STUDY ON THE AFFECT OF MACROECONOMIC VARIABLES ON THE INDIAN STOCK MARKET INDEX : SENSEX

PROJECT REPORT

ON

STUDY ON THE AFFECT OF MACROECONOMIC VARIABLES ON INDIAN STOCK MARKET INDEX-SENSEX

Submitted in partial fulfilment of the requirements for the award of the degree of

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SRI GURU NANAK DEV KHALSA COLLEGE

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DECLARATION

We hereby declare that the project –"The effect of Macroeconomic variables on Indian Stock Market Index- Sensex" , has been completed by us by collecting the material from referenced sources.

The matter embodied in this has not been submitted earlier for the award of any degree or diploma to the best of my knowledge and belief.

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ABSTRACT

Stock market is one of the most vibrant sectors in the financial system , marking an important contribution to economic development. A **stock market**, **equity market** or **share market** is the aggregation of buyers and sellers (a loose network of economic transactions, not a physical facility or discrete entity) of stocks (also called shares); these may include *securities* listed on a stock exchange as well as those only traded privately. Stock market is platform for trading various securities and derivatives. Further, it enables corporate firms , entrepreneurs to raise resources for their companies through public issues. Today long term investors are interested in investing in Stock Market.

There are two main Stock Exchanges in Indian Stock Market:

1. National Stock Exchange (NSE)

2. Bombay Stock Exchange (BSE)

This report attempts to investigate the impact of select macroeconomic variables (GDP, Exchange rate , Inflation) and Gold Prices upon the movements of the Indian Stock Market Index- Sensex.

In this report we use a "LINEAR" regression technique

INTRODUCTION

The stock market is a general term used to refer to an organized exchange where shares of stock are traded. The movement of stock market depends on the rational as well as the irrational behaviour of the investor. The returns in the stock market could depend on the microeconomic variables such as profits, business growth, PE Ratio, dividend etc. Macroeconomic variables such as inflation, GDP , exchange rate would also affect the overall returns in the stock market. Hence a study will be performed to observe the impact of inflation, GDP and exchange rates on stock market returns.

The **Bombay Stock Exchange** (**BSE**) is an Indian stock exchange located at Dalal Street, Kala Ghoda, Mumbai (formerly Bombay), Maharashtra, India. Established in 1875, the BSE is Asia's first stock exchange. It claims to be the world's fastest stock exchange, with a median trade speed of 6 microseconds.[2] The BSE is the world's 11th largest stock exchange with an overall market capitalization of $1.7 trillion as of January 23, 2015.[3] More than 5500 companies are publicly listed on the BSE.

HISTORY

The Bombay is the oldest exchange in Asia. Its history dates back to 1855, when five stockbrokers would gather under banyan trees in front of Mumbai's Town Hall. The location of these meetings changed many times to accommodate an increasing number of brokers. The group eventually moved to Dalal Street in 1874 and in became an official organization known as "The Native Share & Stock Brokers Association" in 1875.

On August 31, 1957, the BSE became the first stock exchange to be recognized by the Indian Government under the Securities Contracts Regulation Act. In 1980, the exchange moved to the Phiroze Jeejeebhoy Towers at Dalal Street, Fort area. In 1986, it developed the BSE SENSEX index, giving the BSE a means to measure the overall performance of the exchange. In 2000, the BSE used this index to open its derivatives market, trading SENSEX futures contracts. The development of SENSEX options along with equity derivatives followed in 2001 and 2002, expanding the BSE's trading platform.

Historically an open outcry floor trading exchange, the Bombay Stock Exchange switched to an electronic trading system developed by CMC Ltd. in 1995. It took the exchange only 50 days to make this transition. This automated, screen-based trading platform called BSE On-Line Trading (BOLT) had a capacity of 8 million orders per day. The BSE has also introduced a centralized exchange-based internet trading system, BSEWEBx.co.in to enable investors anywhere in the world to trade on the BSE platform.

BSE

Type	Stock exchange
Location	Mumbai, Maharashtra, India
Coordinates	18.929681°N 72.833589°E
Founded	9 July 1875
Owner	BSE Limited
Key people	Ashishkumar Chauhan (MD & CEO)
Currency	Indian rupee (₹)
No. of listings	5,749[*citation needed*]
Market cap	US$ 1.64 trillion (Sep. 2015)[1]

SENSEX HISTORICAL CHART

➢ SENSEX

BSE Sensex is a basket of 30 constituent stocks representing a sample of large, liquid and representative companies. The base year of SENSEX is 1978-79 and the base value is 100. The index is widely reported in both domestic and international markets through print as well as electronic media. The Index was initially calculated based on the Full market capitalization methodology but was shifted to the .Free-float methodology with effect from September 1, 2003.

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Due to is wide acceptance amongst the Indian investors; SENSEX is regarded to be the pulse of the Indian stock market. As the oldest index in the country, it provides the time series data over a fairly long period of time (From 1979 onwards). Small wonder, the SENSEX has over the years become one of the

most prominent brands in the country. The growth of equity markets in India has been phenomenal in the decade gone by. Right from early nineties the stock market witnessed heightened activity in terms of various bull and bear runs. The SENSEX captured all these events in the most judicial manner. One can identify the booms and busts of the Indian stock market through SENSEX.

SENSEX CALCULATION METHODOLOGY

SENSEX is calculated using the "Free-float Market Capitalization" methodology. As per this methodology, the level of index at any point of time reflects the Free-float market value of 30 component stocks relative to a base period. The market capitalization of a company is determined by multiplying the price of its stock by the number of shares issued by the company. This market capitalization is further multiplied by the free-float factor to determine the free-float market capitalization. The base period of SENSEX is 1978-79 and the base value is 100 index points. This is often indicated by the notation 1978-79=100. The calculation of SENSEX involves dividing the Free-float market capitalization of 30 companies in the Index by a number called the Index Divisor. The Divisor is the only link to the original base period value of the SENSEX. It keeps the Index comparable over time and is the adjustment point for all Index adjustments arising out of corporate actions, replacement of scripts etc.

LITERATURE REVIEW

- **Naj and Rahman**(1991) studied the relationship between volatility of stock return and of macroeconomic variables in four developed countries and confirmed the relationships Fang and Lee(1990) studied the long term relationships between stock return on the one hand and GNP, inflation and money supply on the other in Taiwan and concluded that the efficient market hypothesis is not valid for an emerging market.

- **Bhattacharya and Chakravarty** (1994) studied the behavior of stock price (BSE) in relation to some key macro-economic variables in India during the scam period 1992. Their dynamic forecasts indicate that the behavior of stock price is unrelated to key macro variables.

- **Mukherjee and Naka**(1995) explored the relationship between exchange rate, inflation , money supply, real economic activity, long term government bond rate and call money rate with the Japanese stock market . The results also suggested the role of government in terms of fiscal and monetary policy in smooth functioning of the stock market is crucial in this region.

- **Bhattacharya and Mukherjee** (2002) studied the nature of the causal relationship between stock prices and macro aggregates in India by using the methodology proposed by Toda and Yamamoto for the period of 1992-93 to 2000-2001.Their results show that there is no causal relationship between stock price and macro-economic variables like money supply, national income and interest rate but there exists a two way causation between stock price and rate of inflation. According to them index of industrial production lead the stock price.

- **Deepti Gulati and Monika Kakhani** (Nov, 2012) Relationship between stock market and foreign exchange market in India . This paper attempts to examine whether or not a causal relationship exists between foreign exchange rates and stock market. By applying the techniques of Granger Causality test and correlation test, relationships between INR/$ exchange rate and Indian stock market indices (SENSEX and NIFTY 50) were

determined for data between 2004 and 2012.

- **Dr. Gaurav Agrawal** (Dec, 2010) : A research paper on "study of Exchanges Rates movement and Stock Market volatility" conducted by This paper analyses the relationship between Nifty returns and Indian rupee-US Dollar Exchange Rates. In this study, it was found that Nifty returns as well as Exchange Rates were non-normally distributed. Through unit root test, it was also established that both the time series, Exchange rate and Nifty returns, were stationary at the level form itself. Correlation between Nifty returns and Exchange Rates was found to be negative.

- **Dr. Prakash G. Apte** (March 2001) : A research report on "The Interrelationship between the Stock Markets and the Foreign Exchange Market" Apte investigated the relationship between the volatility of the stock market and the nominal exchange rate of India by using the EGARCH specifications on the daily closing USD/INR exchange rate, BSE 30 (Sensex) and NIFTY-50 over the period 1991 to 2000. The study suggests that there appears to be a spill over from the foreign exchange market to the stock market but not the reverse.

- **Geetha et.al. (2011)**, studied the relationships between inflation and stock returns.Researchers revealed that there were no long-run relationships between expected and unexpected inflation with stock returns and there was also no short-run relationships between the variables for Malaysia and US but it existed for China.

- **Naka et. al. (1998)**, examined the relationships among macroeconomic variables and Indian stock market. To examine the relationship among the variables, the related data were analysed with the help of Vector Error Correction Model. On the basis of the results of this study researchers suggested that domestic inflation was the most deterrent to Indian stock market performance and domestic output was its predominant driving force.

- **D.V LOKESHWAR REDDY** (2012) The market reacts differently to various factors ranging from economic political, and socio-cultural. The

stock prices of quoted companies are affected either positively or negatively by a number of factors occurring within or without the economic system. The impact of Real Gross Domestic Product (RGDP), Interest Rate (INT) and Inflation Rate (INF) on stock prices of quoted companies from 1997– 2009. Stock prices were represented by Stock Market Value Index in the model. A regression analysis showed that the explanatory variables accounted for 95.6% of the variation in stock prices. While a reduction in interest and inflation rate resulted in increased stock prices, increased RDGP has a positive impact. Government should therefore implement policies that will reduce inflation rate and improve the standard of living of its citizens. The interest rate should be made moderate so as to encourage investment and transactions in stock.

OBJECTIVE

- To analyse and assess the impact of the following Macroeconomic variables on the Indian stock market index – SENSEX

1. Gross Domestic Product (GDP at Factor Cost)
2. Inflation
3. Exchange rate
4. Gold Prices

- To study the relationship between stock market returns with respect to inflation, GDP , Exchange rate and Gold Prices.

- To find the strength of the relation between stock market returns with respect to inflation and GDP, Exchange rate and Gold Prices.

RESEARCH METHODOLOGY

The purpose of the study is to analyse the effects of various Macroeconomic variables on The Indian Stock Index- SENSEX.

The secondary data is used (from websites : Moneycontrol.com, investing.com, research journals, reports, Newspaper) to find out the values of Sensex and various Macroeconomic variables over the years.

All the data is compiled in excel spread sheets, which have been analysed with the help of Statistical Package SPSS version 20 and further all the charts are drawn with the help of Microsoft Excel.

Multi-Regression model has been used with OLS Estimators.

We have used the following tests to analyse the data :-

❖ MEAN

The mean is the average of all numbers and is sometimes called the arithmetic mean. To calculate mean, add together all of the numbers in a set and then divide the sum by the total count of numbers.

❖ STANDARD DEVIATION

The standard deviation is a numerical value used to indicate how widely individuals in a group vary. If individual observations vary greatly from the group mean, the standard deviation is big; and vice versa.

❖ REGRESSION

A statistical measure that attempts to determine the strength of the relationship between one dependent variable (usually denoted by Y) and a series of other changing variables (known as independent variables).

❖ CORRELATION

Correlation is a statistical measure that indicates the extent to which two or more variables fluctuate together. A positive correlation indicates the extent to which those variables increase or decrease in parallel; a negative correlation indicates the extent to which one variable increases as the other decreases.

❖ T-TEST

The t-test is used for testing differences between two means. In order to use a t-test, the same variable must be measured in different groups, at different times, or in comparison to a known population mean.

❖ ANOVA

The variation (Sum of squares), the degrees of freedom (df), and the variance (Mean Square) are given for the within and the between groups, as well as the F value (F) and the significance of the F (Sig.) Sig, indicates whether the null hypothesis – the population means are all equal – has to be rejected or not.

❖ VIF

The variance inflation factor (VIF) quantifies the severity of multicollinearity in an ordinary least squares regression analysis. It provides index that measures how much the variance (the square of the estimate's standard deviation) of an estimated regression coefficient is increased because of collinearity.

❖ DURBIN WATSON

It is a measure that tests for autocorrelation in the residuals from a statistical regression analysis. The durbin Watson statistic is always between 0 and 4. A value of 2 means that there is no autocorrelation in the sample. Values approaching 0 indicate positive autocorrelation and values towards 4 indicate negative autocorrelation.

❖ F TEST

It is a statistical test in which a test statistic has an F distribution under the null hypothesis. It is most often used when comparing statistical models that have been fitted to data set, in order to identify the model that best fits the regression model from which the data was sampled.

❖ NORMALITY TEST

In statistics, normality tests are used to define if a data set is well modelled by a normal distribution and to compute how likely it is for a random variable underlying the data set to be normally distributed.

DATA : Quarterly data from July 2006 to April 2016

MODEL : Linear Regression Technique

We have framed a 4 variable regression model as follows :

$Y = \beta1 + \beta2X1 + \beta3X2 + \beta4X3 + \beta5X4$

where,

Y is BSE Index-Sensex

X1 is GDP

X2 is inflation rate

X3 is exchange rate (USD/INR)

X4 is gold prices

β1 represents the intercept term. β2, β3, β4, β5 represent the coefficient terms for the variables-GDP, inflation rate, exchange rate and gold prices respectively.

INDEPENDENT VARIABLES

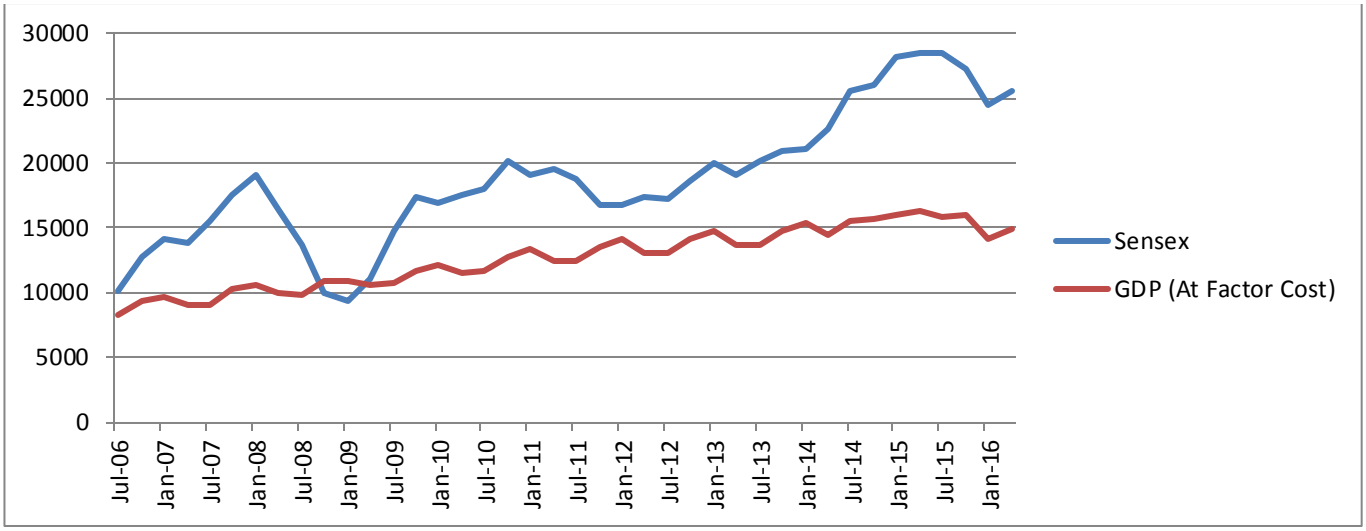
➢ Gross Domestic Product

Gross domestic product (GDP) is the monetary value of all the finished goods and services produced within a country's borders in a specific time period. Though GDP is usually calculated on an annual basis, it can be calculated on a quarterly basis as well. GDP includes all private and public consumption, government outlays, investments and exports minus imports that occur within a defined territory. Put simply, GDP is a broad measurement of a nation's overall economic activity. Gross domestic product can be calculated using the following formula:

GDP = C + G + I + NX, where,

- C is equal to all private consumption, or consumer spending, in a nation's economy, G is the sum of government spending, I is the sum of all the country's investment, including businesses capital expenditures and NX is the nation's total net exports, calculated as total exports minus total imports (NX = Exports - Imports).
- Rise in GDP means that the production by the manufacturing companies increases. This rise in the production capacity leads to increased profits for the companies, which further increases their stock prices. This increase in the stock prices of companies leads to increasing trend for the sensex, therefore sensex and GDP are positively correlated.

Graphical representation between Sensex and GDP



The above graph shows a positive relationship between Sensex and GDP.

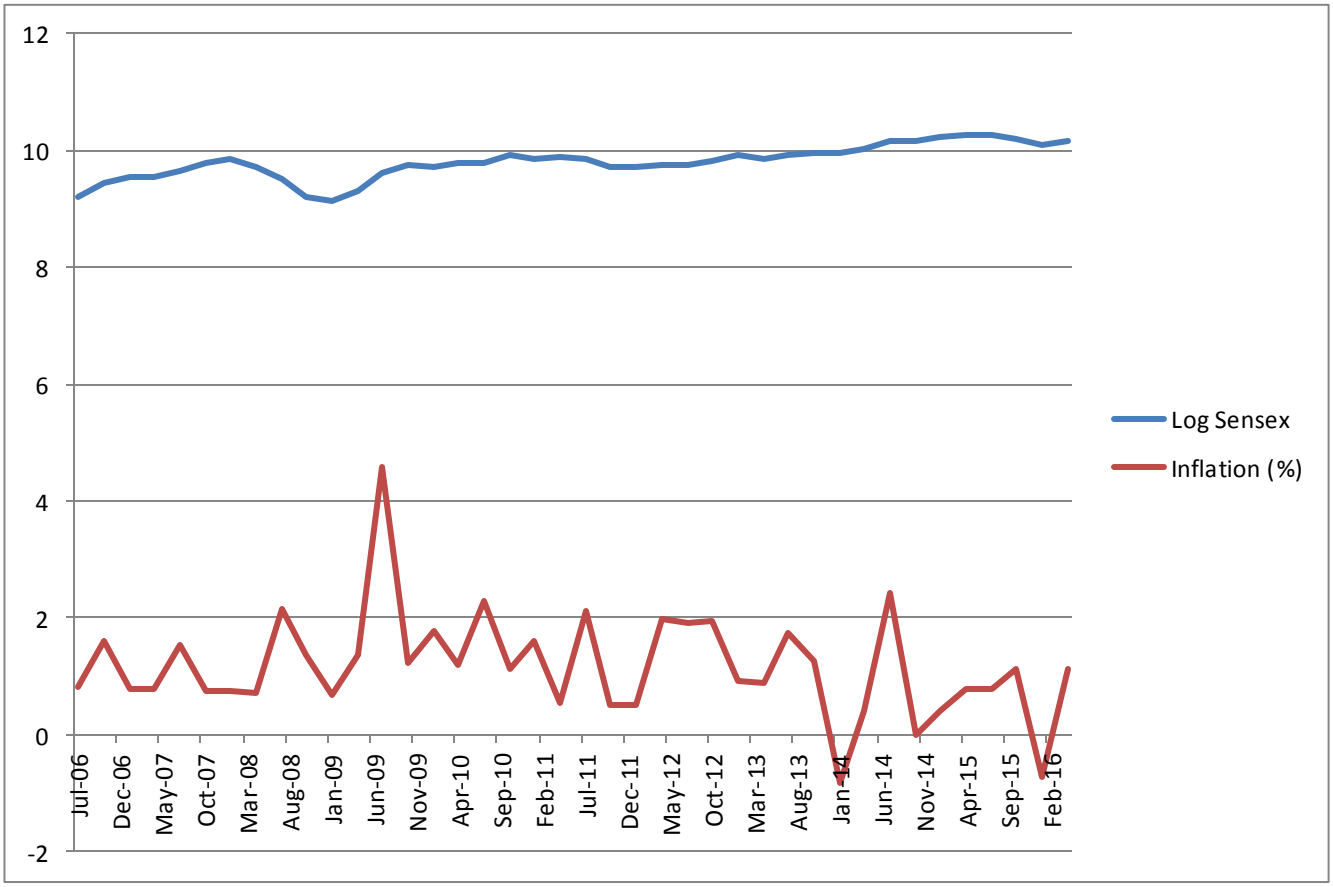
➢ INFLATION

- In economics, **inflation** is a sustained increase in the general price level of goods and services in an economy over a period of time.[1] When the price level rises, each unit of currency buys fewer goods and services. Consequently, inflation reflects a reduction in the purchasing power per unit of money – a loss of real value in the medium of exchange and unit of account within the economy. A chief measure of price inflation is the inflation rate, the annualized percentage change in a general price index, usually the consumer price index, over time Inflation occurs due to an imbalance between demand and supply of money, changes in production and distribution cost or increase in taxes on products. Inflation affects economies in various positive and negative ways. The negative effects of inflation include an increase in the opportunity cost of holding money, uncertainty over future inflation which may discourage investment and savings, and if inflation were rapid enough, shortages of goods as consumers begin hoarding out of concern that prices will increase in the future.

- It is a common belief that inflation is advantageous to common stock. This is majorly because it is argued that inflation increases the returns to shareholders since price of products rise faster than wage rates. The expected relationship between inflation and returns to owners of equity would be valid if business firms were debtors and if the current interest rates on debt finance failed to reflect the future changes in the price level.

- When there is inflation, most prices are rising, though some prices rise faster than others. Have shown from their studies that there is a relationship between inflation and rising prices. A positivity in relation to changes in prices. Therefore, in assessing the impact of inflation on the performance of stock prices; if there is a relationship, one should expect a positive association between inflation and the variation in stock prices.

Graphical representation between Sensex and Inflation

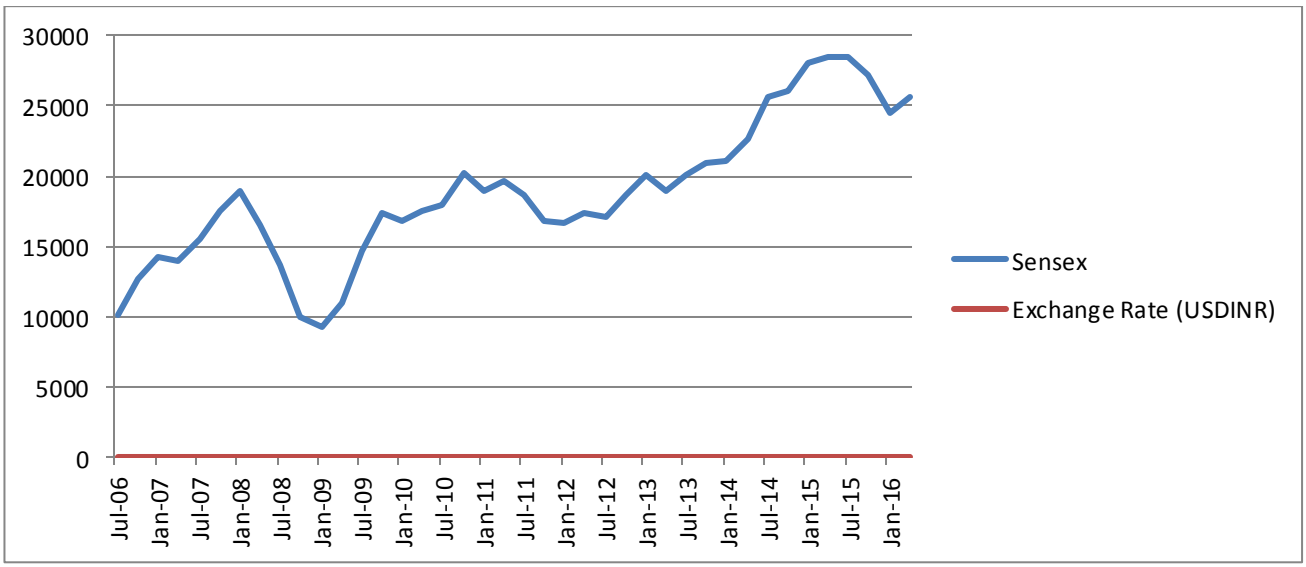


➢EXCHANGE RATE

In finance, an **exchange rate** (also known as a **foreign-exchange rate**, **forex rate**, **ER**, **FX rate** or **Agio**) between two currencies is the rate at which one currency will be exchanged for another. It is also regarded as the value of one country's currency in relation to another currency.[1] For example, an interbank exchange rate of 119 Japanese yen (JPY, ¥) to the United States dollar (US$) means that ¥119 will be exchanged for each US$1 or that US$1 will be exchanged for each ¥119. In this case it is said that the price of a dollar in relation to yen is ¥119, or equivalently that the price of a yen in relation to dollars is $1/119.

The 1997-1998 Asian crises taught a lesson to the entire that there is dynamic linkage between stock prices and exchange rate. During this period, the emerging markets experienced a fall in stock market prices due to substantial depreciation of exchange rate in terms of USD. A stock market which blooms will attract foreign investors to invest in domestic markets which in turn, creates a demand for the company's currency. As a result, exchange rate is appreciated. In case of following stock prices, foreign investors would like to withdraw their investments by selling the shares and converting it into foreign currency against domestic currency. This would create a demand for foreign currency and will lead to depreciation of the domestic currency.

Graphical representation between Sensex and Exchange Rate

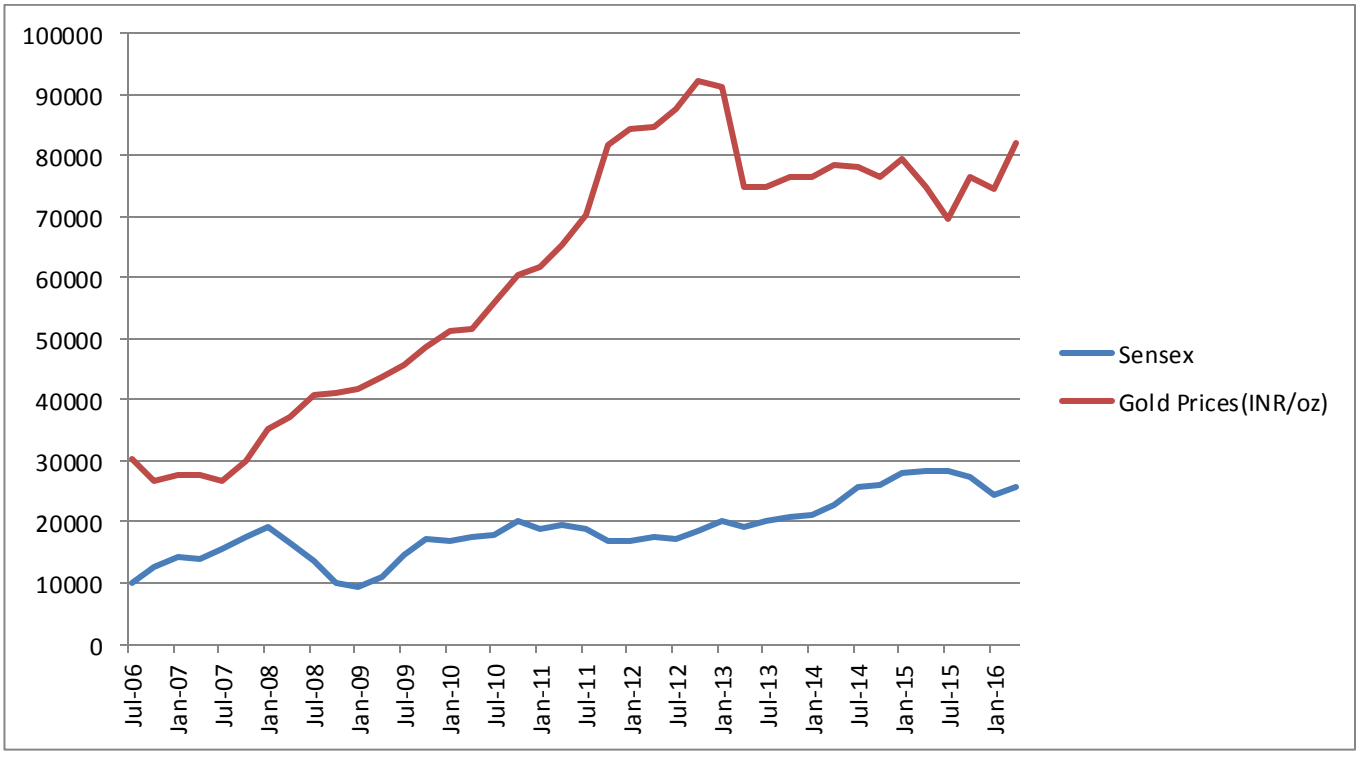


➢GOLD PRICES

Gold is a precious metal used for coinage, jewellery, and other arts throughout recorded history. The world consumption of new gold produced is about 50% in jewellery, 40% in investments, and 10% in industry.

Many holders of gold store it in form of bullion coins or bars as a hedge against inflation. Gold has been used throughout history as money and has been a relative standard for currency equivalents specific to economic regions or countries, until recent times.

Graphical representation between Sensex and Gold Prices



HYPOTHESIS

A statistical hypothesis is an assumption or statement which may or may not be true about a population which is to be tested on the basis of the evidence from a random sample. The hypothesis which is to be tested for the possible rejection under the assumption that is true is called null hypothesis. Any hypothesis which is complementary to the null hypothesis is called alternative hypothesis.

The hypothesis for our model is as follows :

1. H_0: There is no relationship between GDP and Sensex.
   H_1: There is a relationship between GDP and Sensex.

2. H_0: There is no relationship between Inflation rate and Sensex.
   H_1: There is a relationship between Inflation rate and Sensex.

3. H_0: There is no relationship between Exchange Rate and Sensex.
   H_1: There is a relationship between Exchange Rate and Sensex.

4. H_0: There is no relationship between Gold Prices and Sensex.
   H_1: There is a relationship between Gold Prices and Sensex.

We will reject the null hypothesis if the P value calculated is less than the level of significance i.e. 0.05(5%) and vice-versa.

➢REGRESSION TEST : COEFFICIENT

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	-11013.081	3260.900		-3.377	.002	-17633.060	-4393.103		
	Exchange Rate (USDINR)	-28.557	84.882	-.048	-.336	.739	-200.876	143.761	.279	3.585
	Gold Prices(INR/oz)	-.137	.041	-.560	-3.293	.002	-.221	-.052	.199	5.033
	GDP (At Factor Cost)	3.119	.490	1.399	6.361	.000	2.124	4.115	.119	8.404
	Inflation (%)	80.813	453.778	.014	.178	.860	-840.405	1002.031	.875	1.143

a. Dependent Variable: Sensex

REGRESSION LINE

$Y = -11013.081 + 3.119X1 + 80.813X2 - 28.557X3 - 0.137X4 + U_i$

where, Y refers to the dependent variable i.e. SENSEX.

- -11013.081 is the intercept term.
- X1 represents GDP
- X2 represents Inflation rate.
- X3 represents Exchange rate
- X4 represents Gold prices

- U_i represents the residual term or the error term which consists of variables other than GDP, Inflation rate, Exchange rate, Gold Prices.

INTERPRETATION

- The intercept term explains that value of Sensex at 0 level of GDP, Exchange rate, Gold Prices, and 0% increase in inflation rate will be equal to -11013.081
- The regression equation explains that with 1 rupee increase in GDP , the value of Sensex will increase by 3.119
- The regression equation explains that with 1 percent increase in inflation rate , the value of Sensex will increase by 80.813.
- The regression equation explains that with 1 rupee increase in exchange rate , the value of Sensex will decrease by 28.557.
- The regression equation explains that with 1 rupee increase in Gold prices , the value of Sensex will decrease by 0.137
- The p value of the t test of GDP and Gold Prices is less than the level of signifance 0.05 , therefore these are significant , while p values for Exchange rate and Inflation rate are higher than the significance level.
- Variance Inflation Factor (VIF) is less than 5 for all variables except GDP which indicates presence of multicollinearity in our model.

➢DESCRIPTIVE STATISTICS TABLE

Descriptive Statistics

	Mean	Std. Deviation	N
Sensex	18750.4838	5116.82731	40
Exchange Rate (USDINR)	51.5065	8.65652	40
Gold Prices(INR/oz)	60852.6643	20999.74621	40
GDP (At Factor Cost)	12645.9128	2294.18803	40
Inflation (%)	1.1728	.91442	40

- The mean value of Sensex is 18750.4838.
- The mean value of GDP, Exchange Rate, Inflation Rate, Gold Prices is 12,645.9128, 51.5065, 1.1728% and 60852.6643 respectively.
- Standard Deviation of Sensex is 5,116.82731 which explains that the value of Sensex deviates to the extent of 5,116.82731 from the mean.
- Similarly, Standard Deviation of GDP, Exchange Rate, Inflation Rate, Gold Prices is 2,294.18803, 8.65652, 0.91442 and 20,999.74621 respectively.
- The number of observations are 40 for all the variables ie all quarters from 2006-2016

➢ CORRELATION

Correlations

		Sensex	Exchange Rate (USDINR)	Gold Prices (INR/oz)	GDP (At Factor Cost)	Inflation (%)
Pearson Correlation	Sensex	1.000	.726	.644	.857	-.266
	Exchange Rate (USDINR)	.726	1.000	.722	.846	-.270
	Gold Prices(INR/oz)	.644	.722	1.000	.887	-.123
	GDP (At Factor Cost)	.857	.846	.887	1.000	-.259
	Inflation (%)	-.266	-.270	-.123	-.259	1.000
Sig. (1-tailed)	Sensex	.	.000	.000	.000	.049
	Exchange Rate (USDINR)	.000	.	.000	.000	.046
	Gold Prices(INR/oz)	.000	.000	.	.000	.225
	GDP (At Factor Cost)	.000	.000	.000	.	.053
	Inflation (%)	.049	.046	.225	.053	.
N	Sensex	40	40	40	40	40
	Exchange Rate (USDINR)	40	40	40	40	40
	Gold Prices(INR/oz)	40	40	40	40	40
	GDP (At Factor Cost)	40	40	40	40	40
	Inflation (%)	40	40	40	40	40

- Correlation analysis enables us to have an idea about the degree and direction of the relationship between the two variables understudy. It can be either positive ie the values of variables deviate in the same direction or negative ie the variables deviate in the opposite direction.

- Here Karl Peason's coefficient of correlation has been found which measures the intensity or magnitude of linear relationship between the two variables.

The degree of correlation between Sensex and GDP is 85.7%.

In case of Exchange rate and Gold Prices, it is 72.6% and 64.4% thus both variables are positively correlated with Sensex.
But the correlation coefficient is -26.6% in case of inflation rate which show a negative relation. p values are less than the significance level ie 0.05(5%) which means correlation coefficients are significant for all tables.

➢MODEL SUMMARY

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.894[a]	.799	.776	2423.45687	.942

a. Predictors: (Constant), Inflation (%), Gold Prices(INR/oz), Exchange Rate (USDINR), GDP (At Factor Cost)

b. Dependent Variable: Sensex

- **R** that is overall coefficient of correlation is 0.894 which shows a high degree of correlation. It is independent of origin and scale and lies between -1 and 1. It is symmetrical in nature and measures the linear association and dependence.

- **R^2** is considered a better measure of goodness of fit and represents how well the data fits to the regression line. It measures the proportion or percentage of total variation in Y explained by the regression model. In this case, it is 0.799 which is close to 1 representing low level of residual values. **R^2** is a better measure than R because it provides an overall measure of the extent to which variation in 1 variable determines the variation in other.

- **Adjusted R^2** gives a more optimistic picture of the fit of regression particularly when number of explanatory variables is not very small compared to the number of observations. It can be negative although R^2 is necessarily non negative. It increases only if the absolute t value of the added variable is greater than 1. In our model, it is equal to 0.766 which shows that explained variables are significant for the model.

- **Standard Error** is the standard deviation of the sample, which represents that the sample values deviate by the extent of 2423.45687 from the mean.

- **Durbin Watson** measures to check autocorrelation between the two variables.

  In this case, it is equal to 0.942 which is smaller than 1, thus shows there is autocorrelation in our model.

  Autocorrelation maybe defined as correlation between numbers of series of observations ordered in time.

  The linear regression model assumes that autocorrelation does not exist in the disturbance term U_i

➢ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	815534937.1	4	203883734.3	34.715	.000[b]
	Residual	205560011.9	35	5873143.197		
	Total	1021094949	39			

a. Dependent Variable: Sensex

b. Predictors: (Constant), Inflation (%), Gold Prices(INR/oz), Exchange Rate (USDINR), GDP (At Factor Cost)

Here F test is performed to test the overall significance of the model. Hypothesis for the test are as follows :

H_0 : There is no relationship between dependent variable and independent variables.

H_1 : There is a relationship between dependent variable and independent variables.

For this test, ANOVA (Analysis of Variance) table is created

- **Sum of Squares due to Regression** is a quantity which explains how well a regression model represents the data being modelled. In particular the Explained Sum of Squares (ESS) measures how much variation there is in the modelled values, greater the ESS, the better the estimated model performs. Since, it is 815534937.1, it means that data is well represented by model.

- **Residual Sum of Squares** (RSS) is a measure of discrepancy between the data and an estimation model. A small RSS indicates a tight fit of the model to the data.

- **Total Sum of Squares** (TSS) is equal to Explained Sum of Squares (ESS) + Residual sum of squares (RSS). Since it is 1021094949, it represents high level of authenticity of the model.
- **Degree of Freedom (df)** denotes the extent of independence enjoyed by a given set of observed frequencies. df for n observed frequencies subjected to k independent constraints is equal to n-k.
- **Mean Sum of Squares of Regression** is calculated by dividing the respective sum of squares by their degree of freedom(df).

- **F** calculated is equal to mean sum of squares of regression divided by mean sum of residuals.

- **P value** is the probability of committing Type I error ie rejecting the null hypothesis when it is true. For the model to be significant, it has to be lower than the level of significance 5% (0.05).

  Since the P value is equal to 0, null hypothesis is rejected. Thus, our model is statistically significant.

NORMALITY TEST

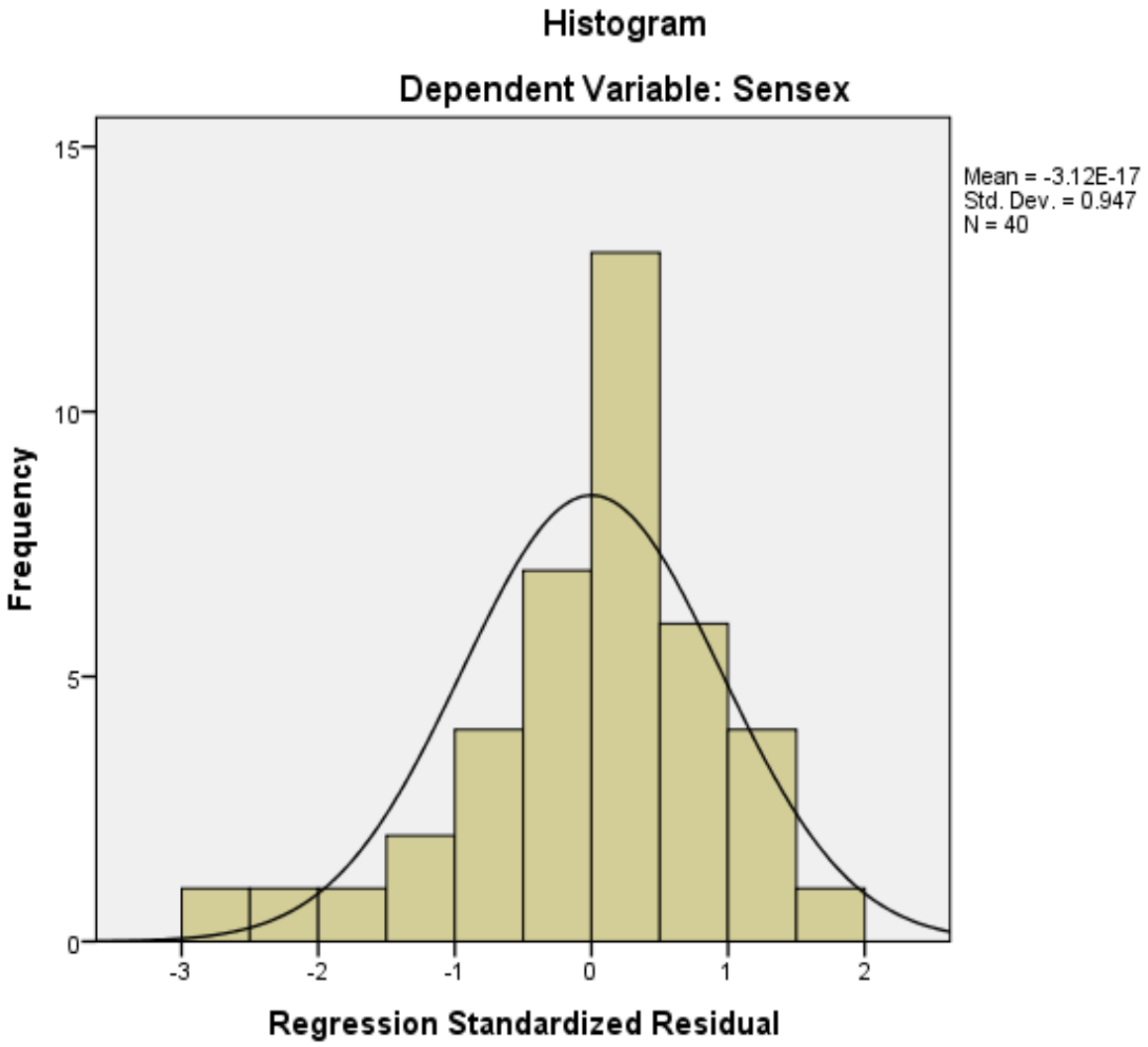
From the analysis performed, it seems that the model we have chosen for explaining the value of Sensex is significant. But it is important to find out whether our variables are Best Linear Unbiased Estimators (BLUE). For this we need to check the normality of the residual term. U_i

According to Central Limit Theorem (CLT) which provides justification for the normality assumption, it shows that if large number of independent and identically distributed (IID) random variables, effect Y then the distribution of their sums tends to its normal distribution, if the number of such variables increase infinitely.

We have performed 2 normality tests :

1. Histogram of Residuals
2. Normal Probability Plot

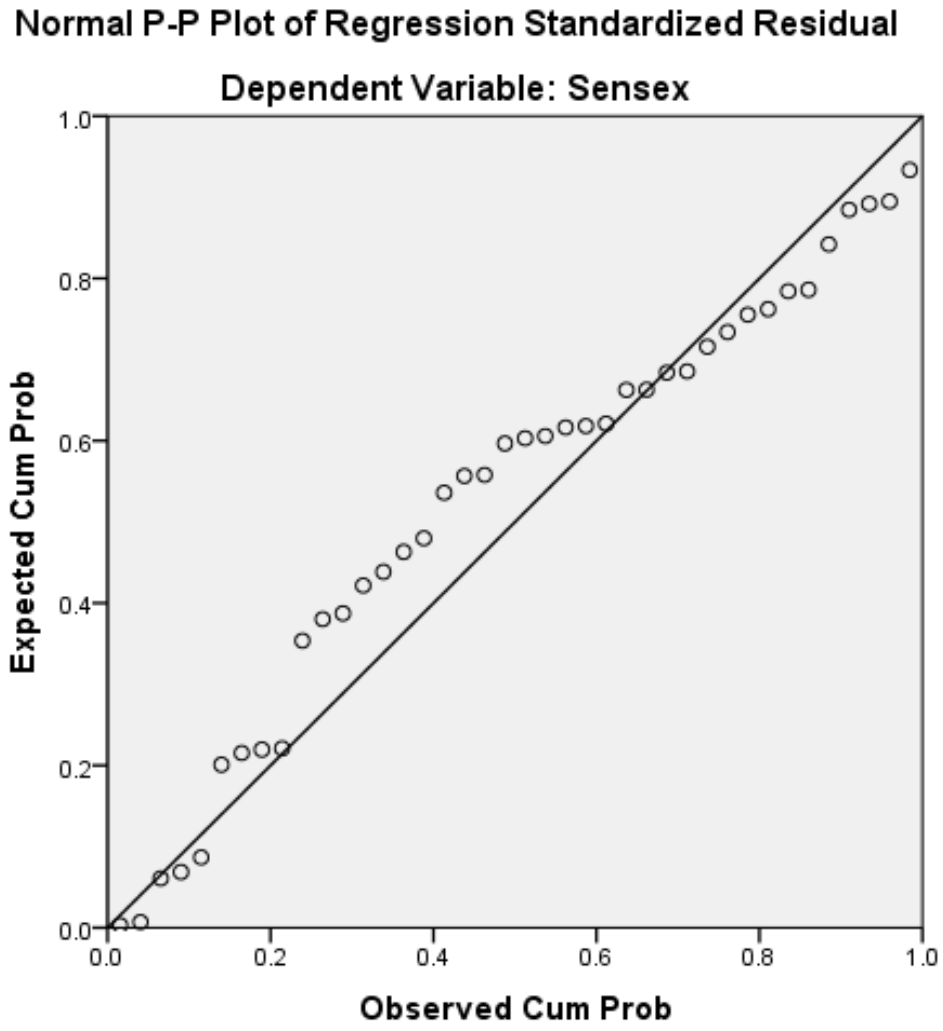
➢HISTOGRAM OF RESIDUALS



The horizontal axis represents the Regression Standardized Residuals and the vertical axis represents Frequency.

The diagram shows that the residuals are perfectly normally distributed ie skewness (a measure of symmetry) is 0 and kurtosis (which measures how tall the normal distribution) is 3.

➢NORMAL PROBABILITY PLOT



Normal Probability Plot is a graphical device to study the shape of PDF of random variables. The horizontal axis represents the Observed Cumulative Probability and the vertical axis represents the Expected Cumulative Probability. From the above figure, we can see that the residuals from our model are relatively normally distributed because the straight line seems to fit the data reasonably well.

CONCLUSION

This report studies the factors which are responsible for the fluctuations in the value of Sensex. We have taken BSE Sensex as the dependent variable and GDP, Inflation Rate, Exchange Rate and Gold Prices as the independent variables. To determine the relationship between the dependent variable and the independent variables, we used regression analysis, descriptive statistics, correlation, ANOVA and the results we found a significant relationship between them.

- R^2 is equal to 0.799 which means 79.9% of the variation in the value of Sensex is explained by GDP, Inflation Rate, Exchange Rate and Gold Prices.

- R is 0.894 which shows a high degree of correlation
- P value of t test for two variables Exchange rate and Inflation rate exceeds the level of significance i.e. 0.05. Thus we accept the null hypothesis. While for the other two variables Gold Prices and GDP, p value of t test is less than the significance level. Thus we reject the null hypothesis.

  Thus variables GDP and Gold prices are significant and Inflation rate and Exchange rate are insignificant for the model.

- P value of F test is 0 which shows that the overall model is significant

LIMITATIONS OF THE STUDY

Lack of Time

The given period for the project work wasn't enough as it required more time. More time duration could have facilitated in making a much more in depth and well- illustrated project.

Lack of Resources

Under the time constraint, field work and more comprehensive approach towards the subject were not feasible,

Data Collection

The time span for research was short and thus less data was taken into consideration.

Multi – Collinearity

The VIF value for GDP is , which is very high (as VIF value should be less than or equal to 5) indicates that there is multi-collinearity. Multi-collinearity is a statistical phenomenon in which two or more predictor variables in a multiple regression model are highly correlated, meaning that one can be linearly predicted from the others with a non-trivial degree of accuracy.

RECOMMENDATIONS FOR FURTHER RESEARCH

Researchers are advised to keep the following points in mind while framing a model :-

1. It is recommended to add more variables to the data to improve the reliability and validity of the results of its efficiency.

2. Data should be collected from reliable and re verified from other sources if possible before analysis.

3. To get the fair view of the relationship between sensex and various factors affecting it besides quantitative research, one should also undertake qualitative research through observations and other tools.

4. Hypothesis formation should be the last thing when taking the study into consideration.

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APPENDIX

Date	Sensex	Exchange Rate (USDINR)	Gold Prices(INR/ oz)	GDP (At Factor Cost)	Inflation (%)
Jul-06	10085.91	46.5	30157.26	8258.33	0.81
Oct-06	12709.4	44.92	26619.9	9362.37	1.6
Jan-07	14182.71	44.08	27745.77	9714.18	0.79
Apr-07	13897.41	41.05	27830.77	9116.02	0.79
Jul-07	15565.55	40.19	26724.77	9045.29	1.54
Oct-07	17559.98	39.2	29994.44	10258.18	0.75
Jan-08	19013.7	39.28	35211.7	10546.85	0.75
Apr-08	16481.2	40.46	37075.89	10009.47	0.73
Jul-08	13635.4	42.48	40883.02	9816	2.14
Oct-08	9975.35	49.33	41057.03	10849.93	1.37
Jan-09	9323.59	48.85	41859.99	10911.35	0.68
Apr-09	11023.09	49.73	43720.82	10601.26	1.35
Jul-09	14744.92	47.83	45578.27	10725.12	4.58
Oct-09	17322.82	46.93	48638.39	11682.51	1.23
Jan-10	16859.68	46.13	51240.91	12151.82	1.78
Apr-10	17591.18	44.28	51490.68	11564.66	1.18
Jul-10	17955.82	46.41	55796.03	11608.79	2.3
Oct-10	20165.86	44.33	60611.13	12698.77	1.12
Jan-11	19007.53	45.83	61669.83	13313.08	1.62
Apr-11	19602.23	44.26	65286.15	12447.06	0.54
Jul-11	18722.3	44.21	70291.7	12421.35	2.12
Oct-11	16785.64	48.7	81798.44	13525.51	0.51
Jan-12	16739.01	49.52	84242.38	14081.36	0.51

Apr-12	17373.84	52.67	84794.82	13002.21	1.99
Jul-12	17158.44	55.56	87535.75	12994.61	1.92
Oct-12	18682.31	53.81	92203.85	14117.85	1.93
Jan-13	20039.04	53.28	91302.27	14706.45	0.91
Apr-13	19016.46	53.69	74837.59	13607.57	0.89
Jul-13	20149.85	60.86	74837.84	13664.41	1.73
Oct-13	20882.89	61.62	76634.49	14762.12	1.26
Jan-14	21063.62	62.69	76559.66	15383.8	-0.84
Apr-14	22628.84	60.35	78378.25	14384.88	0.42
Jul-14	25641.56	60.56	78187.09	15473.78	2.44
Oct-14	26108.53	61.4	76393.2	15735.89	0
Jan-15	28121.89	62.02	79552.14	15973.9	0.4
Apr-15	28442.1	63.53	74885.66	16284.09	0.79
Jul-15	28463.31	63.99	69570.72	15890.79	0.77
Oct-15	27214.6	65.42	76516.7	16062.78	1.13
Jan-16	24455.04	67.88	74380.79	14098.89	-0.74
Apr-16	25626.75	66.43	82010.48	14983.23	1.12