To deepen the understanding about the different factors that determine the stock returns of the Indian market

UNDERGRADUATE THESIS

Submitted in partial fulfilment of the requirements of
BITS F421T Thesis

By

SIDDHARTH SOMANI
ID No. 2014B4A80911g
Under the supervision of:

Prof. Naman Desai

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE PILANI, PILANI CAMPUS
December 2018

ABSTRACT

Emerging stock markets are considered to be partially segmented from global capital markets. As a result, in this paper the stock returns of the American stock market are considered as a determining factor of Indian stock market returns (Bombay stock Exchange). The other factors considered to be of importance are the Money Supply, Exchange rate (dollar to INR), inflation, industrial production, price to earnings ratio, dividend yield and bank rate. A model is made using these variables to determine the linear relationship between them and the Indian stock market returns. To avoid the collinearity between the variables the equation is solved by decomposition of the variables to their principal components and expressing the relationship between the stock market returns and the principal components.

Acknowledgements

I am grateful to a lot of people for their help, advice, support and encouragement while doing this work.

I am obliged to thank Prof. Naman Desai , IIM Ahmedabad who gave me an opportunity to do a 4 month thesis and to work on this project. We constantly learnt new things as the days progressed. He always nudged me in the right direction and the discussions were fruitful and invaluable towards understanding of the statistical methods and the Indian stock market. The amount of time he spent for me and the encouragement makes me in debt to my guide. I thank my On campus supervisor Prof. Mayank Goel, Bits Pilani Goa for providing me insight about the research work and encouragement for learning new things. I would also like to thank Prof. Joshy Jacob, IIM Ahmedabad who provided me with valuable inputs and constructive feedback on my work every week. He was always there for clarifying my doubts in this topic. I would also like to thank my father, Mr Asit Somani and my cousin Parth who helped me with the project. I thank my family for moral support.

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Chapter 1

INTRODUCTION

India most likely to become the fastest growing economy by the end of 2018, having the 5th largest stock market in the world. Currently, a low percentage of household savings are invested in the stock market, but the GDP growing 7-8 % annually there might be an increase in the investment in the stock markets. Investors before investing in the stock market, need to have an idea about the price of the stocks in the future. For this a study needs to be conducted to find know how will the prices in the stock market move.

A number of studies showing the relationship between macroeconomic variables and equity market returns, have been conducted for developed markets. These studies have shown macroeconomic variables as explanatory factors of the variation in stock markets. This paper extends this literature by considering the relationship in the Indian stock market, which is considered as an emerging market. It also extends the research by including some major microeconomic variables.

The Indian stock market, considered as an Emerging stock market, appears to have features that distinguish itself from other stock markets. Returns and risks have been found to be higher relative to developed markets. (Errunza, 1983; Claessens et al., 1993; Harvey,1995a). The returns achievable appear to be more predictable than developed markets and exhibit stronger mean reversion properties (Bekaert, 1995; Bekaert and Harvey, 1995; Harvey, 1995a), with a higher degree of autocorrelation. Even though there is evidence to suggest that emerging stock markets are segmented from world capital markets, Bekaert and Harvey (1995). suggested that sometimes an emerging market may exhibit time-varying integration, relative to the developed markets. This forms a basis to study the Indian stock market.

In this paper, two questions are investigated. The paper investigates the extent to which certain global and local macroeconomic variables, and local microeconomic

variables are able to explain the variation in equity returns over the last 10 years in India, considered as an emerging stock market. The paper investigates whether these factors have an explanatory power over emerging market returns. Moderate support is found to support association between some of the variables and returns. Also this paper tries to find the time taken by the returns to react to a change in this factors.

Chapter 2

COLLECTING DATA

2.1 INTRODUCTION

Multifactor models have been developed to study the stock market returns. The variation of returns in each market can be modelled as a function of N-factors of a global nature. Furthermore, if one global factor is employed and this factor is assumed to be the return on the world equity market, then the well-known International Market Model follows. If we assume that the market is perfectly segmented from world markets then an alternative model can be made by K-factors, which are local in nature. However, studies have shown that emerging stock markets are only partially integrated. So both global and local factors are used in determining equity return variation. The general model used will be

$$R_t = \alpha + \sum_{m=1}^{N} \beta_m G_m + \sum_{j=1}^{K} \gamma_j L_j + \varepsilon \qquad (2.1)$$

Where G_m and L_j are the global and local factors respectively

A single-factor specification (N=1) is assumed for the global component as it can be represented by the return on a value-weighted world market index.

The data used for the model is mentioned below

2.2 GATHERING DATA

1. Indian stock market returns

Stock market index- It is the measurement of a section of the stock market. It is computed as a weighted average of the prices of selected stocks. It is a used by investors and financial managers to describe the market, and to compare the return on specific investments. It is always measured relative to a base year considering its base value (100 or 1000) at that year.

Significance - Stock Market Indices give an idea about the overall trends of the stock prices in the capital markets. They help the investors in identifying the general trends of the market. Investors take the stock market as a reference to decide about which stocks should they invest for.

The Indian stock market indices- The major stock market indices in India include the stock market indices under the Bombay stock exchange (Bse 100, Bse 200, etc…) and the national stock exchange (Nifty 100, Nifty 200, etc…) .

BSE, was established in 1975 is India's oldest stock exchange. It claims to be the world's fastest stock exchange, with a median trade speed of 6 microseconds. It is the world's 10th largest stock exchange, with a market capitalization of more than $2.3 million as on April 2018. The S&P BSE 500 index includes the top 500 companies listed under BSE. It captures approximately 90% of the market capitalization in India. It includes all the major companies in India. It uses the free-float methodology which is the best practice accepted Globally. Hence it was decided to be chosen for analysis

Calculating returns – The value of the S&P BSE 500 index was included for each month for the time period 2008-2017. The returns for each month are calculated as the percentage change in the index value.

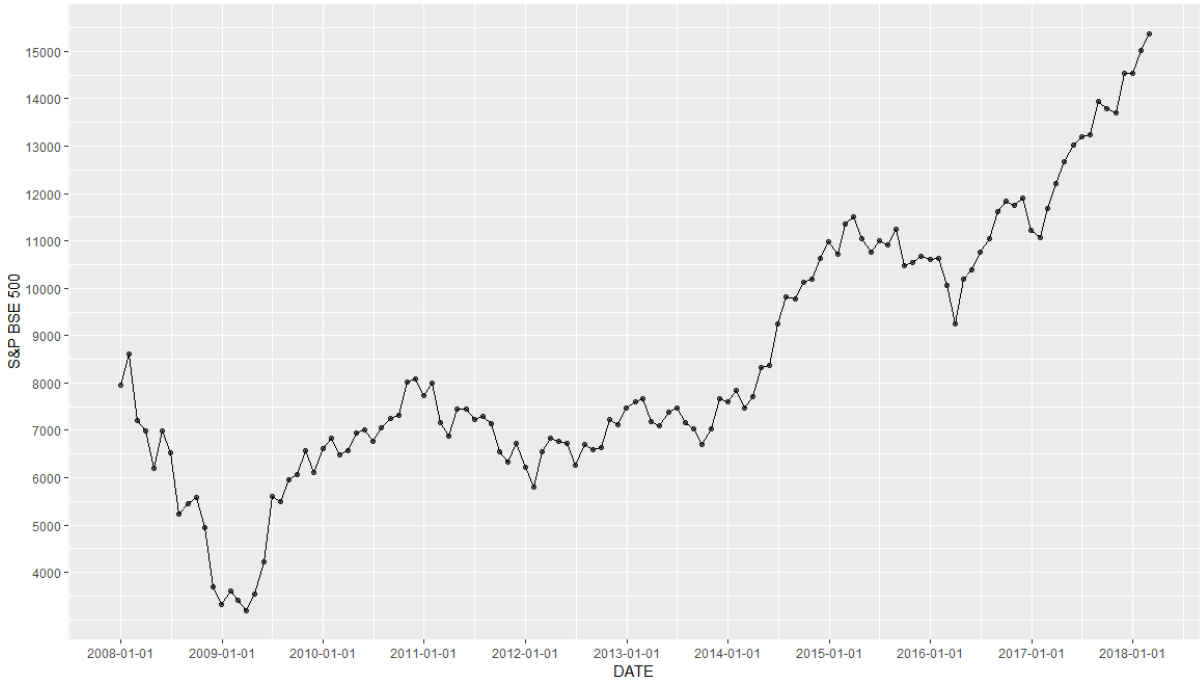

Figure 1.1 – S&P BSE 500

Data source -

https://www.bseindia.com/indices/IndexArchiveData.aspx?expandable=1

2. American Stock market returns (Global factor)–

   The American stock market indices- The major stock market indices in America include the S&P(S&P 500, S&P 1500 , S&P Global 1200, S&P 100 , etc..), NASDAQ (NASDAQ-100, NASDAQ-100 PMI) and the New york stock exchange(NYSE)

   The American stock market is considered to be the representative of global economy. From a global perspective, the U.S. is over one-half of the global stock market, as measured by the S&P Global BMI. It is representative of global macro-economic factors such as recession, bullish market trends etc... Many of the world markets have shown to be correlated with the American stock market. Hence it was chosen for analysis

   Data source-

   Thomoson Reuters Eikon

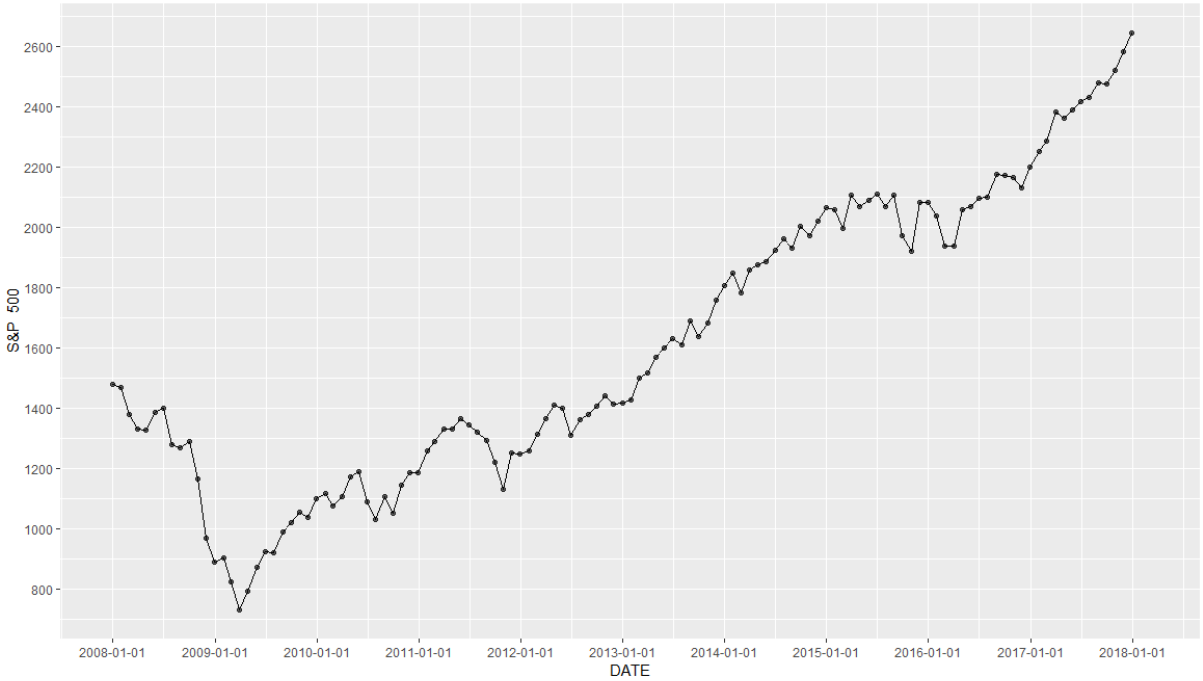

Figure 1.2 – S&P 500

3. INDIA MONEY SUPPLY- It is defined as the total amount of money in circulation or in existence in a country.

   Money supply is measured using the variables M1, M2 and M3

   M1 – It is called narrow money and includes coins and notes that are in circulation and other money equivalents that can be converted easily to cash

   M2 – It includes M1 as well AS the short-term time deposits in banks and certain money market funds

   M3 - It includes M2 as well as the long-term deposits

   The reasons that Money supply affect the stock prices are –

   1.The reserve bank of India and interest rates- While keeping parameters like growth, Inflation, employment, etc… in mind the Reserve Bank of India (RBI) can control money supply through a number of measures. This results in either withdrawal or addition of money into the economy, which results in a change in

the interest rates. An increase in Money supply decreases the interest rates. Lowering of interest rates increases demand and helps in increasing the economic activity and therefore stock prices increase.

2. Interest Rates and Stocks- An increase in money supply and a drop in the interest rates makes stocks a better investment. When the returns by lending money are low, the investors tend to shift more money towards buying stocks.

3. Increased Demand - When the money supply is high there is an increase in demand of goods and services in the economy. The consumers tend to purchase more of every goods and services. This results in an increase in sales for most companies, which increases profits and usually results in higher stock prices.

The variable M3 was chosen as It is the most inclusive and representative definition of liquidity and money supply in modern economy.

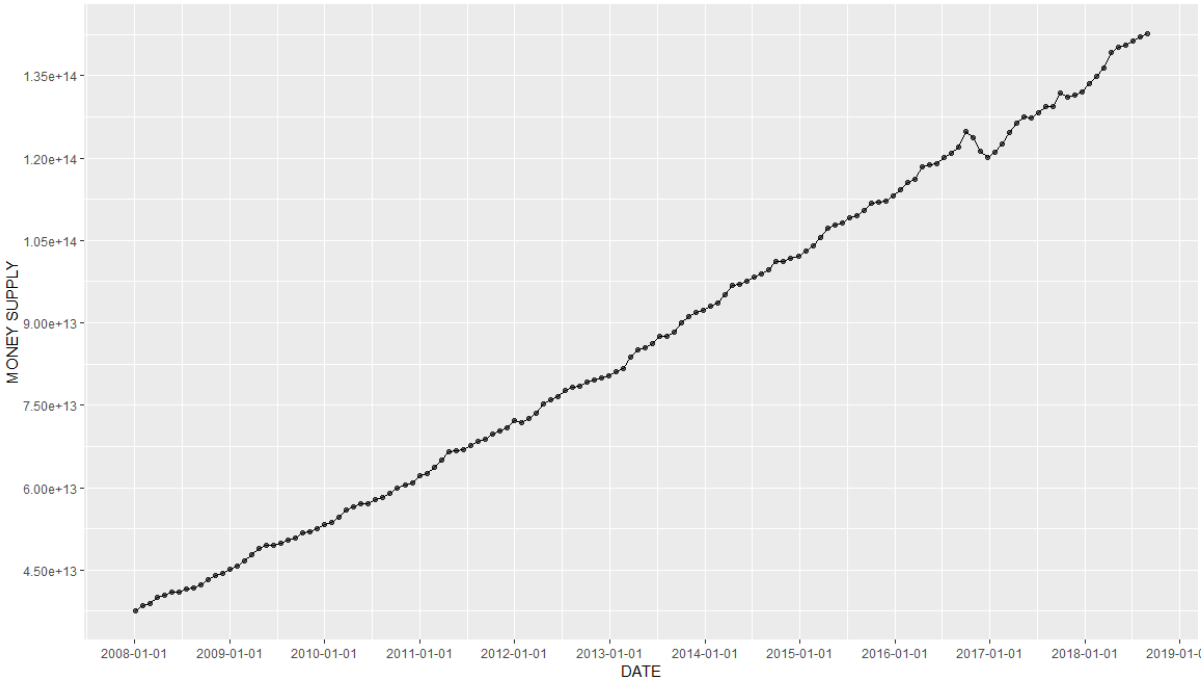

Figure 1.3 – Money Supply

Data source- Thomoson Reuters Eikon

4. INFLATION - It is defined as the rate of increase in the prices of goods and services across the country. It is measured as a change in the consumer price index, the price of a fixed quantity of goods and services.

   When there is there is high inflation, the central bank tries to control this by raising interest rates, to attract investors to invest their cash in fixed income instruments, thereby reducing the liquidity from the system. This reduces the demand for goods in the economy, hence reducing the increase in general prices. This encourages investors to invest their cash from equities to more attractive, less risky securities, like money market funds

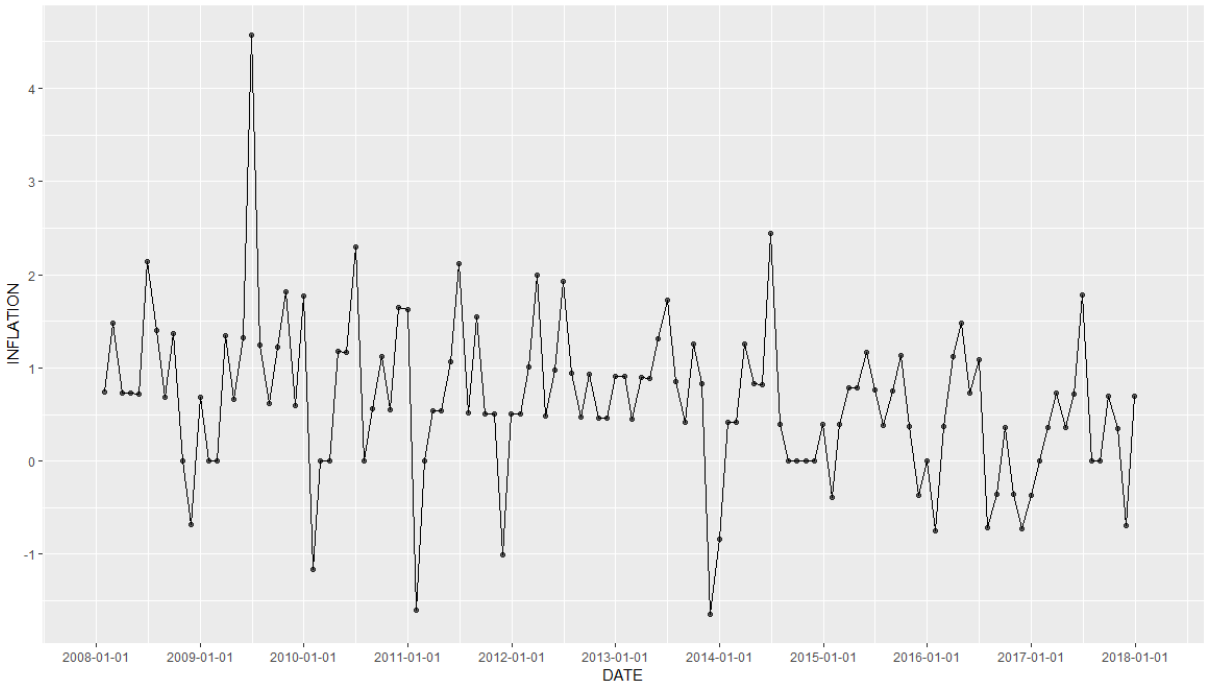

Figure 1.4 - Inflation

Data source - https://www.inflationtool.com/indian-rupee/2000-to-present-value?amount=100

5. INDUSTRIAL PRODUCTION INDEX (REAL ACTIVITY)- The industrial production index (IPI) is a monthly economic indicator measuring real output in the manufacturing, mining, electric and gas industries, relative to a base year

For dividend yielding stocks the increase in IPI means greater amounts of production which results in an increase in revenue for the company. Also increase in IPI figures indicate increase in industrial production. It makes investors and stock markets become more optimistic. Thus due to the increase in the market expectations stock prices increase

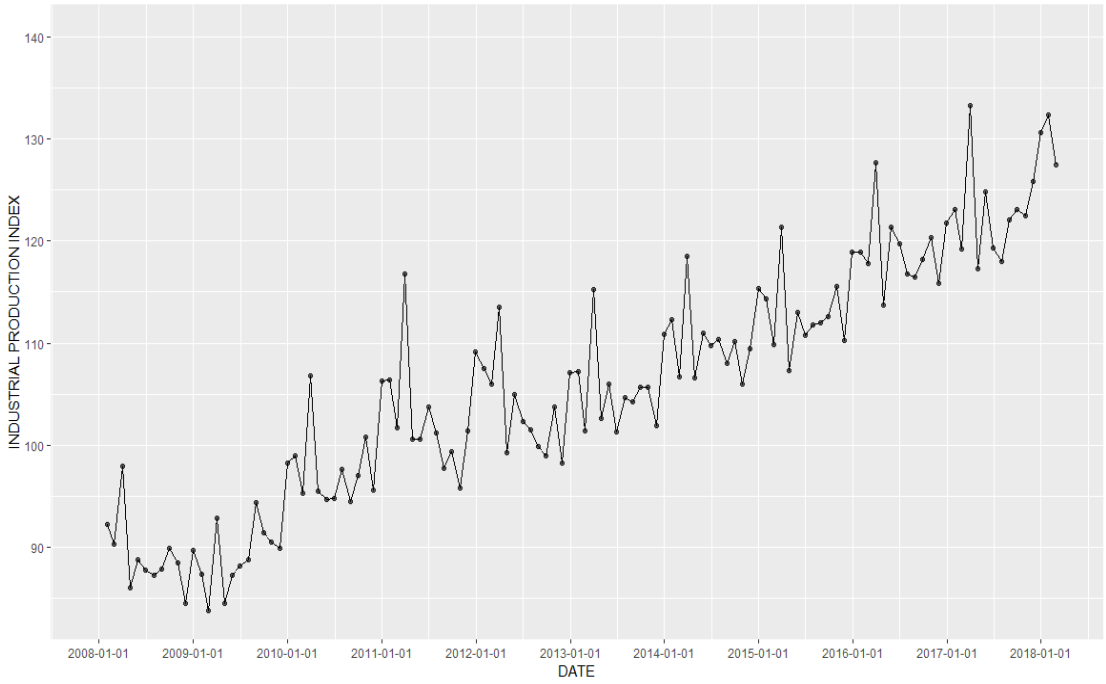

Figure 1.5 – Industrial production Index

Data source- Thomoson Reuters Eikon

- https://dbie.rbi.org.in/DBIE/dbie.rbi?site=home

6. EXCHANGE RATE - The effect of the exchange rate on stock market is

Foreign investors - Foreign investors get lesser realisation for their stock investments in India, when the Rupee falls. Their Indian asset value shrinks. They get lesser Dollar value for the Rupee invested. So, they hasten their exit when rupee falls, resulting in falling stock indices

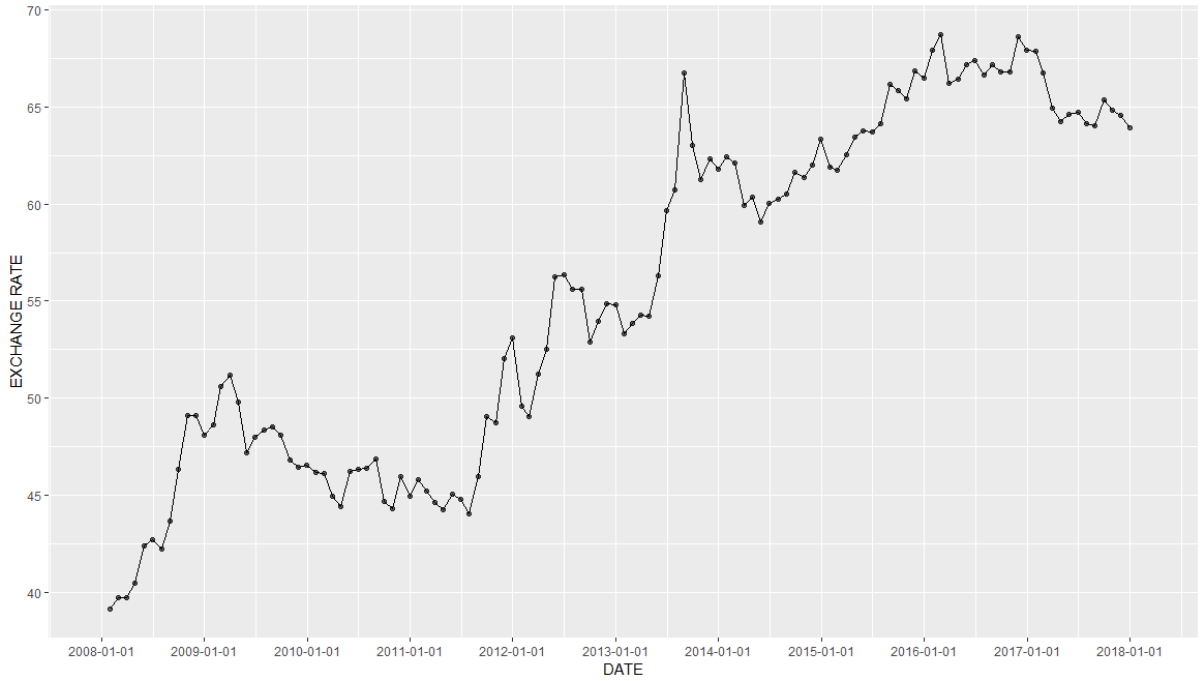

Figure 1.6 – Exchange rate

Data source - https://in.investing.com/currencies/usd-inr-historical-data

7. Dividend yield – It is the ratio that indicates how much a company pays out in dividends each year relative to its share price

$$\text{Dividend yield} = \frac{Annual\ Dividends\ per\ share}{Price\ per\ share}$$

The issuing company, redistributes profits to the shareholders, which makes dividends serve as a source of investment income. Higher dividends make the shareholders more interested in buying shares which results in an increase in the stock prices.

Dividends also affect the market psychology. Sometimes the companies keep rewarding shareholders with consistent – and sometimes increasing – dividends each year. These companies are perceived as financially stable which make for good investments. Conversely, even if a company is making profits but using them in expansion and paying less dividends it may be assumed that the company is performing poorly leading to decrease in stock prices.

The effect of dividend declaration and distribution - Before a dividend is distributed, the issuing company must first declare the dividend amount and the date when it will be paid. It also announces the ex-dividend date. Just Before the ex-dividend date the investors are ready to pay a premium leading to increase in stock prices.

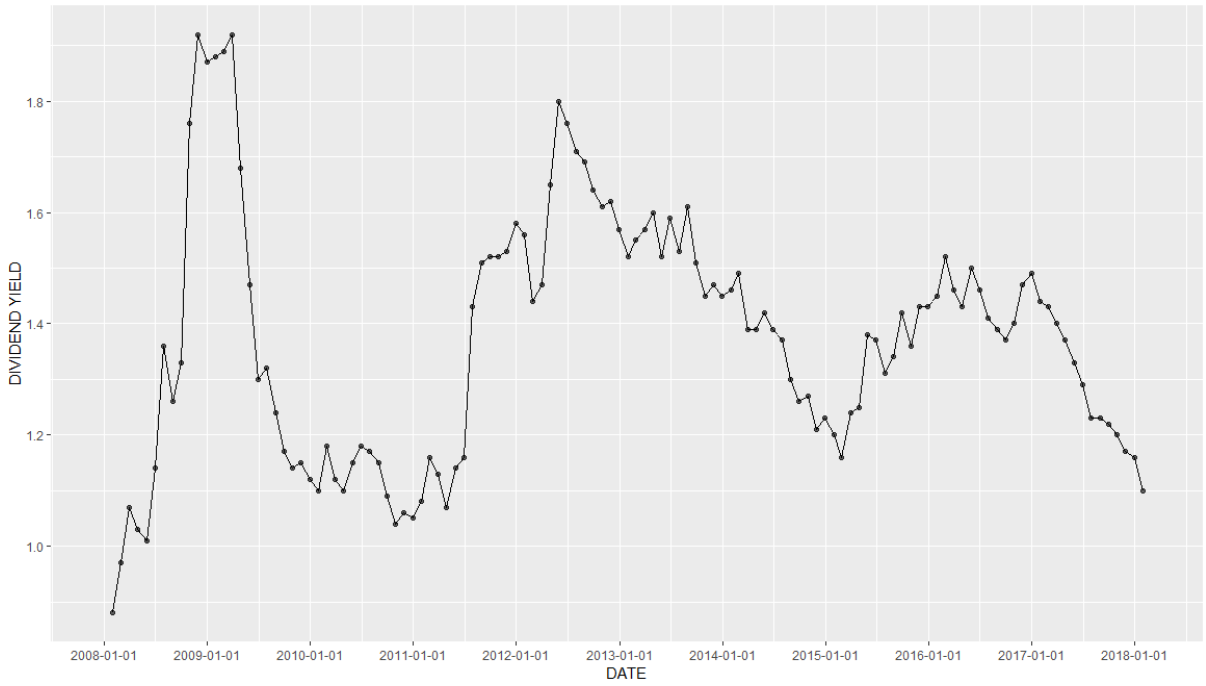

Figure 1.7 – Dividend Yield

Data source -
https://www.bseindia.com/markets/keystatics/Keystat_index.aspx?expandable=2

8. BANK RATE - Bank rate, is the rate of interest which a central bank charges on its loans and advances to a commercial bank.

When the RBI increases the interest rates, it becomes more expensive for the banks to borrow money from the market, due to which they charge a higher interest rate when they lend money. When the banks make borrowing more expensive, companies will borrow less and will pay higher rates of interest on whatever they borrow. This results in the decrease in revenue and growth of the company making the investors less interested in buying the stocks leading to a decrease in stock prices.

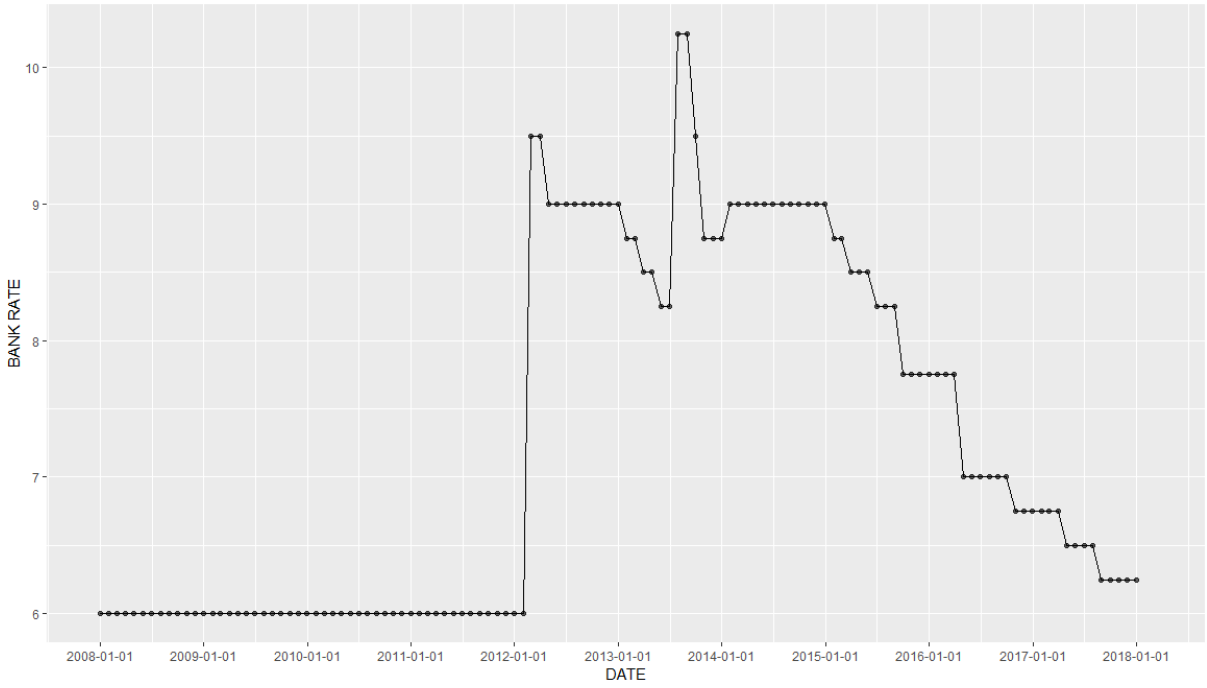

Figure 1.8 – Bank Rate

Data source - https://dbie.rbi.org.in/DBIE/dbie.rbi?site=home

9. Price to earnings ratio - The P/E ratio measures the relationship between a company's stock price and its earnings per share of stock issued. The P/E ratio is calculated by dividing a company's current stock price by its earnings per share (EPS).

$$P/E = \frac{STOCK\ PRICE}{EARNINGS\ PER\ SHARE} =$$

$$\frac{STOCK\ PRICE}{NET\ INCOME/TOTAL\ NO\ OF\ SHARES\ OUTSTANDING}$$

The earnings of the companies have a large share in determining the stock market moments. If the corporate earnings are on rise the market normally moves up. This is because the price of equity shares bears a direct correlation with earnings per share. Therefore, the industry where it is projected that the

earnings will go up is generally favoured by the stock market and therefore stock prices go up for that industry.

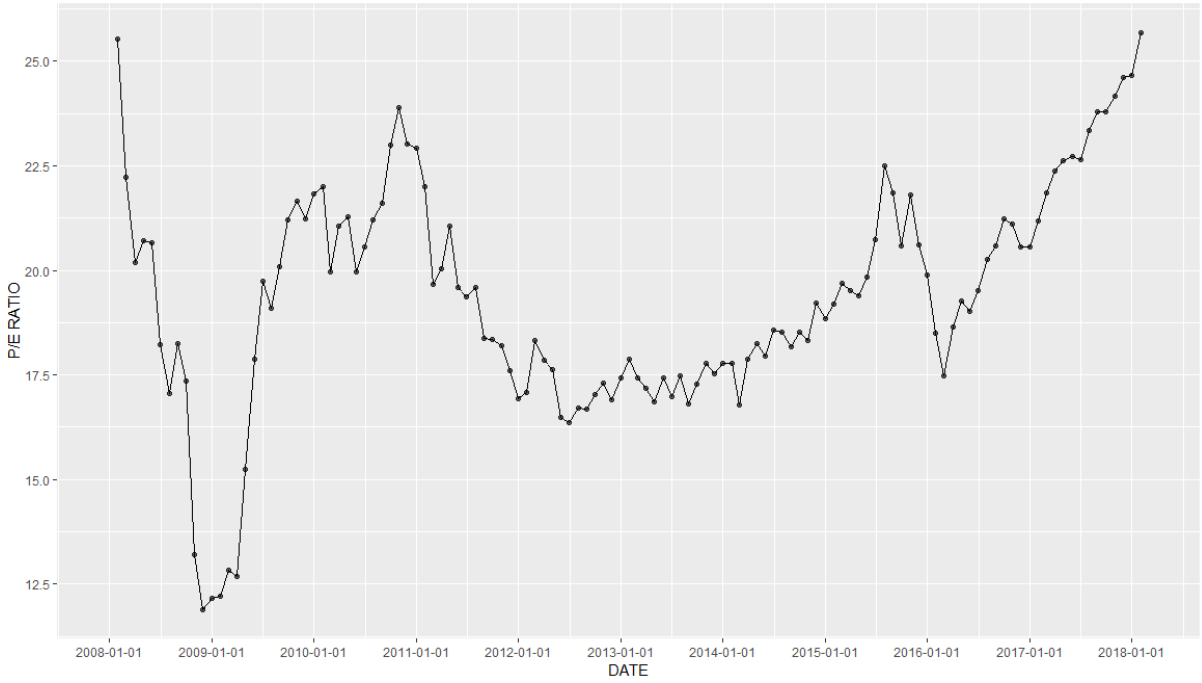

Figure 1.9 – P/E Ratio

Data source -

https://www.bseindia.com/markets/keystatics/Keystat_index.aspx?expandable=2

Based on the gathered data the equation is formed as below

$$R_t^I = \alpha + \beta R_t^A + \gamma MS_t + \xi GP_t + \rho RA_t + \varphi ER_t + \lambda IR_t + \eta DY_t + \delta P/E_t \quad (2.2)$$

Here R_t^I is the returns on Indian stock market(BSE 500) at time t, R_t^A is the returns on American stock market(S&P 500) at time t, MS_t is the percent change in money supply at time t, GP_t is the percent change in goods price(Inflation) at time t, RA_t is the percent change in a real activity variable for country i at time t , ER_t is the percentage change in a exchange rate variable for country i at time t, IR_t is the percentage change in Interest rate at time t , DY_t is the percent change in Dividend Yield at time t , P/E_t is the percent change in P/E ratio at time t

2.3 - DATA CLEANING

The data that was needed in the analysis required data on monthly basis, the beginning of each month. Initially data was filtered to give monthly data. Since some points were missing in the data, the data was plotted using ggplot in R to identify the trends. Based on this the missing data was approximated using suitable methods.

Outliers – The outliers present in the data are due to other factors not included within the equation, like the political risk of the country, which cannot be measured. The outliers were identified through boxplot function in R and the data only present within suitable range was selected.

Chapter 3

ANALYZING DATA

3.1- INTRODUCTION

REGRESSION ANALYSIS - In statistics, Regression analysis is a set of statistical processes for estimating the relationships among several variables. The technique is used in analysing several variables, more specifically it is used in understanding the relationship between an independent variable and more than one dependent variable, in general used to see how the dependent variable changes when when any independent variable that changed, keeping the others fixed. In regression analysis, we characterize the variation of the dependent variable around the regression function using a probability distribution

LINEAR REGRESSION - The most common techniques used for regression analysis is the linear regression model using the ordinary least squares method which is used in this paper. In this method a linear model is considered to exist among the dependent and independent variables. The parameters are found such that the sum of squares error is minimum.

Given, a data set $\{y, x_1, x_2, \ldots . x_m\}_{i=1}^{n}$ n of n statistical units , linear regression model assumes that the relationship between independent variables is linear. It assumes the following model

$Yi = \beta 0 + \beta 1xi1 + \beta 2xi2 + \ldots \beta mxim + \epsilon i$

Where ϵ is the error term

Our goal is to minimize the total sum of squares , SSR = $\sum \epsilon_i^2$

To find the parameters we solve the set of m +1 equations $\frac{\partial SSR}{\partial \beta \mathrm{i}} = 0$

The performance of regression analysis depends on the data generating process and how it relates to the regression approach. Since the true form of the data-generating process is generally not known, regression analysis often makes certain assumptions

about this process. These assumptions can be tested if a sufficient quantity of data is available. Regression models can give incorrect results if the assumptions are incorrect or if the data is incorrect. Sometimes Regression models can also be used to prove the existence of no relationship among variables

3.2 REGRESSION ANALYSIS ON THE INDIAN STOCK MARKET

The necessary data regarding the Indian stock market and the factors affecting it were collected and cleaned as mentioned in the previous chapter. Regression analysis is performed on the cleaned data to conclude whether there exists a relationship among data.

A further complication is that consideration must also be given to time delays in the production of information. Generally, the transmission and incorporation of information contained in the variables into stock market prices is not always instantaneous. There may be delays create between the data of any observation and the returns responding to that data. As a result we test all possible models with variables having delays of 0, 1 or 2 months.

$$R_t^I = \alpha + \beta R_{t-i}^A + \gamma MS_{t-j} + \xi GP_{t-k} + \rho RA_{t-l} + \Phi ER_{t-m} + \lambda IR_{t-n} + \eta DY_{t-o} + \delta P/E_{t-p} \quad (3.1)$$

Where $0 \leq i,j,k,l,m,n,o,p \leq 2$

F test of overall significance – After performing regression analysis to test the validity of our model we use F test. It tests the model for the null hypothesis that the best fit model is an intercept only model. Choosing 5% significance level(α) the models with p value for f test less than 0.05 are selected.

P test – P test is used to test each of the individual variables against the null hypothesis that their coefficients are 0. It is conducted on the data formed after filtering the models from the F test.

S.no	α	β	γ	ξ	ρ	ϕ	λ	η	δ	F
1	0.109	0.009	0.056	0.167	0.125	0.007	0.513	0.746	0.27	0.037
2	0.095	0.011	0.05	0.184	0.097	0.009	0.275	0.894	0.289	0.045
3	0.132	0.01	0.073	0.175	0.187	0.012	0.309	0.713	0.288	0.043
4	0.272	0.016	0.369	0.08	0.105	0.021	0.534	0.883	0.245	0.025
5	0.088	0.016	0.17	0.106	0.042	0.019	0.453	0.978	0.426	0.028
6	0.286	0.017	0.375	0.077	0.105	0.031	0.481	0.819	0.263	0.031
7	0.088	0.02	0.161	0.103	0.034	0.031	0.372	0.652	0.393	0.032
8	0.322	0.012	0.437	0.072	0.186	0.049	0.397	0.53	0.222	0.025
9	0.108	0.018	0.201	0.105	0.081	0.032	0.378	0.74	0.419	0.032
10	0.539	0.021	0.264	0.051	0.447	0.169	0.123	0.005	0.825	0.047
11	0.264	0.011	0.092	0.054	0.503	0.141	0.126	0.006	0.703	0.044
12	0.185	0.012	0.049	0.052	0.395	0.113	0.067	0.013	0.527	0.029
13	0.402	0.032	0.285	0.271	0.211	0.111	0.061	0.006	0.876	0.044
14	0.439	0.027	0.353	0.282	0.204	0.081	0.084	0.006	0.642	0.041
15	0.337	0.019	0.232	0.276	0.147	0.056	0.042	0.011	0.908	0.026
16	0.232	0.015	0.13	0.143	0.087	0.08	0.036	0.014	0.937	0.031
17	0.309	0.012	0.182	0.125	0.073	0.056	0.067	0.015	0.496	0.026
18	0.238	0.01	0.117	0.157	0.057	0.043	0.029	0.024	0.835	0.019
19	0.123	0.018	0.096	0.411	0.854	0.013	0.008	0.008	0.547	0.036
20	0.159	0.016	0.097	0.447	0.263	0.043	0.009	0.003	0.987	0.024
21	0.177	0.015	0.133	0.501	0.244	0.036	0.015	0.003	0.8	0.024
22	0.113	0.008	0.058	0.28	0.171	0.016	0.004	0.005	0.728	0.011

Table 3.1 – Table showing the p values for the t-test of individual coefficients along with the p values for the f test of intercept only model. The table is filtered for the models where f value is less than 0.5, i.e the intercept only model is rejected

From the above table we can see that no more than 4 variables have a p value less than 0.05 (can be considered non – zero). For this the model cannot be accepted.

The major reasons behind the failure of the model may be multi-collinearity. It is the phenomenon in which one predictor variable can be expressed as a function of the other due with a substantial degree of accuracy. Here cause of multi-collinearity may be factors like, Inflation causing the RBI to change the bank rate or the change in Industrial production, the dividend yield affecting the P/E ratios, etc… This results in the requirement of using Principal component analysis.

3.3 PRINCIPAL COMPONENT ANALYSIS - is a statistical procedure that uses an orthogonal transformation to convert a set of observations of correlated variables into a set of values of linearly uncorrelated variables called principal components. It converts an n dimensional data set to another n dimensional data set, where the n dimensions are the principal components. Each principal component is a linear transformation using the n variables, and are independent of one another. The independent components solve the problems of multi-collinearity.

After calculating the principal components, the next step is deciding which ones to include in the model. We 1st arrange the principal components in decreasing order of the proportion of variance explained. We assume that more variability in a particular direction correlates with explaining the behaviour of the dependent variable. We specify the threshold to 80% of the total variability and select the first 3 components.

We perform regression analysis on our model to find the coefficients, p and f values. This time a better result is observed. After filtering for f test and p test for 5% alpha error,110 models could be accepted. The result seems to be accurate. To get the best fit models out of those we choose 1% alpha error to get the 21 different models.

S.no	Intercept	PC1	PC2	PC3	F
1	0.0034	0.0019	0.0056	0.0023	0.0013
2	0.0034	0.0019	0.0054	0.0022	0.0012
3	0.0033	0.0019	0.0057	0.0022	0.0013
4	0.0032	0.0021	0.0048	0.0023	0.0013
5	0.0032	0.0021	0.0046	0.0023	0.0013
6	0.0031	0.0021	0.0049	0.0022	0.0013
7	0.0031	0.0063	0.0081	0.0032	0.0024
8	0.0031	0.0062	0.0078	0.0031	0.0022
9	0.003	0.0061	0.0082	0.0031	0.0024
10	0.0049	0.0067	0.0013	2.1E-08	1.8E-08
11	0.005	0.0064	0.0014	2.1E-08	1.7E-08
12	0.0044	0.0067	0.0014	2.1E-08	1.7E-08

13	0.0032	0.007	0.00078	2.2E-08	1.7E-08
14	0.0033	0.0067	0.00085	2.1E-08	1.7E-08
15	0.0029	0.007	0.00084	2.1E-08	1.6E-08
16	0.0098	0.0099	0.0074	2.3E-10	8.3E-10
17	0.0095	0.0097	0.0072	2.3E-10	8.5E-10
18	0.0093	0.0099	0.0067	2.8E-10	1.1E-09
19	0.0095	3.9E-06	2.4E-06	4.7E-07	1E-09
20	.0099	7.6E-06	3.2E-06	4.4E-07	2.9E-09
21	0.0098	8.3E-06	3.4E-06	4.2E-07	2.9E-09

Table 3.2 - Table showing the p values for the t-test of individual coefficients along with the p values for the f test of intercept only model

S.no	Intercept	PC1	PC2	PC3
1	1.41	0.62	-0.45	0.32
2	1.41	0.63	-0.45	0.32
3	1.42	0.63	-0.45	-0.32
4	1.43	0.62	-0.47	0.32
5	1.43	0.62	-0.47	-0.32
6	1.43	0.62	-0.46	-0.32
7	1.45	0.58	-0.44	0.3
8	1.45	0.58	-0.44	-0.3
9	1.46	0.58	-0.44	0.3
10	1.20	0.64	0.24	-0.74
11	1.20	0.64	0.24	-0.74
12	1.22	0.64	0.24	-0.74
13	1.26	0.63	-0.25	-0.74
14	1.26	0.64	-0.25	-0.74
15	1.27	0.63	-0.25	-0.74
16	1.09	0.44	0.31	-0.72
17	1.09	0.45	0.31	-0.72
18	1.12	0.44	0.31	0.72
19	1.14	1.04	0.5	0.58
20	1.13	1.06	0.5	-0.59
21	1.14	1.08	0.51	-0.59

Table 3.3 – Table showing the coefficients of PC1, PC2 and PC3 along with the intercepts

As in equation 3.1 the values from $[i, j, k \ldots p]$ in the 18 models will be

S.no	I	J	K	L	M	N	O	P
1	0	0	0	0	1	0	1	0
2	0	0	1	0	1	0	1	0
3	0	0	2	0	1	0	1	0
4	0	1	0	0	1	0	1	0
5	0	1	1	0	1	0	1	0
6	0	1	2	0	1	0	1	0
7	0	2	0	0	1	0	1	0
8	0	2	1	0	1	0	1	0
9	0	2	2	0	1	0	1	0
10	1	0	0	1	1	2	1	1
11	1	0	1	1	1	2	1	1
12	1	0	2	1	1	2	1	1
13	1	1	0	1	1	2	1	1
14	1	1	1	1	1	2	1	1
15	1	1	2	1	1	2	1	1
16	1	2	0	0	0	2	1	0
17	1	2	1	0	0	2	1	0
18	1	2	2	0	0	2	1	0
19	2	2	0	1	1	2	1	0
20	2	2	1	1	1	2	1	0
21	2	2	2	1	1	2	1	0

Table 3.4 – Table showing the $[i, j, k \ldots p]$ values, i.e. the time delays used for the variables while forming the equation.

As observed from tables 3.2,3.3 and 3.4 and using the rotation matrix we observe that columns (1,2…9), (10, 11, …15), (16,17,18) and (19,20,21) are almost similar. This makes us consider 1st ,10th ,16th and 19th model as our 4 unique models

	PC1	PC2	PC3
SP-500	0.083	-0.029	0.177
MS	0.015	-0.028	-0.004
GP	-0.003	-0.018	0.014
IIP	0.402	0.106	-0.831
ER	-0.096	0.005	-0.089
DY	-0.276	-0.876	-0.081
PE	0.248	0.229	0.47
IR	0.827	-0.408	0.208

(a) 1st model

	PC1	PC2	PC3
SP-500	0.13	0.284	0.386
MS	0.012	-0.007	-0.009
GP	0.021	-0.014	0.001
IIP	0.239	-0.822	0.149
ER	0.012	-0.083	0.21
DY	-0.267	-0.469	0.164
PE	-0.15	-0.13	-0.85
IR	0.912	0.018	-0.189

(b) 2nd model

	PC1	PC2	PC3
SP-500	0.144	-0.347	-0.198
MS	0.01	0.004	0.072
GP	0.002	0.011	0.003
IIP	0.508	-0.565	0.362
ER	0.032	-0.105	0.128
DY	-0.134	0.347	0.857
PE	-0.005	0.462	-0.265
IR	0.838	0.464	-0.055

(c) 3rd model

	PC1	PC2	PC3
SP-500	0.06	-0.244	0.265
MS	0.004	0.003	-0.067
GP	0.012	-0.017	-0.011
IIP	0.29	-0.867	0.246
ER	-0.06	-0.119	-0.132
DY	0.098	-0.283	-0.911
PE	0.237	0.031	-0.13
IR	0.918	0.305	0.028

(d) 4th mode

Table 3.5 - Principal component loadings (rotation matrix) from the economic variable set from Jan 2008 to December 2017. This table reports the factor loadings obtained from a principal components analysis of the variables in equation 3.1. The variables are SP 500 –S&P 500 returns, MS -Money Supply, GP–Goods Price, IIP –Real Activity (industrial production), ER–Exchange Rate, DY-Dividend Yield, PE–Price–Earnings ratio, IR – Interest rate.

Based on the equations and the values derived above we can form the 4 equations as –

1. $$R_t^I = 1.41 + 0.122\ R_t^A + 0.021\ MS_t + 0.011 GP_t - 0.060\ RA_t - 0.090\ ER_{t-1} - 0.198\ DY_t + 0.200\ P/E_{t-1} + 0.767\ IR_t + \varepsilon$$

constraints –8.28 < PC1 < 8.33, -9.34 < PC2 < 10.23, 13.1 < PC3 < 13.14

Where

$$PC1 = 0.083\,R_t^A + 0.015\,MS_t - 0.003\,GP_t + 0.402\,RA_t - 0.096\,ER_{t-1} - 0.276\,DY_t + 0.248\;P/E_{t-1} + 0.827\,IR_t$$

$$PC2 = -0.029\,R_t^A - 0.028\,MS_t - 0.018\,GP_t + 0.106RA_t + 0.005\,ER_{t-1} - 0.876\,DY_t + 0.229\;P/E_{t-1} - 0.408\,IR_t$$

$$PC3 = 0.177\,R_t^A - 0.004\,MS_t + 0.014\,GP_t - 0831\,RA_t - 0.089\,ER_{t-1} - 0.081\,DY_t + 0.47\;P/E_{t-1} + 0.208IR_t$$

2. $$R_t^I = 1.20 + 0.134\,R_{t-1}^A + 0.013\;MS_t + 0.009\,GP_t - 0.157\,RA_{t-1} - 0.167\,ER_{t-1} - 0.405\,DY_{t-2} + 0.500\;P/E_{t-1} + 0.725\;IR_{t-1} + \varepsilon$$

constraints –5.72 < PC1 < 5.64, -15.03 < PC2 < 14.46, -10.84 < PC3 < 10.60

Where

$$PC1 = 0.13\,R_{t-1}^A + 0.012\,MS_t + 0.021\,GP_t + 0.239\,RA_{t-1} + 0.012\,ER_{t-1} - 0.267\,DY_{t-2} - 0.150\;P/E_{t-1} + 0.912\,IR_{t-1}$$

$$PC2 = 0.284\,R_{t-1}^A - 0.007\,MS_t - 0.014\,GP_t - 0.822\,RA_{t-1} - 0.083\,ER_{t-1} - 0.469\,DY_{t-2} - 0.130\;P/E_{t-1} + 0.018\,IR_{t-1}$$

$$PC3 = 0.386\,R_{t-1}^A - 0.009\,MS_t + 0.001\,GP_t + 0.149\,RA_{t-1} + 0.210\,ER_{t-1} + 0.164\,DY_{t-2} - 0.850\;P/E_{t-1} - 0.189IR_{t-1}$$

3. $$R_t^I = 1.09 + 0.101\,R_{t-1}^A - 0.046\,MS_{t-2} + 0.002\,GP_t - 0.209\,RA_t - 0.110\,ER_t - 0.573DY_{t-2} + 0.330\,P/E_{t-1} + 0.555\,IR_t + \varepsilon$$

constraints – 8.67 < PC1 < 8.49, -14.58 < PC2 < 13.64, -10.94 < PC3 < 10.63

Where

$$PC1 = 0.144\,R_{t-1}^A + 0.010\,MS_{t-2} + 0.002\,GP_t + 0.508\,RA_t + 0.032\,ER_t - 0.134\,DY_{t-2} - 0.005\,P/E_{t-1} + 0.838\,IR_t$$

$$PC2 = -0.347\,R_{t-1}^A + 0.004\,MS_{t-2} + 0.011\,GP_t - 0.565\,RA_t - 0.105\,ER_t + 0.347\,DY_{t-2} + 0.462\,P/E_{t-1} + 0.464\,IR_t$$

$$PC3 = -0.198\,R_{t-1}^A + 0.072\,MS_{t-2} + 0.003\,GP_t + 0.362\,RA_t + 0.128\,ER_t + 0.857\,DY_{t-2} - 0.265\,P/E_{t-1} - 0.055\,IR_t$$

4. $$R_t^I = 1.14 + 0.095\,R_{t-2}^A - 0.033\,MS_{t-2} - 0.002\,GP_t + 0.014\,RA_{t-1} - 0.198\,ER_{t-1} - 0.568DY_{t-2} + 0.185\,P/E_{t-1} + 1.118\,IR_t + \varepsilon$$

constraints – 6.87 < PC1 < 6.44, -13.33 < PC2 < 12.24, -10.32 < PC3 < 10.69

Where

$$PC1 = 0.060\,R_{t-2}^A + 0.004\,MS_{t-2} + 0.012\,GP_t + 0.290\,RA_{t-1} - 0.060\,ER_{t-1} + 0.098\,DY_{t-2} + 0.237\,P/E_{t-1} + 0.918\,IR_t$$

$$PC2 = -0.244R^{A}_{t-2} + 0.003MS_{t-2} - 0.017\ GP_t\ - 0.867\ RA_{t-1} - 0.119\ ER_{t-1} - 0.283\ DY_{t-2} + 0.031\ \ P/E_{t-1} + 0.305\ IR_t$$

$$PC3 = 0.265\ \ R^{A}_{t-2} - 0.067\ MS_{t-2} - 0.011\ GP_t + 0.246\ RA_{t-1} - 0.132\ ER_{t-1} - 0.911\ DY_{t-2} - 0.130\ \ P/E_{t-1} + 0.028\ IR_t$$

OBSERVATIONS AND CONCLUSION

4.1 – OBSERVATIONS –

Global factor (S&P 500) – As suggested it found to affect the Indian stock market to a certain extent. Including itself and the other variables, all of which affect to a significant extent, it can be considered as partially integrated.

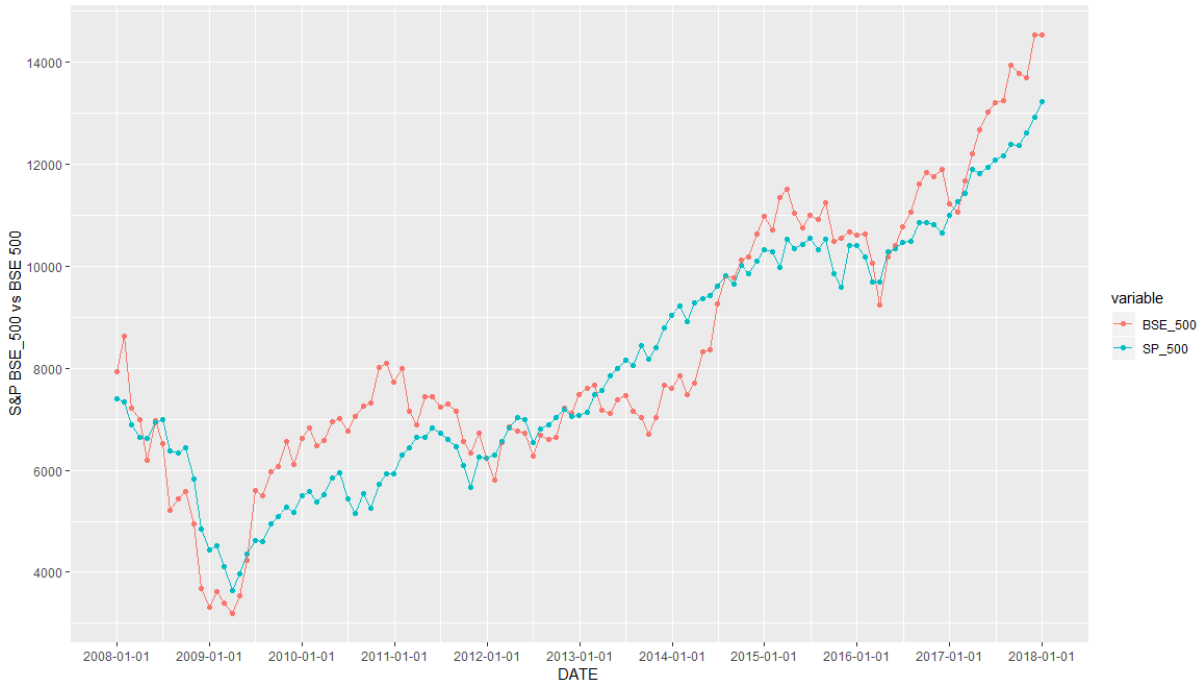

Figure 4.1 – Figure showing the integration between the two markets. S&P 500 was scaled to fit the graph

MONEY SUPPLY – As we see from the graph below that the change in money supply does not change abruptly over the period of time (except certain points). The change generally is predictable to a large extent as compared to other variables and remains almost the same. Therefore, most of the change caused may be constant and transferred to the Intercept leading to a low value(negligible) of the coefficient. Hence the effect caused cannot be ignored.

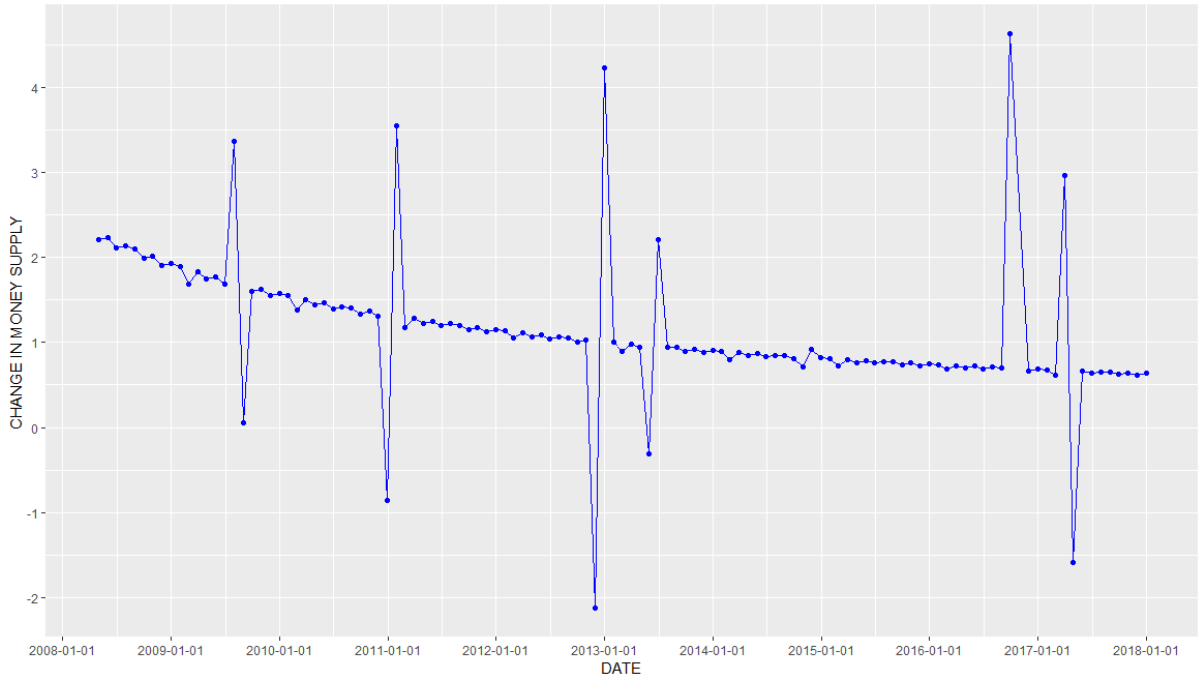

FIGURE 4.2 – percent change in money supply

INFLATION – It is found out not that it did not affect the stock prices. Stocks can beat inflation over time because companies can raise prices to account for rising costs brought about by inflation. When companies increase their prices, their revenues and earnings also increase. This leads to an increase in stock prices and hence Inflation may have no effect

Real activity – The 4 equations show a different coefficient for the Real Activity variable. Equations 1 and 3 which consider no time delay show no relation and a positive relationship simultaneously. Equations 2 and 4 considering time delay 1 month show a positive relation and no relation simultaneously. The reason may be due inaccurate method or factors like price to book value ratio, political instability, oil prices, investors sentiments which we may not have considered.

EXCHANGE RATE – We got the negative coefficient in the exchange rate as suggested earlier.

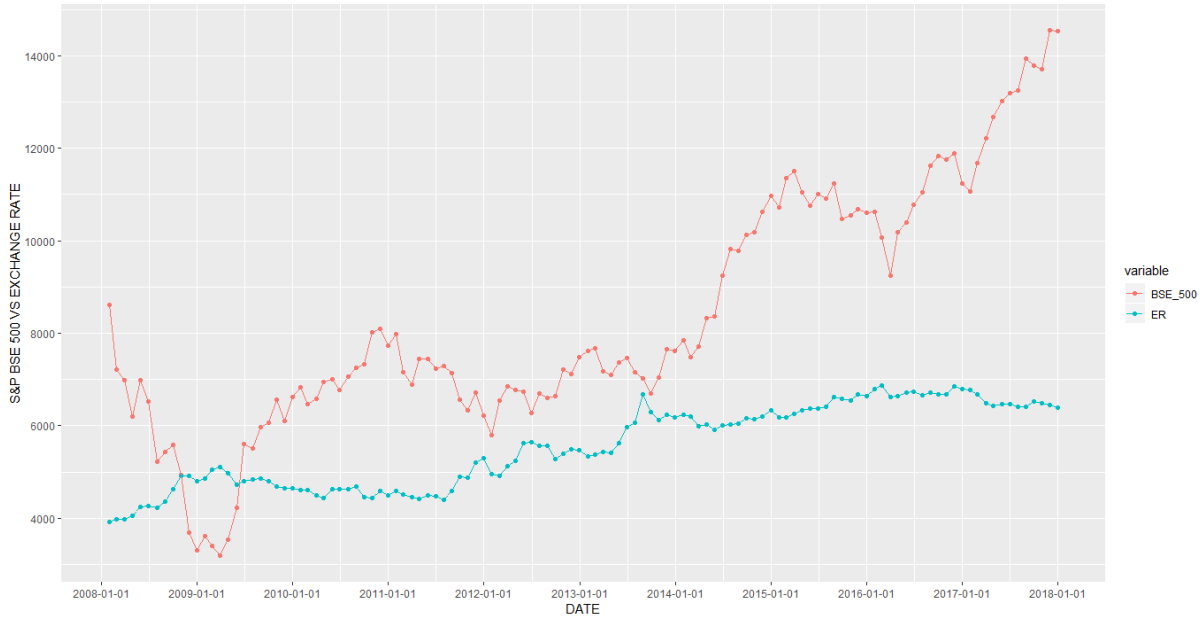

Figure 4.3 – Figure showing S&P BSE 500 vs Exchange Rate. Exchange rate was scaled to fit the graph

DIVIDEND YIELD - Higher dividend yield means for the same dividend the stock prices go down. That means when investors do not have faith in a company or an industry or a market, they are not prepared to pay a higher price for the shares and therefore dividend yield increases which may be the result for the negative coefficient.

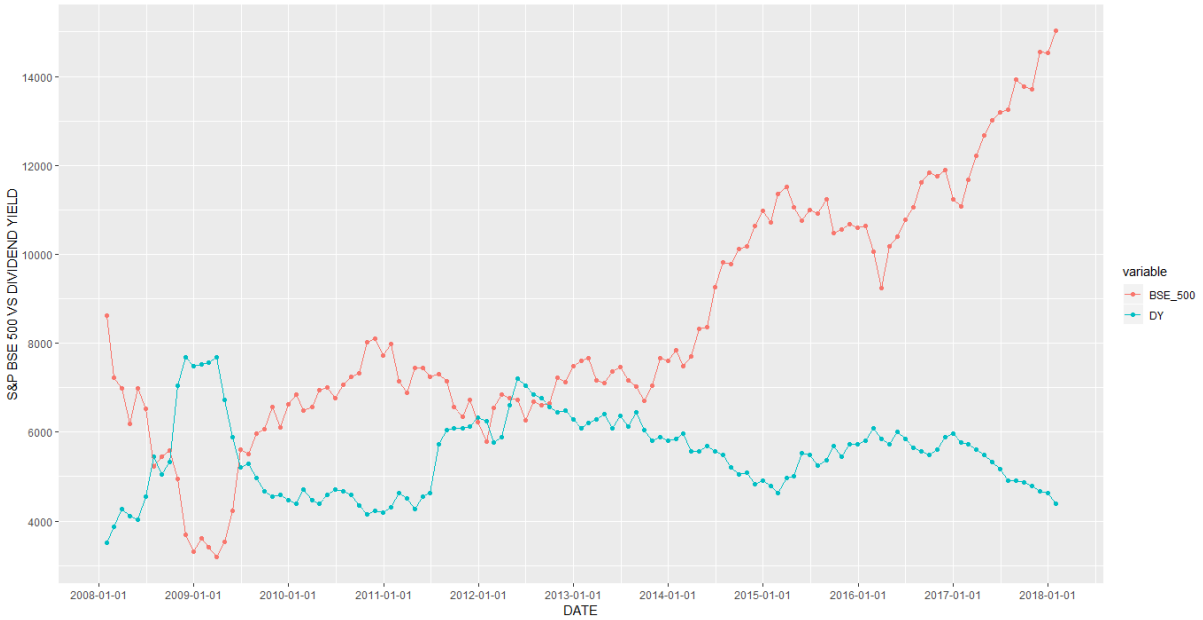

Figure 4.4 – Figure showing S&P BSE 500 vs dividend yield. Dividend yield was scaled to fit the graph

P/E RATIO- Higher P/E ratio means for the same earnings people are willing to pay a higher price for the shares of a company, showing more faith in the company which may lead to the positive coefficient.

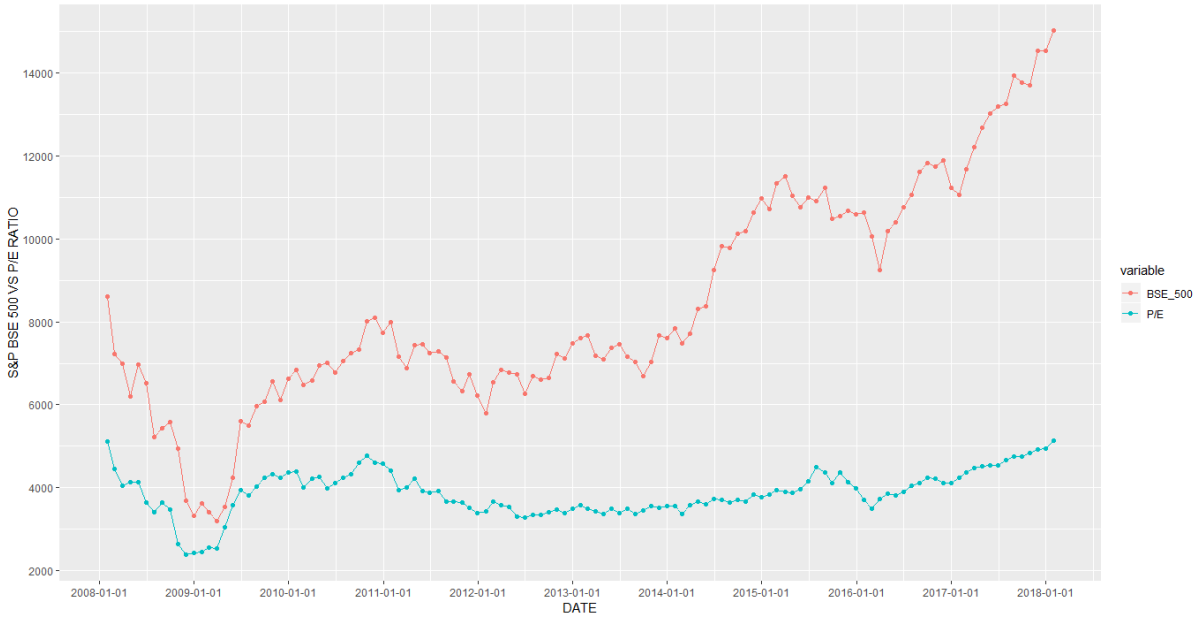

Figure 4.5 – Figure showing S&P BSE 500 vs P/E ratio. Dividend yield was scaled to fit the graph

As per the formulas of dividend yield and P/E ratio, both have an inverse relationship with each other and hence should have an opposite relation to the stock market returns as evident from the equations.

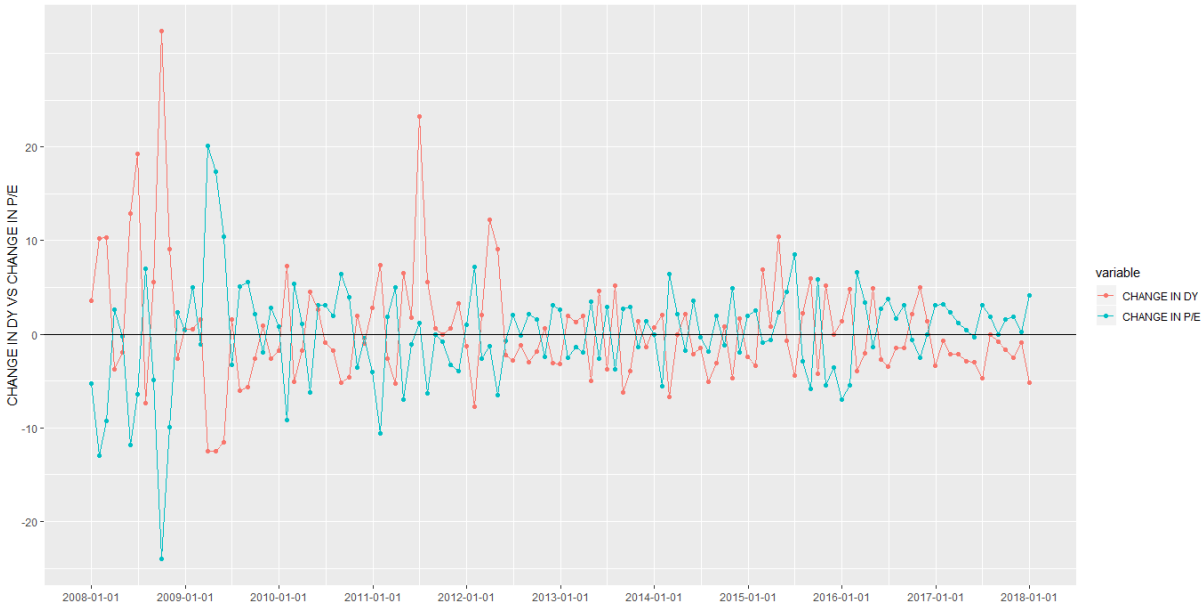

Figure 4.6 – percent change in Dividend yield vs percent change in P/E ratio. The figure shows that these are oppositely related hence affect the stock market oppositely

Bank rate – Contradictorily it is found to have a positive coefficient in all the 4 equations instead of having a negative one. The reason may be due inaccurate method or factors like price to book value ratio, political instability, oil prices, investors sentiments which we may not have considered.

4.2 CONCLUSIONS –

A number of studies have found that a relationship exists between macroeconomic and microeconomic variables and equity market returns. This paper considers India as an emerging market and considers global factors (world market return index) assuming the Indian market to be partially segmented. The variables used are S&P500, money supply, Inflation, real activity, exchange rate, bank rates, dividend yield and price to earnings ratio. Principal components are extracted from these variables and the returns of the market are regressed against these components to give results.

After regression, we observe that the major factors driving the stock return characteristics were the exchange rate, dividend yield, price to earnings ratio and money

supply. It also supported our assumption about the partial integration of the Indian stock market with the Global market (considered as the American Stock market). It concluded that Inflation had no effect in the stock market movements. The effect due to industrial production could not be considered as it showed different effects in different equations. Also the effect due to bank rate could not be taken into consideration as the equations showed an opposite relation to what was expected. Money supply, global factor (S&P 500) and price to earnings ratio had a positive effect, while exchange rate and dividend yield had a negative effect.

We were not able to find the effects due to real activity and Bank rate. The possible reasons may be that certain factors like investor sentiments, political risk, etc… which could not be quantified were not taken into consideration. We need to use other suitable techniques to study the effect of these variables.

Also, we need to keep in mind that a mathematical equation can never correctly predict the stock markets. There will always be a risk associated with such predictions which we need to keep in mind.