

**AN ANALYTICAL INSIGHT INTO THE EFFECTS OF CHANGES IN
SELECTED BROAD BASED STOCK MARKET INDICES OF THE
WORLD, FOREIGN EXCHANGE RATES AND INTERNATIONAL
PRICES OF GOLD & CRUDE PETROLEUM ON CNX NIFTY**

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ABSTRACT

With increasing globalization of business, cross-border investment has gained momentum. Increasing international mobility of capital has resulted in connectedness between capital markets across the globe. Financial contagion is now a common phenomenon as capital markets in countries have become sensitive not only to the domestic economic and other situations but also to the foreign capital markets which are linked with the domestic capital market. However, the sensitivity depends on the extent to which the foreign capital market movements affect the domestic capital market. This paper presents a study on the connectedness of the Indian Stock Market certain prominent broad-based stock-market indices of the World as well as with prices of crude petroleum and gold in the international markets and foreign exchange rates by utilizing multivariate linear regression method. To assess the time lag of the effects of the foreign stock market performance as well as the international prices of crude petroleum and gold and foreign exchange rates on the Indian Stock market, such factors were considered at zero to seven days' lag. The study identifies the performance of selected European stock markets, price of crude petroleum and exchange rates of USD and Euro to have significant effects on the performance of the Indian Stock market.

Key words : Financial Contagion; Foreign Stock Market Indices, International prices of Gold and Crude Petroleum; Exchange Rates of USD and Euro; Indian Stock Market; Multivariate Linear Regression

Introduction

In July 1997, a currency crisis in Thailand quickly spread throughout East Asia and then to Russia and Brazil. The developed markets in North America and Europe were also affected which resulted in the fall of Long Term Capital Management (LTCM), a big U.S. hedge fund.

The more recent global financial crisis triggered by the credit crisis in the USA from the middle of 2007 to almost the end of 2008, spread rapidly across the globe resulting crash of various global stock markets and bankruptcy of leading financial institutions.

The transmission of a financial crises from one country or region to another is usually referred to as a financial contagion.

The vulnerability of any national economy to get infected by such financial contagion is affected by the interconnectedness of such economy with the global economy.

Developed economies e.g. the US and European Economies as well as developing and emerging economies have fallen prey to such financial contagion.

It is thus imperative for every economy to identify the factors of the international financial environment which have significant effect on it and also the time lag i.e. the time taken for a financial shock to be transmitted to the economy.

Such factors, as identified by scholars include performance or more specifically volatility of foreign capital markets, exchange rates of foreign currencies, interest rates, and economic policies of different nations.

The three fundamental aspects related to financial contagion are the channels through which financial crises is transmitted across nations, the difference in time lag in different nations being affected by a crises and the possible pro-active protective measures to resist such transmission of financial crises.

Literature Survey

Literature survey for the study has been done to address four issues relating to financial contagion i.e. the working definition of financial contagion, the identified causes thereof, the effects thereof and the methodologies to measure the degree of contagion.

Walti (2003) interprets contagion as a significant change in the way that country-specific shocks are transmitted across international stock markets. Forbes (2012) defines contagion as the spillovers from extreme negative events. Moser (2003) uses the term more broadly and includes into currency, banking and debt crises in the definition. Tjahjawandita et al (2009) opines that there is no firm consensus on the appropriate definition of financial contagion. However, for a working definition, this study follows the definition provided by The World Bank Group which defines the phenomenon as a cross-country transmission of shocks or the general cross country spillover effects.

Countries with weak fundamentals can be more prone to crises when they liberalize their financial sectors. Globalization can also lead to crises in countries with strong fundamentals due to imperfections in financial markets or external factors. Open economies are exposed to contagion through different link points such as real links, financial links, and herding behavior. (Schmukler et al). Kaminsky et al (2003) distinguish three factors i.e. abrupt reversal in capital inflows, surprise announcements and a leveraged common creditor to be the principal determinants of a financial contagion. Dornbusch et al (2000) identifies trade and finance linkages between countries for transmission of financial crises.

Financial contagion has different effects on different countries. Kuusk et al (2011) stock returns' correlations between US and Baltic States increased during crisis times. However, volatility has not spilled over from US to Estonia, Latvia and Lithuania, neither have volatility spillovers become stronger after the crisis. Dornbusch et al (2000) cited the identification of certain nations which are at a risk of contagion as against other nations.

Kleimeier et al (2003) used price observations which were exactly aligned in time to correct for time-zone and end-of-business-day differences between markets. They further provided for time lags between price observations in order to test the assumption that the shock is not immediately transmitted from one market to the other. Mondria & Quintana-Domeq (2012) considered two stock markets with uncorrelated fundamentals and used the fluctuations in international investors attention allocation to measure the degree of financial contagion.

Tjahjawandita et al (2009) estimated the spill-over effect of the global financial crises across borders and regions by using spatial econometrics method employing distance based weight matrix to estimate the spatial dependence and spatial heterogeneity of the crises.

Objective of the Study

The objective of this paper is to identify the countries which can be a potential sources of financial contagion that can affect the Indian Stock market as well as to examine whether prices of crude petroleum and gold in international markets and foreign exchange rates affect the Indian stock market. Thus this paper envisages to identify the foreign stock markets whose performance affects the performance of the Indian stock market. Moreover this paper also examines the effects of international prices of gold and crude petroleum along with those of INR-USD and INR-EUR exchange rates on the performance of the Indian Stock Market. This paper further uses the lag approach to assess the time lag of a change in the foreign factors to affect the Indian Stock Market.

Scope of the study

The scope of the study is limited to the effect of selected independent variables i.e. three Asian broad-based stock market indices, three European Broad-based stock market indices, S&P500 of USA, Bovespa of Brazil, prices of spot crude (FOB), gold, INR-USD & INR-EUR exchange rate of daily closing values of CNX Nifty. The time period during which the data were collected was between September 3 2012 to August 21, 2013.

Limitations of the study

The study is subjected to two obvious limitations. Firstly, dynamics of other macroeconomic variables also affect the CNX NIFTY which have not been considered. Secondly, if the time frame is widened, the results might be different.

Methodology of the Study

CNX Nifty has been taken to be the barometer of the Indian Stock Market. Three Asian stock market indices i.e. Sanghai Composite of China, Hang Seng Index of Hong Kong and Nikkei of Japan, three European stock market indices i.e. CAC 40 of France, DAX of Germany and FTSE 100 of The Great Britain, the S&P 500 index of USA and Bovespa of Brazil were selected to the predictor stock market indices to cover, Asia, Europe and South America as well as the emerging economies of the World. For CNX Nifty, daily closing balances for the period from September 3rd 2012 to August 21st 2013 were taken from <http://www.nseindia.com>. Regarding the predictor variables, the opening, high, low and closing values of the selected foreign stock market indices were taken from <http://in.finance.Yahoo.com> for the same dates considering the effect of the International Date Line. As additional predictor variables the opening, high, low and closing prices of Gold in international markets for the same dates were taken from http://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm. Daily closing Brent Crude Petroleum Oil spot FOB price were taken from http://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm. The daily end-of-business-day spot prices of USD and INR were taken from <http://www.exchangerates.org.uk>.

The CNX Nifty values were taken to be the dependent variable and all the other 36 variables were taken to be the regressor or predicting variables. The method of multivariate linear regression was applied to test the association of CNX Nifty values with the selected predictor variables from the adjusted R squared value.

The level of significance was taken at 5%. Only those predictor variables were considered to be statistically significant whose coefficients had an absolute value of t statistic greater than or equal to 2 and a corresponding p value of less than 0.05.

The Durbin-Watson statistic was also calculated to assess the autocorrelation among the predictor variables. However, as the same set of predictor variables were selected for all the lag situations, the effect of the autocorrelation was also same for all the lag situations considered and as such autocorrelation did not affect the findings of this comparative study.

The multiple regression analysis was done of SPSS 21 (Base Module) platform.

Findings of the Study

It was observed from the findings that the closing values of DAX were significant predictor variables for the closing values of CNX Nifty for all the time lags considered including the no-lag situation also. The daily high of DAX were also found to be significant regressors for all the time lags except the lags of 4, 5 and 7 days. The daily price movements of gold were found to have significant effects on the same day closing values of CNX Nifty as the coefficients of all the opening, high, low and closing prices of gold were found to be statistically significant in no-lag situation. The opening price of gold had a negative coefficient whereas all the other prices had positive coefficients. However, gold prices lost the significance as regressor variables in all the lag situations. The INR-USD and INR-EUR exchange rates as well as the closing spot Brent FOB price of crude petroleum were found to be significant predictor variables for all the situations considered in this study including the no-lag situation. Coefficients of INR-USD exchange rate has positive coefficients and those of INR-EUR and Spot FOB Price of Brent Crude Petroleum had negative coefficients for all the situations considered in the study.

The values of adjusted R Squared remained slightly over 0.64 in the no-lag situation as well as in lag situations of upto 5 days. If the lag situation was increased further, the value of Adjusted R Squared fell sharply to slightly over 0.60.

The details are contained in Table Nos. 1 to 4 as given in the Annexure.

Inference of the Study

The findings of the study obviated the following inferences.

Firstly, spot prices of Crude Petroleum in international markets affected the Indian Stock market significantly.

Secondly, INR-USD exchange rate affected the Indian Stock market significantly.

Thirdly, INR-EUR exchange rate affected the Indian Stock market significantly.

Fourthly, spot price of gold in international markets affected the Indian Stock market.

Fifthly, the daily high and closing values of German Stock market Index DAX had significant effect on the Indian stock market. The closing value of DAX was found to be comparatively more significant.

Sixthly, all the other selected broad-based global stock market indices did not have any significant effect on the Indian Stock Market.

Seventhly, the selected predictor variables could explain more than 64% of the variations in the dependent variable i.e. CNX Nifty upto 5 days lag. If the lag was increased to 6 and 7 days, the percentage fell to slightly over 60%. This indicates the presence of other extraneous variables not considered in the study.

Scope of Further Research

The findings of this study may be tested for generalization by extending the scope to other global indices. The association of the sectoral and thematic Indian stock market indices with global stock market indices and prices of crude oil, gold and foreign exchange rates may be explored to assess the effect of the regressor factors on the specific sectors of the Indian industry.

Annexure

Table 1. Significant Predictor Variables for Regression with No Lag & Lag of 1 Day

| <i>Predictor Variables</i> | <i>No Lag – Same Day</i> | | | <i>Lag of 1 Day</i> | | |
|----------------------------|---|---|----------------|---|---|----------------|
| | <i>Adjusted R² = 0.646</i> | <i>Durbin-Watson Static = 0.590</i> | | <i>Adjusted R² = 0.646</i> | <i>Durbin-Watson Static = 0.613</i> | |
| | <i>Coefficient</i> | <i>t statistic</i> | <i>p value</i> | <i>Coefficient</i> | <i>t statistic</i> | <i>p value</i> |
| Nikkei – High | - | - | - | 0.360 | 2.484 | 0.014 |
| DAX – High | -0.933 | -2.396 | 0.017 | -1.011 | -2.618 | 0.010 |
| DAX – Close | 0.683 | 1.969 | 0.050 | 0.858 | 2.507 | 0.013 |
| Gold – Opening | -3.671 | 2.684 | 0.008 | - | - | - |
| Gold – High | 3.601 | 2.310 | 0.022 | - | - | - |
| Gold – Low | 2.523 | 1.942 | 0.050 | - | - | - |

| | | | | | | |
|-------------------|---------|--------|-------|---------|--------|-------|
| Gold – Closing | -2.482 | -2.123 | 0.035 | - | - | - |
| INR-USD Exch Rate | 81.056 | 4.589 | 0.000 | 81.807 | 4.638 | 0.000 |
| INR-EUR Exch Rate | -39.712 | -3.082 | 0.002 | -38.288 | -3.006 | 0.003 |
| Brent Crude FOB | -8.271 | -2.771 | 0.006 | -8.394 | -2.823 | 0.005 |

Note: p value of 0.000 shows the output as per SPSS which indicates a very low value.

Table 2. Significant Predictor Variables for Regression with Lags of 2 & 3 Days

| <i>Predictor Variables</i> | <i>Lag of 2 Days</i> | | | <i>Lag of 3 Days</i> | | |
|----------------------------|--|---|----------------|--|---|----------------|
| | <i>Adjusted R² =</i> 0.642 | <i>Durbin-Watson</i> <i>Static = 0.589</i> | | <i>Adjusted R² =</i> 0.651 | <i>Durbin-Watson</i> <i>Static = 0.586</i> | |
| | <i>Coefficient</i> | <i>t statistic</i> | <i>p value</i> | <i>Coefficient</i> | <i>t statistic</i> | <i>p value</i> |
| DAX – High | -0.864 | 2.228 | 0.027 | -0.852 | -2.236 | 0.026 |
| DAX – Close | 0.718 | 2.088 | 0.038 | 0.812 | 2.407 | 0.017 |
| Bovespa – Opening | 0.047 | 1.993 | 0.048 | 0.050 | 2.132 | 0.034 |
| INR-USD Exch Rate | 102.939 | 5.812 | 0.000 | 108.56 | 6.241 | 0.000 |
| INR-EUR Exch Rate | -49.994 | -3.908 | 0.000 | -51.659 | -4.112 | 0.000 |
| Brent Crude FOB | -11.387 | -3.813 | 0.000 | -11.717 | -3.995 | 0.000 |

Note: p values of 0.000 show the output as per SPSS which indicates a very low value.

Table 3. Significant Predictor Variables for Regression with Lags of 4 & 5 Days

| <i>Predictor Variables</i> | <i>Lag of 4 Days</i> | | | <i>Lag of 5 Days</i> | | |
|----------------------------|--|---|----------------|--|---|----------------|
| | <i>Adjusted R² =</i> 0.647 | <i>Durbin-Watson</i> <i>Static = 0.586</i> | | <i>Adjusted R² =</i> 0.646 | <i>Durbin-Watson</i> <i>Static = 0.553</i> | |
| | <i>Coefficient</i> | <i>t statistic</i> | <i>p value</i> | <i>Coefficient</i> | <i>t statistic</i> | <i>p value</i> |
| DAX – Low | - | - | - | -0.851 | -2.463 | 0.015 |

| | | | | | | |
|-------------------|---------|--------|-------|---------|--------|-------|
| DAX – Close | 0.732 | 2.164 | 0.032 | 0.940 | 2.767 | 0.006 |
| CAC40 – Closing | - | - | - | -1.536 | -2.214 | 0.028 |
| INR-USD Exch Rate | 110.326 | 6.326 | 0.000 | 106.338 | 6.073 | 0.000 |
| INR-EUR Exch Rate | -52.802 | -4.192 | 0.000 | -47.252 | -3.737 | 0.000 |
| Brent Crude FOB | -11.761 | -4.000 | 0.000 | -11.336 | -3.840 | 0.000 |

Note: p values of 0.000 show the output as per SPSS which indicates a very low value.

Table 4. Significant Predictor Variables for Regression with Lags of 6 & 7 Days

| <i>Predictor Variables</i> | <i>Lag of 6 Days</i> | | | <i>Lag of 7 Days</i> | | |
|----------------------------|---|---|----------------|---|---|----------------|
| | <i>Adjusted R² = 0.609</i> | <i>Durbin-Watson Static = 0.591</i> | | <i>Adjusted R² = 0.603</i> | <i>Durbin-Watson Static = 0.558</i> | |
| | <i>Coefficient</i> | <i>t statistic</i> | <i>p value</i> | <i>Coefficient</i> | <i>t statistic</i> | <i>p value</i> |
| Nikkei – High | - | - | - | 0.315 | 2.056 | 0.041 |
| DAX – High | -0.887 | -2.194 | 0.029 | - | - | - |
| DAX – Low | -0.808 | -2.218 | 0.028 | - | - | - |
| DAX – Close | 1.038 | 2.898 | 0.004 | 0.843 | 2.329 | 0.021 |
| INR-USD Exch Rate | 98.577 | 5.341 | 0.000 | 90.369 | 4.845 | 0.000 |
| INR-EUR Exch Rate | -37.952 | -2.847 | 0.005 | -27.115 | -2.013 | 0.045 |
| Brent Crude FOB | -11.225 | -3.607 | 0.000 | -10.470 | -3.329 | 0.001 |

Note: p value of 0.000 shows the output as per SPSS which indicates a very low value.

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