autoregressive model to detect co-integration relationships. He found that Central European markets tend to display stronger linkages with their mature counterparts rather than their neighbours.

Yang and Doong (2004)\textsuperscript{25} explored the nature of the mean and volatility transmission mechanism between stock and foreign exchange markets for the G-7 countries. The results point to significant volatility spillovers and to an asymmetric effect from the stock market to the foreign exchange market for France, Italy, Japan and the US, suggesting integration between stock and foreign exchange markets in these countries.

Verma, Jackson and Swisher (2005)\textsuperscript{26} examined price and volatility spillovers from interest rates and exchange rates to American Depository Receipts (ADRs) originating from Mexico, Brazil and Chile. In terms of volatility spillovers, their results indicated that both interest rates and exchange rates spillover to Brazilian and Chilean ADRs, whereas only exchange rates spillover to Mexican ADRs. In relation to asymmetry, the interest rates of Mexico, Brazil and Chile as well as the exchange rates of Chile, indicate that negative innovations increase volatility more than positive innovations. One of the existing evidence on this issue for Asian countries is that of Wu
(2005) who examines volatility spillovers between stock prices and exchange rates for Japan, South Korea, Indonesia, the Philippines, Singapore, Thailand and Taiwan for the period 1997-2000, splitting the sample into crisis and recovery periods. He found a bi-directional relationship between the volatility of stock returns and exchange rate changes during the recovery period in all countries except South Korea, as well as significant contemporaneous relationships between the two markets for most of the countries. Furthermore, he found that volatility spillovers increased in the recovery period. The literature review that has been done so far with regard to the linkages between stock markets, and exchange rates in developed and emerging economies, demonstrates that there is a substantial amount of studies analyzing this issue. However, the results appear to be quite mixed, and there is no clear evidence explaining the true nature of the relationship between stock markets and exchange rates. Throughout this analysis, it has become obvious that there are major discrepancies among the studies that have been done; these discrepancies involve issues such as sample size, data frequency, dealings with structural breaks, differences between countries under investigation, and most importantly clear methodology issues. Depending on the model or technique that is used, which can vary from study to study, the results tend to change. Therefore, it is the author’s major concern to deal with the analysis of these issues in a more comprehensive manner so as to present a robust and relevant evidence in the area.

Yau and Nieh (2006)\textsuperscript{27} employed various linear and nonlinear time series methodologies to investigate the short-term and long-term relationships among the stock prices of Taiwan and Japan and the NTD/Yen exchange rate during the period of January 1991 to July 2005. They found that the conventional Johansen test and advanced Granger
causality test were consistent and both showed no long-term co-movement among the three variables. Furthermore, the results from the Granger causality test showed that bidirectional feedback relationships between the stock prices of Taiwan and Japan are significant. However, there is no significant linkage or causal relationship found between each of the stock prices and the NTD/Yen exchange rate.

The major findings of research done in that area pertaining to developed economies tend to be consistent to the idea that stock markets do impact exchange rates and not the other way around. Furthermore in some cases results could be influenced by sample selection (very different countries under investigation), structural breaks, and the methodology chosen to investigate this issue. These factors are a major source for discrepancies throughout the analysis.

2.1.1. Developing Economies

Ayayi and Mougoue (1996)\textsuperscript{28} examined whether stock prices and exchange rates are related to each other. The data used in the analysis consisted in the major stock prices indices of these countries (KSE100 index for Pakistan, BSE 200 for India, CSE Sensitive Index for Sri-Lanka and DSE All Share Price Index for Bangladesh) and the exchange rates between the currencies of these countries and the US Dollar. The study used monthly data for four South Asian countries. They employed co-integration and vector error correction modelling techniques and a standard Granger causality test to examine the long-term and short-term association between stock prices and exchange rates. Their results showed no short-term association between stock prices and exchange rates.
for all four countries. There was also no long-term relationship between stock prices and exchange rates for Pakistan and India. However, they found that for Bangladesh and Sri Lanka there appears to be bidirectional causality between these two financial variables.

Abdalal and Murinde (1997) carried out very detailed examination of the interactions between exchange rates and stock prices in the emerging markets of Asia and Pacific basin regions. The sample period is from 1985 to 1994. The authors focus on Asian emerging markets because of their expansions in international trade and adoption of freely floating exchange rate. Abdalal and Murinde first checked the stationarity and the order of integration of their variables with augmented Dickey-Fuller tests. Their results show that all their variables are I(I) series. Then, co-integration tests were run and co-integration was found in India and Philippine markets, but no co-integration found in the Korean and Pakistan markets. Two different methods were used in their study. The standard Granger-Causality test method is used on Korean and Pakistani markets, and error correction model (ECM) is used on the Indian and Phillippine markets. The authors argued that the reason why two different methods are used is that Granger-Causality tests cannot be used for variables which have co-integration. In order to make sure that the Granger-Causality test model to be used was free from conventional econometric problems, they checked for heteroscedasticity problems using the White, Glejser and Ramsey tests, as well as the Lagranger Multiplier test for checking autocorrelation with. They report no autocorrelation and heteroscedasticity problems. They next tested the equation for structural break in order to examine whether the relationship between stock price and exchange rate held good over the entire sample period. Chow’s structural break test was used and the F-statistic showed no structural
break for all the variables. After running the above tests, Granger-Causality test was carried out, and the results show that there existed uni-directional Granger-Causality from exchange rate to stock prices in the Korean and Pakistani markets. ECM results indicate that India also has uni-directional causality from exchange rates to stock prices, but there is uni-directional causality from stock prices to exchange rates in Philippines.

Qiao, Yu (1997)\textsuperscript{30} employed daily stock price indices and spot exchange rates obtained from the financial markets of Hong Kong, Tokyo and Singapore over the period from January 3, 1983 to June 15, 1994 to examine the possible interaction between these financial variables. Based on Granger causality test, he found that the changes in stock prices are caused by changes in exchange rates in Tokyo and Hong Kong Markets. However, no such causation was found for the Singapore market. On the reverse causality from stock prices to exchange rates, his results show such causation for only Tokyo market. Therefore for Tokyo market there is a bi-directional causal relationship between stock returns and changes in exchange rates. The study also uses the Vector Autoregression model to analyse a long run stable relationship between stock prices and exchange rates in the above Asian financial markets. His results found a strong long run stable relationship between stock prices and exchange rates on levels for all three markets.

Ayayi, Friedman & Mehdian (1998)\textsuperscript{31} study the relationship between exchange rate and stock markets for a set of developed countries and emerging Asian countries. Granger-Causality test is used on both daily and weekly data. Seven developed markets and eight Asian emerging markets are included in their study. They firstly run the unit root test with Dickey-Fuller test and find all data are stationary at first difference. Then, Akaike’s final prediction error criterion (FPE)\textsuperscript{32} is used to select the optimal lag length. They found the
optimal lag length was lag 5, which was consistent with Malliaris and Urrutia (1992). Aijayi, Friedman & Mendian found uni-directional causality from stock return to the movement of exchange rates in all six advanced markets in both daily and weekly analysis. The daily data result showed three emerging Asian markets had uni-directional causality and four emerging Asian markets have no causality relationship, and one emerging country had bi-directional causality. However, only two emerging Asian markets have uni-directional causality from stock to currency and no causality is found for the rest of the markets. Their findings indicate that currency market and stock market are well integrated in developed markets but not in emerging Asian markets. The authors argue that the smaller size, the lower access to foreign investors, and the higher concentration found in emerging Asian markets contributes to the different causality results as compared to developed markets.

Granger, Huang and Yang (2000) analysed the relationship between stock prices and exchange rates using Asian data. They employed daily data and the methodology consisted of the use of impulse response functions to explore the relationship between the two variables and their dynamics. In addition, they used advanced unit root and co-integration techniques, to study the exchange rates and stock prices for Hong Kong, Indonesia, Japan, South Korea, Malaysia, the Philippines, Singapore, Thailand and Taiwan over the period January 3, 1986 to June 16, 1998. They divided the sample into three sub-periods: period one (1987- crash) covered the period from January 3, 1986 to November 30, 1987; period two (after the crash) started in December 1, 1987 and ended on May 31, 1997 and period three (the Asian flu period), continued from June 1, 1997 through June 16, 1998. Their findings showed that during period one, there existed little
interaction between currency and stock markets except for Singapore. The study also indicated that changes in the exchange rates led stock prices in Singapore. In period two (or after the crash period) there is no definite pattern of interaction between the two markets; however, during period three (the Asian flu period) seven of the nine countries suggested significant relationships between the two markets. In the case of South Korea, changes in the exchange rates led the stock prices. A reverse direction is found in Hong Kong and the Philippines. The rest of the markets (Malaysia, Singapore, Thailand and Taiwan) are characterized by feedback interactions in which changes in exchange rates can take the lead and changes in stock markets can also impact on changes in exchange rates.

Ibrahim (2000) investigated the interactions between stock prices and exchange rates in Malaysia, using bi-variate and multivariate co-integration and the Granger causality test. The study took multiple variables such as stock prices, three exchange rate measures, viz, the real effective exchange rate, the nominal effective exchange rate and RM/US$, money supply, and reserves during the period 1979:1 to 1996:6. The results from bi-variate models indicated that there was no long-run relationship between the stock market and any of the exchange rates; however, there was some evidence of co-integration when the models were extended to include money supply and reserves. This finding indicates that in the short run, a concerted stance on monetary policy, exchange rate and reserve policy is vital for stock market stability. It also indicated informational inefficiency in the Malaysian stock market. Multivariate test showed: (i) unidirectional causality from stock market to exchange rate; (ii) both the exchange rates and the stock indices were Granger caused by the money supply and reserves; (iii) there was bi-directional causality between variables only in the case of nominal effective exchange rate.
Chowdhury (2004) analyses the relationship between exchange rates and stock prices for four East Asian countries (Indonesia, Malaysia, Philippines and Thailand) and the effect of the financial crisis in East Asian countries on stock prices indices. He uses monthly data on the bilateral nominal exchange rates of the four countries, against the US Dollar, and the Jakarta Composite Index for Indonesia, the KLSE Composite Index for Malaysia, the PSE Composite Index for the Philippines and the SEI for Thailand’s stock price indices for the period January 1990 to January 2003. Given that there exists a distinct structural break in July/August 1997 due to the occurrence of the currency crisis in East Asian countries, he applied a co-integration test for the entire period between 1990-2003, as well separately for 1990 to June 1997 and between July 1997 and 2003, so as to investigate the effect of the currency crisis on the stock prices before and after the event took place. The results indicate that exchange rates and stock prices were co-integrated over the entire period not only for Thailand, but also for all the countries during the pre currency crisis period and post-currency crisis, except Indonesia. Using an error correction model (ECM) and standard Granger Causality tests, he found bidirectional causality for Indonesia and Malaysia and no causality for the Philippines and Thailand over the entire period between these two financial variables. The analysis shows that exchange rates Granger caused stock prices in Indonesia and stock prices led currency markets in Thailand during and after the currency crisis period, and bi-directional causality was detected for Malaysia and the Philippines for both the pre-crisis and post-crisis periods.

Mishra, A.K (2007) examined whether stock market and foreign exchange markets are related to each other or not in the context of India. The study employed Granger’s causality test and Vector Auto Regression technique on monthly stock return,
exchange rate, interest rate and demand for money for the period April 1992 to March 2002. The major findings of the study are (a) there exists a unidirectional causality between the exchange rate and interest rate and between the exchange rate return and demand for money; (b) there is no Granger’s causality between the exchange rate return and stock return. Through Vector Auto Regression modeling, the study confirmed that through stock return and exchange rate return, the demand for money and interest rate were related to each other but lacked a consistent relationship. The forecast error variance decomposition further evidences that (a) the exchange rate return affects the demand for money, (b) the interest rate causes exchange rate return change (c) the exchange rate return affects the stock return, (d) the demand for money affects stock return, (e) the interest rate affects the stock return, and (f) the demand for money affects the interest rate.

Nath G.C., et al (2004)\textsuperscript{37} in their paper examines the extent of integration between Foreign exchange and stock market in India during the liberalization era. The scholars have tried to find out whether any relationship exists between the two based on “goods market approach” (Dornbusch and Fischer, 1980) and “portfolio balance approach”, taking into account 10 year daily database on stock price index and exchange rate of Indian Rupee. They have applied different econometric tests like Granger’s causality test in VAR framework, in which they have used F-Test to test this hypothesis; and to test these series for stationarity, ADF Unit Root test is applied. Another econometric technique used by them is Gweke’s Measures\textsuperscript{38} for the extent of market integration. The results that they have derived from these techniques differ a lot. As per the former test it reveals the sign mild-to-strong causal relationship between returns in foreign
exchange and capital markets during the study period. Whereas as per the latter test, there is a high degree of integration between the two and there is even bi-directional as well as contemporaneous causal relationship between them.

Hatemi-J and Roca (2005)\textsuperscript{39} used bootstrap causality tests with leveraged adjustments to analyse the link between exchange rates and stock prices in Malaysia, Indonesia, the Philippines and Thailand, before and during the Asian financial crisis of 1997. They used daily data for nominal exchange rates and the Morgan Stanley Capital international price indices for stock prices from 1 January to 31 December 1997. The sample period was divided into two sub-periods; the first period from 1 January to 31 July 1997 representing the period before the crisis or the normal situation and the second period from 2 July to 31 December 1997 representing the crisis period. They found that during the period before the Asian crisis (with the exception of the Philippines) exchange rates and stock prices were significantly related with the direction of causality running from the former to the latter in the case of Indonesia and Thailand, and from the latter to the former in the case of Malaysia. However, during the crisis period, this relationship ceased to exist in any of the countries.

2.2. Equity Market and Gold Price

Mills (2003)\textsuperscript{40} investigated the statistical behaviour of daily Gold price data from 1971 to 2002. He found that the phenomenon of volatility prices scaling with long-term correlations is important. He found that Gold returns are characterised by short-term persistence and scaling with a break point of 15 days. Daily returns are highly leptokurtic with multi-period returns only recovering gaussianity after 235 days.
Using co-integration techniques, Eric et al. (2006) suggests that there is a long-term relationship between the price of Gold and the US price level. Second, the US price level and the price of Gold move together in a statistically significant long-run relationship supporting the view that a one percent increase in the general US price level leads to a one percent increase in the price of Gold. There was a positive relationship between Gold price movements and changes in US inflation, US inflation volatility and credit risk. The study also found a negative relationship between changes in the Gold price and changes in the US Dollar trade-weighted exchange rate and the Gold lease rate.

Hiller, Draper and Faff (2006) investigated the role of precious metals in financial markets by analysing daily data for Gold, platinum and silver from 1976 to 2004. They included the S&P 500 Index as a proxy for stock market returns from the US investors’ perspective. They found that all three precious metals have low correlations with stock index returns, which suggests that these metals may provide diversification within broad investment portfolios. They found that normally financial portfolios that contain precious metals perform significantly better than standard equity portfolios. They also found that precious metals exhibit some hedging capability during periods of abnormal market volatility.

Tully and Lucey (2006) investigated the macroeconomic influences on Gold using the asymmetric power GARCH model (APGARCH). They examined cash and futures prices of Gold and significant economic variables over the 1983-2003 period, paying special attention to two periods, around 1987 and in 2001, the year of the equity market crash. Their results suggest that the APGARCH model provides the most adequate description for the data, with the inclusion of a GARCH term, free power terms.
and unrestricted leverage effect terms. They also found that the Gold cash and futures data over a long period confirmed the US Dollar is the main macroeconomic variable which influences Gold.

Batten, Ciner and Lucey (2008) investigated the impact of macroeconomic factors (inflation, monetary aggregates, industrial production, US Dollar exchange rates, stock index returns and consumer confidence indices) that affect price returns of precious metals markets (Gold, silver, palladium and platinum). They found limited evidence that the same macroeconomic factors jointly influence volatility processes of the precious metals price series, although there is some evidence of volatility feedback between the precious metals series. This finding lends weight to the view that these individual commodities are too distinct to be considered a single asset class or to be represented by a single index.

Pravit (2009) uses Multiple Regression and Auto Regressive Integrated Moving Average (ARIMA) to forecast Gold prices. The research result suggests that ARIMA (1, 1, 1) is the most suitable model to be used for forecasting Gold price in the short term. Using multiple regression model the study suggests that that Australian Dollars, Japanese Yen, US Dollars, Canadian Dollars, EU Ponds, Oil prices and Gold Future prices have effect on the change of Thai Gold price.

Mishra et al (2010), analysed the causality relation that may run between domestic Gold prices and stock market returns in India. The study by taking into consideration the domestic Gold prices and stock market returns based on S&P BSE 100 index, investigates the Granger causality in the Vector Error Correction Model for the period January 1991 to December 2009. The analysis provides the evidence of feedback
causality between the variables. It infers that the Gold prices Granger-causes stock market returns and stock market returns also Granger-causes the Gold prices in India during the sample period. Thus, both the variables contain some significant information for the prediction of one in terms of another.

Amalendu Bhunia, Amit Das (2011) their study examined the Gold price volatility and the causal relationship between Gold prices and stock market returns in India. Taking into consideration the domestic Gold prices and stock market returns based on NSE, the study investigates the Granger causality in the Vector Error Correction Model for the period from April 2001 to March 2011. Empirical results provide the support of feedback causality between the selected variables and indicate that the Gold prices Granger-causes stock market returns and stock market returns also Granger-causes the Gold prices in India during the study period. The results indicate the co-movement of Gold prices and stock prices even during the period global financial crisis and thereafter. Indians have started considering Gold not only as jewellery but also an important mode of investment like investment in bonds and equities.

Ron Christner and Mehmet F. Dicle (2011) examined the degree of correlation and possible causation between the prices of Gold, Oil, short- and long-term interest rates, U.S. equities and the U.S. currency value against the Euro and British Pound. Causation exists towards the Dollar for the 2006-2008 period. 2008-2011 is the period of negative correlation and instantaneous feedback. There is an increasing negative correlation since 2007. Correlation is lower for 2011. The sign of the correlation turns negative with the 2007-2009 financial crisis and due course also increases. 2011 seems to follow the negative correlation pattern but to a lesser level. These relationships however
react on the results when the entire sample is used. Because of these period specific
relationships, the results based on all years combined shows causality from equities
towards the Dollar, instantaneous feedback and negative correlation. In the case of the
Gold, while there is no causality, instantaneous feedback and correlation exists since year
2000 until the end of the sample period. Negative correlation is persistent and highest for
the period 2003-2004 and for the financial crises period of 2007-2009. Correlation is
decreasing after 2009. Instantaneous feedback is also noticeably decreasing after 2009,
post crisis. Entire sample results reflect the persistent instantaneous feedback and the
negative correlations. However, interestingly, when there are only a few years of causal
relationships, entire sample results show evidence of bi-directional causality

Sarbapriya Ray (2011) This article aims to enquire into the causal nexus between
Gold price and stock price in India for the period, 1990-91 to 2010-11. The unit root test
clarified that Gold price and stock price were found to be integrated of order one using the
Kwiatkowski, Phillips, Schmidt and Shinn (KPSS) test for unit root. The co-integration test
confirmed that Gold price and stock price are co-integrated, indicating an existence of long
run equilibrium relationship between the two as confirmed by the Johansen co-integration
test results. The Granger causality test finally confirmed the presence of uni-directional
causality which runs from Gold price to stock price. Other aspects on which future
researchers can pay attention are the longer time horizon, larger sample sizes using other
macroeconomic and non-macroeconomic variables.

Sujit and Rajesh Kumar (2011) found that Gold prices are typically denominated
in US Dollars, and this implies that the exposure gained from buying or selling Gold is
influenced by changes in the exchange rate for US Dollars. Changes in exchange rate
through changes in costs and revenues will have direct impact on profits and thus impact stock returns. However, Gold index in euro fails to show similar effects on exchange rate as the shock in Gold price in euro explains just 1% of the variations in exchange rate.

Patel (2013) investigates the causal relationship between stock market indices and Gold price in India. The monthly time series data for Mumbai Gold prices and three stock market indices, viz., Sensex, S&P BSE 100 and S&P CNX Nifty are used for the period January 1991 to December 2011. By applying Augmented Dickey-Fuller unit root test, Johansen co-integration test and Granger causality test in Error Correction Model framework, the study concludes that all series are I(1) and there exists a long-run equilibrium relation between all the variables. The study also provides evidence that the Granger causality runs from Gold price to Nifty only. Hence, Gold price contains some significant information to forecast Nifty return.

2.3. Oil Price and Gold Price

2.3.1 Developed Countries

Jana Šimáková (2011) analysed the relationship between Gold and Oil price levels in this paper. The main research was performed for the period of 1970 – 2010 for global economy using co-integration test and Granger causality test method and then adapted separately to each quantitative analysis. Relationship between selected variables was expressed verbally, graphically and algebraically. Strong positive correlation in the whole sample between Gold and Oil was found out, but in recent years, some unconventional development was noticed. On the other hand, proportional analysis confirmed that Gold/Oil ratio during this time moved on its long-term values. Correlation analysis confirmed it in case of inflation, industry, interest rates and stock
prices of Gold mining companies. Least squares method verified just inflation regression model. Regarding Granger causality test, causal links between Gold and Oil price levels were identified. Johansen co-integration test revealed long-term relationship between examined variables and Vector Error Correction model confirmed, that after market fluctuations, both time series return to long-term equilibrium.

Bradley and Farooq (2013) used univariate and bivariate GARCH models to examine the volatility of Gold and Oil futures incorporating structural breaks using daily returns from July 1, 1993 to June 30, 2010 for the US. They argue that unless structural breaks were accounted for in the volatility of Gold, the findings would not provide a fully accurate answer. They firstly find that Gold’s volatility went through 9 different phases over the sample used. Without breaks they found a very high degree of persistence in Gold’s volatility with shocks having a half-life of 69 days. Once breaks were allowed to occur, this dropped off significantly to a period of five days. In looking at volatility transmission between the two markets they found that there were significant direct effects. This is explained as a through investor cross hedging. They relate these results to real world investment decisions. The optimal portfolio allocation between the two assets without structural breaks is 85% in Gold, 15% in Oil. When breaks were allowed in the variance this percentage increased to 91% Gold. An investor who wishes to maximize their return per unit of risk would buy more Gold that in a simple model with no breaks. Their model is also shown to improve hedging decisions for investors.

Amalendu bhunia (2013) mainly investigated the co-integration relationships among crude Oil price, domestic Gold price and selected financial variables (exchange rates and stock price indices) in India. Increasing crude Oil prices will likely increase the
production costs that will affect cash flow and decrease stock prices. Investors were showing fewer concerns in stock markets and investing in the yellow metal due to increasing trend in Gold prices on account of less fear and future loss. Again, exchange rate fluctuations tend to affect international trades, thus influence the stock market. The author explained the study which is mainly based on secondary data obtained from various data sources including BSE database, NSE database and World Gold Council database for the period from January 2, 1991 to October 31, 2012. In the course of analysis, ADF unit root test, Johansen co-integration analysis and Granger causality test have been designed. Johansen co-integration test result indicates that there exists a long-term relationship among the selected variables. Granger causality test result shows that there must be either bidirectional or no causality among the variables.

Thai-Ha Le and Youngho Chang (2011) use the monthly data spanning from January 1986 to April 2011 to investigate the relationship between the prices of two strategic commodities: Gold and Oil for world economy. The data used for research based on West Texas Intermediate (WTI) crude Oil which is represented as world Oil price and Gold price is collected from world Gold council. We examine this relationship through the inflation channel and their interaction with the index of the US Dollar. We use different Oil price proxies in our investigation and find that the impact of Oil price on Gold price is not asymmetric but non-linear. Our results show that there is a long-run relationship existing between the prices of Oil and Gold. Our findings imply that the Oil price can be used to predict the Gold price.

Malliaris and Malliaris (2009) analysed the inter-relationships among the price behavior of Gold, Oil using a standard time series methodology then employed neural
networks to build a forecast for each of the three variables. The author then compared the results of the neural network to those implied by the time series tests. The statistical evidence of time series analysis demonstrates that both short-term and long-term relationships exist between the three variables. Both the time series and neural network results indicate that the series move together though they identify slightly different relationships. The time series results imply that Oil adjusts to Gold, the euro and Oil have equal affects on each other, and the weakest relationship is between Gold and the euro. The neural network indicates that Oil impacts Gold more than Gold impacts Oil. Oil's affect on the euro is greater than the euro's effect on Oil and last, Gold's impact on the euro is greater and faster than the euro's impact on Gold.

2.4. Oil and Equity Market

2.4.1 Developed Countries

Bruce et al (2005) therefore investigates the relationship between the price of crude Oil and equity values in the Oil and gas sector using data relating to the United Kingdom, the largest Oil producer in the European Union. The evidence indicates that the relationship is always positive, often highly significant and reflects the direct impact of volatility in the price of crude Oil on share values within the sector.

Anoruo and Mustafa (2007) examined the relationship between Oil and stock market returns for the United States using co-integration techniques and the VECM in the period of 1993-2006. They found that Oil and stock market returns were co-integrated. Using the VECM they also found that causality runs from stock market returns to Oil market returns but not vice versa. Based on these results, they concluded that the two markets are integrated rather than segmented. They interpreted the finding of
co-integration between Oil and stock market returns as evidence that investors cannot benefit from diversification by holding assets in Oil and stock markets simultaneously.

Lardic and Mignon (2008) studied the long-term relationship between Oil prices and economic activity, proxied by GDP in the year 1982 to 2008 for US economy, G7, Europe and Euro area economies. To account for asymmetries existing in the links between the two variables, the author presented an approach based on asymmetric co-integration. The empirical analysis concerns the U.S. economy, but also the G7, Europe and Euro area economies. Results indicate that, while standard co-integration is rejected, there is evidence for asymmetric co-integration between Oil prices and GDP.

George Filis (2009) examines the relationship of the cyclical components of Consumer Price Index (CPI), Industrial Production, Stock Market in Greece and the influence of Oil prices on these variables. The period of the study is from 1996:1 to 2008:6. Using a VAR the results showed that the Greek CPI exercises a significant negative influence in the Greek stock market. Further, Oil prices are negatively influencing the Greek CPI and stock market, at a significant level. It is worth noting that on average, shocks from CPI require about three years to be absorbed by the each of the other variables, shocks from the stock market and Oil need about 2to3 years, whereas shocks from industrial production will be absorbed within a period of 1-2 years from each of the other variables. The findings of this study are of a particular interest and importance to financial managers, financial analysts and investors dealing with the Greek market.

Isaac and Ronald (2009) mainly analysed the long-run relationship between the world price of crude Oil and international stock markets over 1971:1 to 2008:3 using a
co-integrated vector error correction model with additional regressors. Allowing for endogenously identified breaks in the co-integrating [36] and error correction matrices, evidence for breaks after 1980:5, 1988:1, and 1999:9 are found. A clear long-run relationship between these series for six OECD\textsuperscript{46} countries for 1971:1-1980.5 and 1988:2-1999.9, suggesting that stock market indices respond negatively to increases in the Oil price in the long run was also found. During 1980.6-1988.1, the results shows that relationships that are not statistically significantly different from either zero or from the relationships of the previous period. The expected negative long-run relationship appears to disintegrate after 1999.9. This finding supports a conjecture of change in the relationship between real Oil price and real stock prices in the last decade compared to earlier years, which may suggest the presence of several stock market bubbles and/or Oil price bubbles since the turn of the century.

Alex et al (2011) examines the recent interactive relationships between crude Oil prices and stock performances of alternative energy companies during the period 2001 to 2010. Oil prices and stock index of alternative energy sector are found independent from each other before late 2006. Contrary to existing studies, however, the results show that significant interdependence between Oil prices and stock index of alternative energy industry in the recent years. Since late 2006, Oil prices become significantly responsible for the stock performances of alternative energy companies.

Emmanuel Anoruo (2011) examines both the linear and nonlinear causal relationships between crude Oil price changes and stock market returns for the United States during the period 1974-2009. In particular, the study applied a battery of unit root tests to ascertain the time series properties of crude Oil price changes and stock market
returns. The linear and nonlinear causality tests were conducted through the standard VAR and the M-G frameworks, respectively. The results from both the linear and nonlinear unit root tests indicate that crude Oil price changes and stock market returns are level stationary. The results from the standard VAR model provide evidence of bidirectional causality between crude Oil price changes and stock market returns. The results from the M-G causality test support the finding of nonlinear bidirectional causality between crude Oil price changes and stock market returns.

Wang and Xie (2012), author take a fresh look at the cross-correlations between WTI crude Oil market and U.S. stock market from the perspective of econophysics. The three major U.S. stock indices is chosen (i.e., DJIA, NASDAQ and S&P 500) for the research objects and select the sample data from Jan 2, 2002 to Jun 29, 2012. In the empirical process, first, using a statistical test in analogy to the Ljung-Box test, the author found that there are cross-correlations between WTI and DJIA, WTI and NASDAQ, and WTI and S&P 500 at the 5% significance level. Then, employing the multifractal detrended cross-correlation analysis (MF-DCCA) method, the author finds that the cross-correlated behavior between WTI crude Oil market and U.S. stock market is nonlinear and multifractal. An interesting finding is that the cross-correlation exponent is smaller than the average scaling exponent when \( q < 0 \), and larger than the average scaling exponent when \( q > 0 \). Finally, using the rolling windows method, which can capture the dynamics of cross-correlations, we find that there are three special periods whose time-varying Hurst exponents are different from the others.

Nikolaos and George (2013) examine the influence of Oil prices on stock market time-varying correlation. Five stock market indices from both Oil-importing (US, UK
and Germany) and Oil-exporting economies (Canada and Norway) are considered for the period 1988-2011. The findings from the DCC-GARCH\textsuperscript{47} framework suggest that the effects of Oil price changes on stock market correlation are not constant over time and they depend on the status of the economy, i.e. whether it is Oil-importing or Oil-exporting. In addition, utilizing the identification of Oil price shocks, it is found that the aggregate demand shocks and precautionary demand shocks tend to exercise a negative effect on stock market correlation, whereas no effects from the supply-side Oil price shocks could be reported.

Sadorsky's (1999) research meanwhile draws attention to a negative relationship between shocks in Oil prices and real stock returns for the US economy and a negative impact of shocks to real stock returns on interest rates and industrial production in the period of after 1986. In a later study\textsuperscript{48}, finds a significant and positive relationship between Oil and gas equity index and the price of crude Oil in Canada from 1983 to 1999. Furthermore the author indicates a positive relationship between the return on the index and the return on the stock market as a whole. Finally a negative association is found between the stock market index value and both the premium on a 3month Vs 1month government debt and the US/Canadian Dollar exchange rate.

Oil price shocks have a statistically significant impact on real stock returns contemporaneously and/or within the following month in the U.S. and 13 European countries over 1986-2005 is discussed by Jung and Ronald (2008). Norway as an Oil exporter shows a statistically significantly positive response of real stock return to an Oil price increase. The median result from variance decomposition analysis is that Oil price shocks account for a statistically significant 6% of the volatility in real stock returns.
For many European countries, but not for the U.S., increased volatility of Oil prices significantly depresses real stock returns. The contribution of Oil price shocks to variability in real stock returns in the U.S. and most other countries is greater than that of interest rate. An increase in real Oil price significantly raises the short-term interest rate in the U.S. and eight out of thirteen European countries within one or two months. Counter to findings for the U.S., there is no evidence of asymmetric effects on real stock returns of positive and negative Oil price shocks for any of the European countries.

Mohan and Shawkat (2007) examined the relationship between beta risks and realized stock index return in the presence of Oil and exchange rate sensitivities for fifteen countries in the Asia-Pacific region using the international factor model. Thirteen of the 15 countries have the expected beta signs and show significant sensitivity to domestic risk when the world stock market is in both up and down modes. In terms of Oil sensitivity, only the Philippines and South Korea are Oil-sensitive to changes in the Oil price in the short run, when the price is expressed in local currency only. Basically no country shows sensitivity to Oil price measured in US Dollar regardless whether the Oil market is up or down. Nine countries are affected by changes in the exchange rate. In terms of relative factor sensitivity distribution, one is willing to conclude that these stock markets are more conditionally sensitive to local currency Oil price changes than to beta risk wherever the relationships are significant.

2.4.2 Developing Countries

Maghyereh (2004) examines the dynamic linkages between crude Oil price shocks and stock market returns in 22 emerging economies. The Vector Autoregression (VAR) analysis is carried on daily data for the period spanned from January 1, 1998 to
April 31, 2004. This study utilized the generalized approach to forecast error variance decomposition and impulse response analysis in favor of the more traditional orthogonalized approach. Inconsistent with prior research on developed economies, the findings imply that Oil shocks have no significant impact on stock index returns in emerging economies. The results also suggest that stock market returns in these economies do not rationally signal shocks in the crude Oil market.

Al-Fayoumi and Nedal (2009) have examined the relationship between changes in Oil prices and stock market returns in three Oil importing countries, namely Turkey, Tunisia and Jordan. Monthly data of Oil prices, interest rate, industrial production and stock market indices are modeled as a co-integrated system in a Vector Error Correction Model (VECM). Based on the data from December 1997 to March 2008, our empirical results do not support the hypothesis that Oil prices lead to changes in stock market returns in these countries. However, our results bring evidence that the effect of the local macroeconomic variables on the changes in stock market returns is more important than that of Oil prices. The results of this study may have implications for policy makers and portfolio managers who should focus on macroeconomic factors such as interest rate and industrial production, rather than focusing on Oil prices to be the main factor in predicting future stock returns.

Amalendu Bhunia (2012) examines the short-term and long-term relationships between BSE 500, BSE 200 and S&P BSE 100 Index of Bombay Stock Exchange and crude price by using various econometric techniques. The surge in crude Oil prices during recent years has generated a lot of interest in the relationship between Oil price and equity markets. The study covers the period between 02.04.2001 and 31.03.2011 and
was performed with data consisting of 2496 days. The empirical results show there was a co-integrated long-term relationship between three index and crude price. Granger causality results reveal that there was one way causality relationship from all index of the stock market to crude price, but crude price was not the causal of each of the three indexes.

Anthony Olugbenga Adaramola (2012) examines the long-run and short-run dynamic effects of Oil price on stock returns in Nigeria over 1985:1–2009:4 using the Johansen co-integration tests. A bivariate model was specified and empirical results show a significant positive stock return to Oil price shock in the short-run and a significant negative stock return to Oil price shock in the long-run. The Granger causality test showed strong evidence that the causation runs from Oil price shock to stock returns; implying that variations in the Nigerian stock prices are explained by Oil price volatility.

Crude Oil is directly or indirectly present in every productive activity. Crude Oil price fluctuations directly influence the international financial markets is analysed by Andre Assis de Salles (2013) in the period of 2007 to 2011. This way the Oil market is related to the capital market once it is the stock market that provides resources for investment and financing of production. The purpose of this work is to study the relationship between crude Oil prices and selected sectors of the Brazilian economy. Moreover this study focuses on the influence that international crude Oil prices have on the Brazilian stock market. The main aim of this work is to determine the conditional correlation of the crude Oil price and equity returns of nine sectors of the Brazilian economy as well as the performance indicator of Brazil using bivariate volatility models such as the vector autoregressive model.
2.5. Gold Price, US Dollar, Oil Price and Equity Market

2.5.1 Developed Countries

Wang, Wang and Hung (2010) used the Oil prices, Gold price, exchange rates of Dollar in contrast with currencies and stock markets of Germany, Japan, Taiwan, China and USA. This study derives results from empirical results that there exists co-integration and long-term stable relationship among these variables in the mentioned countries except USA. Nevertheless, there is no co-integration and long-term stable relationship among these variables in the USA.

Subarna K. Samanta, Ali H. M. Zadeh (2012), examined the co-movements of several macro-variables in the US economy over a period of more than twenty years from 1989-2009. Long-term co movements are examined by tracking the co-integration, common trend factor and the spillover index over these variables (Gold price, stock price, real exchange rate for Dollar and the Oil price of crude Oil). Preliminary examination suggests the possibility of co-integration among these variables indicate co-movements, although the spillover indices are found to be very small.

Sujit and Rajesh Kumar (2011) attempted to test the dynamic relationship among Gold price, stock returns, exchange rate and Oil price in the world economy. All these variables have witnessed significant changes over time and hence, it is absolutely necessary to validate the relationship periodically. The study uses daily data from 2nd January 1998 to 5th June 2011, constituting 3485 observations. Using techniques of time series, the study tried to capture dynamic and stable relationship among these variables using vector autoregressive and co-integration technique. The results show that exchange rate is highly affected by changes in other variables.
Le et al (2011) employs the bounds testing approach to co-integration to investigate the relationships between the prices of two strategic commodities: Gold and Oil and the financial variables (interest rate, exchange rate and stock price) of Japan, a major Oil-consuming and Gold-holding country in the period from 1980-2010. The results suggest that the price of Gold and stock, among others, can help form expectations of higher inflation over time. In the short run, only Gold price impacts the interest rate in Japan. Overall the findings of this study could benefit both the Japanese monetary authority and investors who hold the Japanese yen in their portfolios.

2.5.2. Developing Countries

Kanakarajammal et al (2013) was to examine the long-run and short-run relationships between the crude Oil prices, Gold prices, Exchange rate and BSE SENSEX Indian data. The monthly data from January 1995 to September 2012 was used in this study. The author entails the use of ADF test, PP test and KPSS test for testing the stationarity of variables, Johensen multivariate co-integration test to examine the existence of long run relationships among the variables. In order to capture the short run dynamics, VEC model is established. Granger causality test is carried out to study the direction of causality between the variables. The variance decomposition method is used to find out the proportion of the forecast error of one variable due to the other variables. The results show that all the variables were stationary at first difference with constant and trend, one co-integrating equation was present.

Saeed Samadi, Ozra Bayani, Meysam Ghalandari (2011) Impact of variables such as inflation rate, liquidity, Oil price, Gold price and foreign exchange rate on stock return in Tehran Stock Exchange in Iran have been studied in the present survey. GARCH
approach that is highly applied to explain financial phenomenon with high alternation has been used in this analysis. Results reveal foreign exchange rate, inflation rate and Gold price are effective on stock return in the period under study (monthly data related to 2001-2011) and Oil price and liquidity have no impact on stock return. In other words, stock return index in Tehran Stock Exchange has had a limited reaction towards Oil price changes due to Iran's small capital market and delayed influence of Oil price changes on profitability and stock price of companies despite undeniable impacts of global Oil price changes on many macro economy variables.

2.6. Oil Price, US Dollar and Gold Price

Yingjun Lou (2010) adopted quantile regression to make empirical analysis of the relationship of Gold, Oil and Dollar which is called G.O.D for world economy. It is found that from 1985 to 1993 and from 1994 to 2000, the real relationship of G.O.D had not yet formed. However, after building the strategic Oil reserve system in 2001, the significant positive correlation shows between Oil and Gold, and the significant negative correlation shows between Oil and U.S Dollar, which implies the relationship of G.O.D became stable. Meanwhile, the quantile regression results indicate that, the interaction of G.O.D will greatly.

Myeong and David (2011) investigate the relationship between the value of the Dollar and the prices of two commodities, Gold and Oil. Granger causality is used on monthly data from January of 1970 through July of 2008 for world economy. The empirical results show that the hypothesis that there is no causal relation between the value of the Dollar and the prices of Gold and Oil are not supported by the evidence. There are causal relations between each of the prices, and there is a negative relation between the
value of the Dollar and the price of each of the commodities, as predicted by standard economic theory. Also consistent with the predictions of classical economic theory is that there is a positive statistical association between the prices of Gold and Oil. The implication is that Gold and Oil represent safe havens from fluctuations in the value of the Dollar.

Ranjan Dasgupta (2012)\(^2\) has made a study to examine the long-run and short-run relationships between BSE SENSEX and four key macroeconomic variables (wholesale price index, index of industrial production, exchange rate and call money rate) of Indian economy by using monthly data from April, 2007 to March, 2012 with the application of financial econometrics. Empirical results of the study showed that there are no short-run causal relationships between SENSEX and four macro-economic variables but confirmed long-run relationships between BSE SENSEX with index of industrial production and call money rate.

Subarna K. Samanta and Ali H. M. Zadeh (2012)\(^3\) examined the co-movements of selected macro-variables (Gold price, stock price, real exchange rate and the crude Oil price) based on 21 years data using econometric models for the periods from January 1989 to September 2009. The study exposes that there is a co-integration relationship between the variables.

S. Kaliymoorthy and S. Parithi (2012)\(^4\) have made a study to examine the relationship between Gold price and stock market for the period from June 2009 to June 2010. They prove that there is no relationship with the stock market and Gold price and stock market is not a ground for rising Gold price.

Le Thai-Ha et al (2011)\(^5\) have made a study to investigate the relationships between the prices of two strategic commodities, that is, Gold and Oil in terms of index
of US Dollar by using monthly data from January, 1986 to April, 2011 with the application of financial econometrics. Empirical results of the study showed that there is a long-run relationship existing between the prices of Oil and Gold and the Oil price can be used to predict the Gold price.

Seyed Mehdi Hosseini et al (2011) examined the relationships between stock market indices and four macroeconomics variables, namely crude Oil price, money supply, industrial production and inflation rate in China and India using yearly data between January 1999 and January 2009. The study points out that there are both long and short run linkages between macroeconomic variable and stock market index in each of these two countries.

Gagan Deep Sharma and Mandeep Mahendra (2010) made a study to evaluate the long-term relationship between BSE and Macroeconomic variables (exchange rates, foreign exchange reserve, inflation rate and Gold price) for the period from January 2008 to January 2009 using multiple regression model. The study reveals that exchange rate and Gold price influences the stock prices in India.

Shefali Timwar and Barkha Gupta (2015) examined the causal relationship between gold prices and stock market returns in India. The researcher has used nine years monthly average BSE index and gold price data for this purpose and they used ADF unit root test and granger causality test. For the purpose of analysis, linear deterministic trend and lags interval in first differences have used. The Study found that the time series are not stationary at levels and selected time series are stationary at first difference. Granger Causality test indicates that no causal relationship exist between gold price and BSE sense.
Manisha Luthra and Shikha Mahajan (2014) studied impact of Macro factors on BSE Bankex. The Bombay Stock Exchange launches the BSE Bankex index in the year 2003 and this index consists of major public and private sector banks listed in BSE. Further, they selected four macroeconomic factors namely inflation rate, Exchange rate, GDP and Gold price. They studied the intensity of relationship between these macro factors and BSE Bankex using 10 years monthly average index. The researcher used SPSS for develop a multiple regression model and which showed the regression co-efficient between the share prices and various factors affecting the same. Regression results indicate that Exchange rate, Inflation, GDP growth rate affect banking index positively whereas Gold prices have negative impact on BSE Bankex but none of them have significant impact on Bankex.

In a study, Esref Savas BASCI and Suleyman Serdar KARACA (2013) examined the relationship between ISE 100 Index and a set of four macroeconomic variables using Vector Autoregressive (VAR) model. Variables we used in our model are Exchange, Gold, Import, Export and ISE 100 Index. ISE 100 Index is a dependent variable and the others are independent variables. In this study we used 190 observations for the sample period from January, 1996 to October, 2011. All variables have seasonal movements. After seasonal adjustments, all series have had stationary in their first difference. After determining optimal lag order, it was given one standard deviation shock for each series and their response. And in variance decomposition carried out subsequently, it has been determined that especially as of the second default of exchange, it was explained 31% by share indices.

In a study Amalendu BHUNIA and Sanjib PAKIRA (2014) has investigated the affiliation between three financial variables of gold price, exchange rates and Sensex.
between 1991 and 2013. for the purpose they used econometrics models namely unit root test, granger causality test and Johansen co integration test. They found that Johansen cointegration test result indicates that there exists a long-term relationship among the selected variables. The Granger causality test result shows that there must be either bidirectional or no causality among the variables.

Vishal Sood and et.al., (2014)\textsuperscript{62} examined the effects on gold returns by the important and highly traded financial assets - Gold ETFs, Gold Futures, BSE SENSEX and S&P CNX NIFTY. The research also explores the correlation and their impact on each other individually and collectively with respect to volatility clustering by using GARCH (1, 1) Model. The study shows that while inefficiency is present in the gold, Gold ETFS, Gold Futures, BSE SENSEX returns and S&P CNX NIFTY returns together affect the volatility of gold returns for the period 2011-2013.

Karunanithy Banumathy and Ramachandran Azhagaiah (2014)\textsuperscript{63} examined in a study that, exists a causal link between BSE Sensex (SENSEX) and gold price (GOLD). Time series data (monthly) of BSE Sensex and gold price for the period from January 2004 to December 2013 are used. To provide evidence on the existence of causal relationship between the variables, the Granger Causality test employed. Johansen cointegration results show that there is a cointegration between the two variables chosen and which leads to prove the existence of causal relationship between them. The study found that there exists a causal relationship, which is running from SENSEX to GOLD however there is no such relationship exists from GOLD to SENSEX, and therefore the study concludes that there is a unidirectional relationship existed between stock price and gold price.
RESEARCH GAP

As could be inferred from the literature review, there is extensive literature analysis on the inter-relationship between the variables such as Stock Market, Oil, Gold and US Dollar. The main objective of this research is to focus on the inter-relationship and dependence between the Stock Market, Gold price, the US Dollar and Oil price as it could play an important role in the spillover between each other. This also effects the growth of an economy. This research is a major contribution to the existing literature in this area as it throws light on new evidence on the relationships among these markets by updating and extending new evidence and introducing a new approach that lays emphasis on inter-dependence and inter relationship over the period between the years 1990 to 2015 in India.

The rescaled range is a statistical measure of the variability of a time series introduced to provide an assessment of how the apparent variability of a series changes with the length of the time-period being considered.

SR can be performed in supervised, unsupervised and semi-supervised situations. It can make efficient use of both labeled and unlabeled points to discover the intrinsic discriminant structure in the data.


If the variables under study have unit roots and are cointegrated, a variant on the VAR called the Vector error correction model (VECM) should be used.


Switching Regime beta model is used to describe markets in disequilibrium. This approach is successfully applied to exchange rates.

Economic and monetary union (EMU) is an umbrella for the group of policies converging the economies of all members of the European Union.


32 FPE criterion provides a measure of model quality by simulating the situation where the model is tested on a different data set. According to Akaike’s theory the most accurate model has the smallest set.


Geweke (1982) provides a methodology for measuring the degree of co-movement (interrelationship) between pairs of stock markets. This has certain advantage over other means (VAR or Granger causality).


Pravit (2009), The model is referred to as an ARIMA(p,d,q) where p,d,q are non-negative integers that refer to the order of the autoregressive, integrated and moving average parts of the model respectively.

Vector error correction model is a dynamical system with the characteristics that the deviation of the current state from its long-run relationship will be fed into its short-run dynamics and it adds error correction features to a multi-factor model such as a vector auto regression model.

Organization for Economic Co-operation and Development is an international economic organization of 34 countries founded in 1961 to stimulate economic progress and world trade.

Dynamic Conditional Correlation Generalized Autoregressive Conditional Heteroskedasticity are used to characterize and model observed time series

See Sadorsky (2001)

Augmented Dickey-Fuller is a test for a unit root in a time series sample.

Phillips-Perron is a unit root test for analyzing the stationary variables
Kwiatkowski–Phillips–Schmidt–Shin tests are used for testing a null hypothesis that an observable time series is stationary around a deterministic trend.


