

# “A STUDY ON INDIAN STOCK MARKET PREDICTION USING STATISTICAL TOOLS “

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## ABSTRACT

Today Stock market share typically considered to be a dynamic, non-linear, complicated, non-parametric, and chaotic in nature. The profitability of investing and trading in the stock market in large part depends at the predictability. If the trends of the share market is precisely forecasted, the shareholder may effectively be escorted and earn high return. Various statistical models are sufficient to analyse properly compiled, structured, and non-missing data. But, it is insufficient to analyse unstructured, noisy and improperly compiled data. So, statistical models for the prediction of stock market which is mostly based on data having certain patterns that might be noisy, unstructured and improperly compiled would be insufficient. Whereas, in many research, it has been established that, the most important capacity of the neural network is its proficiency to detect patterns and deformity as well as identifying multi-dimensional, non-linear co-relation in data.

Since the data of the Stock Markets are dynamic, non-linear, non-parametric, and chaotic in nature, so the prediction over such fluctuating data is not accurate with the help of conventional computers. Because, we cannot develop an algorithm, model, function or method to solve the problems based on such volatile data. But, the Neural Network helps us to get the solutions by formulating algorithm. Because, it follows different paradigm for computing based on the parallel architecture of Biological Brain. So, Artificial Neural Networks (ANNs) simply has the capacity to differentiate unknown and hidden structure in data which can be adequate for predicting the share market and stock exchange index. The Technical Analysis, Fundamental Analysis, Traditional time series forecasting are insufficient for stock market prediction. Hence, Standard Supervised Back-propagation Neural Network Learning Methodology where Boltzmann Machine, ADALIN, MADALIN will be used for the research.

**Key Words:** *Technical Analysis, Fundamental Analysis, Traditional time series forecasting, Supervised Back-propagation Neural Network Learning, Boltzmann Machine, ADALIN, MADALIN.*

## INTRODUCTION:

The market cannot always be predicted, but it can be predicted often enough. There are costs which might be critical for any investor to recognize: the current price of the funding she or he owns, or plans to personal, and its future bid price. in spite of this, traders are constantly reviewing beyond pricing history and the usage of it to steer their future funding decisions. some traders won't buy a inventory or index that has risen too sharply, because they assume it's due for a correction, at the same time as other investors avoid a falling inventory because they fear it's going to continue to become worse.

stock marketplace is an area wherein shares of public indexed organizations are traded. The number one marketplace is where organizations float shares to most of the people in an initial public presenting (IPO) to elevate capital.

once new securities had been bought within the number one market, they are traded in the secondary market—where one investor buys stocks from every other investor at the triumphing marketplace fee or at some thing

charges both the purchaser and dealer agree upon. The secondary market or the stock exchanges are regulated via the regulatory authority. In India, the secondary and primary markets are governed by the safety and change Board of India (SEBI).

A stock trade helps stock agents to trade enterprise shares and other securities. A inventory may be bought or sold simplest if it's miles listed on an exchange. for that reason, it's miles the meeting vicinity of the stock shoppers and dealers. India's most reliable inventory exchanges are the Bombay inventory alternate and the national inventory alternate.

In this paper we predict the Indian stock market Indices using statistical tools and madaline neural network. Since in a stock market a huge amount of non-linear data is produced daily and one of the three after effects occurs in the indices: ups, down and remain the same, which will occur is uncertain. For predicting stock price, researcher has developed a model based on regression and the effectiveness of the model depends on the effective input variable and their unique pattern. For the said purpose the researcher has done a **sensitive analysis** of the input variable to restrict the repetitive use of input variables for completing his research.

### **REVIEW OF LITERATURE:**

Birgul Egeli, Meltem Ozturan, Bertan Badur Researcher propose that the ANN can successfully be used to are expecting the Istanbul inventory change(ISE) index values the usage of previous day's index cost, preceding day's TL/USD trade fee, previous day's in a single day interest rate and five dummy variables every representing the working days of the week. Supervised gaining knowledge of fashions were applied wherein certain output nodes have been trained to reply to positive enter patterns. For this experimental records were collected immediately from the primary bank of republic of Turkey for a length of 417 day's starting from July 2, 2001 to February28, 2003. From this statistics set the primary 376 cases (about 90%) have been taken for training and forty one as testing examples. finding the quality model for the prediction of Istanbul stock trade marketplace index values. The prediction fashions based totally on ANNs were greater accurate than the ones based on **MAs**

Youngohc Yoon and George Swales in1991 established that the neural network method is able to gaining knowledge of a feature that maps inputs to output and encoding it in magnitudes of the weights within the community connection. They in comparison Neural network techniques with Multivariate Discriminate analysis technique, indicated that the Neural network technique can appreciably improve the predictability of stock fee overall performance.

Lawrence Kryzanowski, Michael Galler, David Wright in 1993 determines the artificial Neural Networks accuracy in predicting destiny go back overall performance as either superb or negative or as bad neutral or tremendous. The artificial neural network successfully classifies 72% of nice or bad returns.

Ramon Lawrence in 1997 surveyed the software of neural network to economic structures. It tested how neural networks were used to check the efficient marketplace speculation and the way they outperform statistical and regression strategies in forecasting percentage charges.

SaeedMoshiri and Norman Cameron in 2000 as compared the overall performance of again Propagation synthetic Neural community (BPN) model with the traditional monetary tactics to forecasting the inflation price and determined that the hybrid BPN fashions are able to forecasts as well as the traditional econometric technique.

Erdinc Altay and M. HakanSatman ESQ in 2005, studied the Istanbul inventory exchange which can be forecasted through the gaining knowledge of process of artificial Neural community and in comparison the forecasting performance of synthetic neural community with linear regression and purchase and keep strategies.

Qing Cao, Karyl B Leggio, and Marc J. Schniederjans in 2005 used synthetic Neural Networks to are expecting inventory rate movement (i.e. charge return ) for firms traded on the Shanghai inventory trade and as compared the predictive energy of univariate and multivariate neural community fashions and outcomes suggests that Neural network outperform the linear models in comparison and these consequences are statistically extensive across our sample companies and indicated neural networks are useful tool for stock rate Prediction in emerging markets like china.

GoutamDatta, PankajJha, Arnab Kumar Laha and Neeraj Mohan in 2006, discusses the modelling of the Indian inventory marketplace records the usage of artificial Neural network and studied the performance of ANN in Bombay inventory exchange.

Chakaradhara Panda and V. Narasimahan in 2006 used the artificial Neural community for the forecasting of each day Bombay stock trade (BSE) touchy Index (Sensex) returns and compare the overall performance of the neural community with performances of random walk and linear autoregressive fashions by means of using six overall performance measures.

BirölYildiz, AbullahYalama , and MetinCoskun in 2008 evolved an efficient 3 layer Neural network with revised Backpropagation algorithm to predict the direction of Istanbul inventory exchange country wide-100 Indices (ISE country wide -a hundred) and as a result, the version forecast and path of ISE national -one hundred to an accuracy of 74.51%.

Monica Isfan, RuiMenezes and Diana A. Mendes in 2010 shows that the Neural community may be used to discover the nonlinearity that exists inside the monetary facts and compared the Artificial neural community version with a traditional technique by way of analysing the deterministic /stochastic traits of the Portuguese inventory market information.

Aldin, Dehnavi, and Entezari, in 2012 used ANN for stock rate index forecasting at the Taiwan inventory alternate. last charge, the high and low price index had been transformed into technical signs for predicting the position of stock charge moves. inside the examine, neuron numbers in the hidden layer was decided empirically.

Dastgir and Enghiad, in 2012 evaluated Iran stock marketplace with the aid of that specialize in forecasting Tehran stock trade charge Index which is the maximum widespread index of Iran stock market. inside the examine, two hidden layers had been used with many mixtures of architecture. The wide variety of neurons in each hidden layer turned into changed from one to sixteen. consequences of the take a look at revealed that ANN model with 3 hidden neurons on the first hidden layer and four hidden neurons on the second completed the satisfactory performance in Iran inventory market.

Ruxanda and Badea, in 2014 supplied special configured ANNs and in comparison them in phrases of forecasting errors at the same time as making predictions on Bucharest inventory marketplace Index. input variables were set based totally on a stepwise ahead regression.

Adebiyi, Adewumi, and Ayo, in 2014 observed that ten inputs received from the new york stock exchange together with open price, low charge, high charge, close fee, and volume traded, seventeen hidden neurons, and one output neuron supply extra accurate consequences in ANN version.

Laboissiere, Fernandes, and Lage, in 2015 used ANN to predict the maximum and minimal day stock charges of Brazilian electricity distribution agencies. inside the take a look at, correlation analysis became used to pick enter variable and exceptional ANN architectures have been examined empirically. The first-rate results had been determined with one hidden layer and only five hidden neurons.

(Zahedi and Rounaghi in 2015) applied ANN and fundamental aspect analysis to expect inventory price on Tehran stock alternate. The results of the examine show that ANN model has superiority over its competitors. also, most important component evaluation approach can accurately expect inventory rate on Tehran stock exchange using 20 accounting variables.

If any model that may be evolved to predict the trends of the dynamic stock markets and removes uncertainties, it isn't handiest going to help to growth the investments within the inventory markets but additionally could be beneficial for regulators to take corrective measures. To increase one of these Neural community model, there is back propagation getting to know approach that may be used for education the Neural community model to predict the inventory markets to take higher funding selections and devise higher hazard management gear.

### **Objectives**

- To perform the reliability analysis over the research sample.
- To predict the Indian stock market indices and share prices using Multidimensional Regression Analysis.
- To determine the prediction accuracy of Multidimensional Regression model by using ANOVA.
- To test the performance of the predicted value of the next day of CNX S&P Nifty Index by using Sign Correctness Percentage (SCP) measure.

### **Research Method**

#### **Multidimensional Regression Analysis:**

The main objective of regression analysis is to explain the variation in one variable (called the dependent variable), based on the variation in one or more other variables (called the independent variables). If there is only one dependent variable and one independent variable is used to explain the variation in it, then the model is known as a simple regression. If multiple independent variables are used to explain the variation in a dependent variable, it is called a multiple regression model.

There are a variety of quantitative and qualitative methods used in forecasting of any parameter, and regression is only one of the better known (and often used) quantitative techniques.

There are basically two approaches to regression –

- A hit and trial approach
- A pre- conceived approach.

In the hit and trial approach we collect data on a large number of independent variables and then try to fit a regression model with a stepwise regression model, entering one variable into the regression equation at a time.

The general regression model (linear) is of the type

$$Y = a + b_1X_1 + b_2X_2 + \dots + b_nX_n$$

Where  $y$  is the dependent variable and  $x_1, x_2, x_3, \dots, x_n$  are the independent variables expected to be related to  $y$  and expected to explain or predict  $y$ .  $b_1, b_2, b_3, \dots, b_n$  are the coefficients of the respective independent variables, which will be determined from the input data.

The pre-conceived approach assumes the researcher knows reasonably well which variables explain 'y' and the model are pre-conceived, say, with 3 independent variables  $x_1, x_2, x_3$ . Therefore, not too much experimentation is done. The main objective is to find out if the pre-conceived model is good or not. The equation is of the same form as earlier.

The general form of the **multiple regression models** is as follows:

$(Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \dots + \beta_kX_k + \epsilon)$  which is estimated by the following equation:

$$(\hat{Y} = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_kX_k).$$

Where  $a$  represents the intercept, and  $b$ 's represents the partial regression coefficients.

### Statistics Associated with Multiple Regressions:

**Adjusted  $R^2$**  -  $R^2$  coefficients of multiple determinations, is adjusted for the number of independent variables and the sample size to account for the diminishing returns. After the first few variables, the additional independent variables do not make much contribution.

**Coefficients of multiple determinations** - The strength of association in multiple regressions is measured by the square of the multiple correlation coefficients,  $R^2$ , which is also called the coefficient of multiple determinations.

**F test.** The F test is used to check the null hypothesis that the coefficient of multiple determination inside the population,  $R^2_{pop}$ , is 0. this is equivalent to testing the null speculation. The take a look at statistic has an F distribution with  $k$  and  $(n - k - 1)$  levels of freedom.

**Partial F test.** The importance of a partial regression coefficient,  $\beta_i$ , of  $X_i$  may be tested using an incremental F statistic. The incremental F statistic is based at the increment within the defined sum of squares resulting from the addition of the unbiased variable  $X_i$  to the regression equation after all the other independent variables have been blanketed.

**Partial regression coefficient.** The partial regression coefficient,  $b_1$ , denotes the alternate within the anticipated cost,  $\hat{Y}$ , per unit change in  $X_1$  when the alternative impartial variables,  $X_2$  to  $X_k$ , are held constant.

### Data Analysis:

- a) For the purpose of research the researcher has collected the data from the following sources -
- 1) NIFTY 50 from [https://www.nseindia.com/products/content/equities/indices/historical\\_pepb.htm](https://www.nseindia.com/products/content/equities/indices/historical_pepb.htm),
  - 2) Dow Jones Industrial Average Historical Data from <https://in.investing.com/indices/us-30-historical-data>
  - 3) USR/INR Historical Data from <https://in.investing.com/currencies/usd-inr-historical-data>
  - 4) HANG SENG INDEX (^HSI) <https://finance.yahoo.com/quote/%5EHSI/history?period1=1167849000&period2=1531333800&interval=1d&filter=history&frequency=1d>

A descriptive analysis and statistical presentation of the data taken from the mentioned sources for a particular duration from 4<sup>th</sup> January 2007 to 28<sup>th</sup> March 2018 is done and presented in the table below.

**(Descriptive Statistics)**

	N	Minimum	Maximum	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
Nifty	2560	2524.20	11130.40	6315.2458	38.18153	1931.84944	.447	.048	-.644	.097
P/E	2560	10.68	28.29	20.6984	.06149	3.11119	-.268	.048	.172	.097
DY	2560	.82	2.24	1.2933	.00481	.24315	.702	.048	.939	.097
DJ	2560	6547.05	26439.48	14600.5382	79.93968	4044.66318	.587	.048	-.116	.097
HSK	2560	.00	32966.89	22305.2862	69.72077	3527.62280	-.467	.048	3.832	.097
Rs/\$	2560	39.08	68.81	54.2498	.18462	9.34103	-.016	.048	-1.489	.097
Valid N (listwise)	2560									

**Reliability Analysis:** Reliability analysis is done to check whether the Five Independent variables i.e. Rs/\$, P/E, HSK, DY, DJ and one dependent variable Nifty would produce consistent result or not.

**Case Processing Summary**

	N	%
Valid	2560	100.0
Cases Excluded <sup>a</sup>	0	.0
Total	2560	100.0

a. Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items

.685	.740	6
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From the Table: Reliability Statistics the calculated Cronbach's Alpha cut-off rate of 0.7 can proof good reliable (Hair et al, 2009). The cronbach's Alpha for the current study is 0.685 and Cronbach's Alpha based on standardized items is 0.740. So it can be concluded that all the factors used to measure the Nifty are found to be reliable.

**b) Multiple Regression Analysis:** The fundamental analysis of the stock market based on multiple regression analysis is the process of finding the least squares prediction equation, testing the efficiency of the model and carry on tests about predicting the values of the model parameter. However, this model is suitable for linear pattern of data.

### Regression Model:

#### Variables Entered/Removed<sup>a</sup>

Model	Variables Entered	Variables Removed	Method
1	Rs/\$, P/E, HSK, DY, DJ <sup>b</sup>		Enter

a. Dependent Variable: Nifty

b. All requested variables entered.

#### Model Summary<sup>b</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.986 <sup>a</sup>	.972	.972	324.49189	.972	17629.278	5	2554	.000	.042

a. Predictors: (Constant), Rs/\$, P/E, HSK, DY, DJ

b. Dependent Variable: Nifty

#### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9281372768.403	5	1856274553.681	17629.278	.000 <sup>b</sup>
	Residual	268923388.144	2554	105294.984		
	Total	9550296156.547	2559			

a. Dependent Variable: Nifty

b. Predictors: (Constant), Rs/\$, P/E, HSK, DY, DJ

From the Model Summary and Anova Table, it is found that Regression Model is statistically significant. The  $R^2$  (Coefficient of determination) value is 0.972 and adjusted  $R^2$  value is also 0.972, this indicates that 97.2% of regression model is explained by all the 5 independent variables taken together. Also, the impact of multi-collinearity on regression model is present but not significant because there is no any difference between  $R^2$  value and adjusted  $R^2$  value.

Durbin-Watson test from above Table shows that effect of auto correlation on the regression is very much insignificant (value of Durbin-Watson test is 0.042 which indicates that serial correlation is not present).

F-test: in Multiple regression it is natural to ask whether the value of  $R^2$  really indicates that the independent variables explain dependent variables or might have happened just by chance. The question “is the regression as a whole significant?” This can be explained through the F- test and it is evident from our regression model mentioned in Model Summary table that the value of F is significant.

In the model summary the theoretical value of F is 17629.278 for numerator degree of Freedom  $df_1 = 5$  and Denominator degree of freedom  $df_2 = 2554$ . The P-value is .000 i.e. our regression model is statistically significant at 1%. So, we conclude that all the five independent variables taken together are affecting the dependent variable Nifty. Hence, it is statistically proved that it not happening just by chance.

#### Residual Statistics<sup>a</sup>

		Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value		2229.8762	11135.4639	6315.2458	1904.45609	2560
Residual		-1176.45935	1160.29077	.00000	324.17472	2560
Standard Value	Predicted	-2.145	2.531	.000	1.000	2560
Standard Value	Residual	-3.626	3.576	.000	.999	2560

a. Dependent Variable: Nifty

#### Coefficients<sup>a</sup>

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Co-linearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	-7431.926	158.289		-46.952	.000		
P/E	262.093	5.236	.422	50.058	.000	.155	6.449
1 DY	365.691	64.090	.046	5.706	.000	.169	5.902
DJ	.160	.004	.336	36.482	.000	.130	7.682
HSK	.034	.004	.062	9.531	.000	.259	3.867

Rs/\$	87.516	1.624	.423	53.878	.000	.179	5.595
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a. Dependent Variable: Nifty

Application of t-test as indicated in Coefficients table for significance of individual independent variable indicates that all five independent variables  $X_1$  (P/E),  $X_2$  (DY),  $X_3$  (DJ),  $X_4$  (HSK) and  $X_5$  (Rs./\$) are statistically significant. The intercept of the regression equation is also statistically significant.

It is also evident from above table that all the parameters coefficient of regression model has positive impacts on the Nifty.

Dependent variable  $Y = \text{Nifty}$

Independent variables:

$X_1 = \text{Price Earnings Ratio (P/E)}$

$X_2 = \text{Dividend Yield (DY)}$

$X_3 = \text{Dow Jones (DJ)}$

$X_4 = \text{Hang Seng (HSK)}$

$X_5 = \text{Rs./Dollar (RS./\$)}$

Input Data set consisting of 2560 observations

**Regression equation obtained from the Analysis as per standardized coefficient Beta is:**

$$\text{Nifty} = 0.422 (\text{P/E}) + 0.046 (\text{DY}) + 0.336 (\text{DJ}) + 0.062 (\text{HSK}) + 0.423 (\text{Rs. /\$})$$

$$Y = 0.422 X_1 + 0.046 X_2 + 0.336 X_3 + 0.062 X_4 + 0.423 X_5$$

**Regression equation obtained from the Analysis is:**

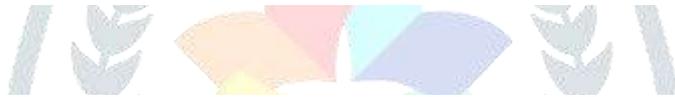
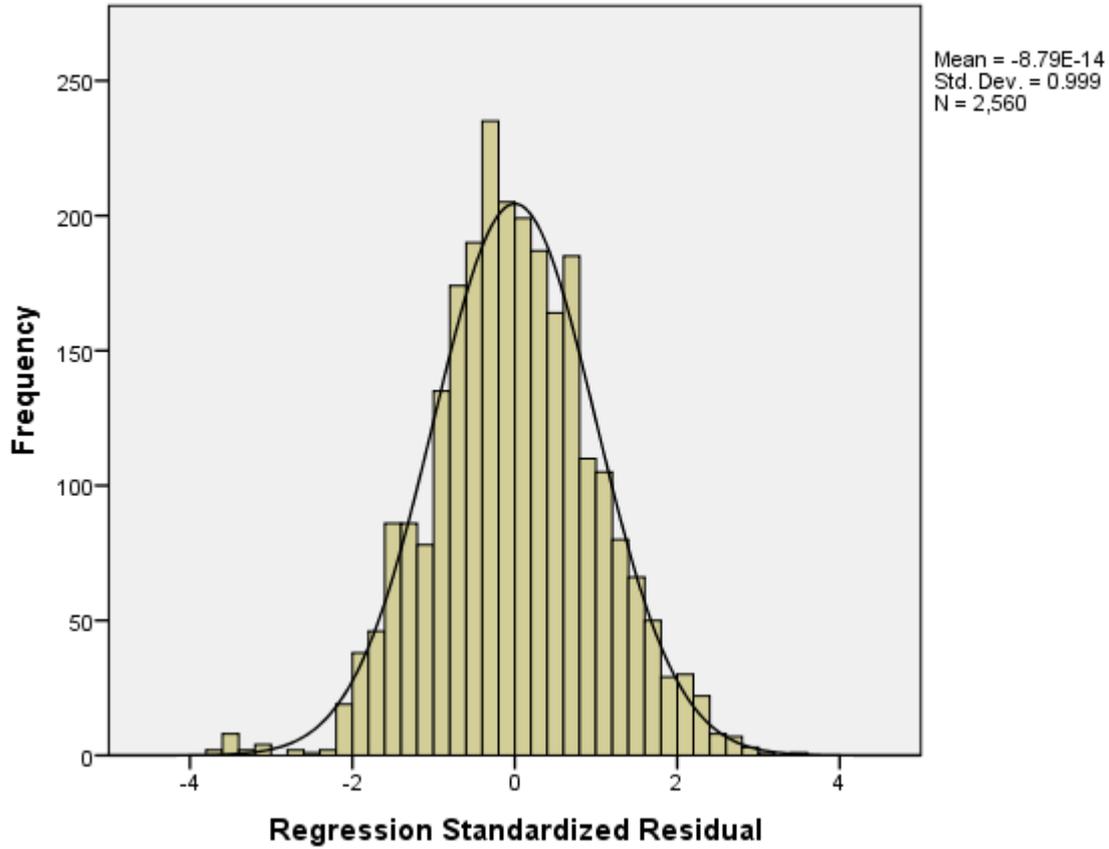
$$\text{Nifty} = -7431.926 + 262.093 (\text{P/E}) + 365.691 (\text{DY}) + 0.160 (\text{DJ}) + 0.034 (\text{HSK}) + 87.516 (\text{Rs. /\$})$$

$$Y = -7431.926 + 262.093 X_1 + 365.691 X_2 + 0.160 X_3 + 0.034 X_4 + 87.516 X_5$$

		Correlations					
		Nifty	P/E	DY	DJ	HSK	Rs/\$
Pearson Correlation	Nifty	1.000	.694	-.243	.936	.680	.788
	P/E	.694	1.000	-.792	.556	.753	.177
	DY	-.243	-.792	1.000	-.138	-.576	.302
	DJ	.936	.556	-.138	1.000	.675	.780
	HSK	.680	.753	-.576	.675	1.000	.235
	Rs/\$	.788	.177	.302	.780	.235	1.000

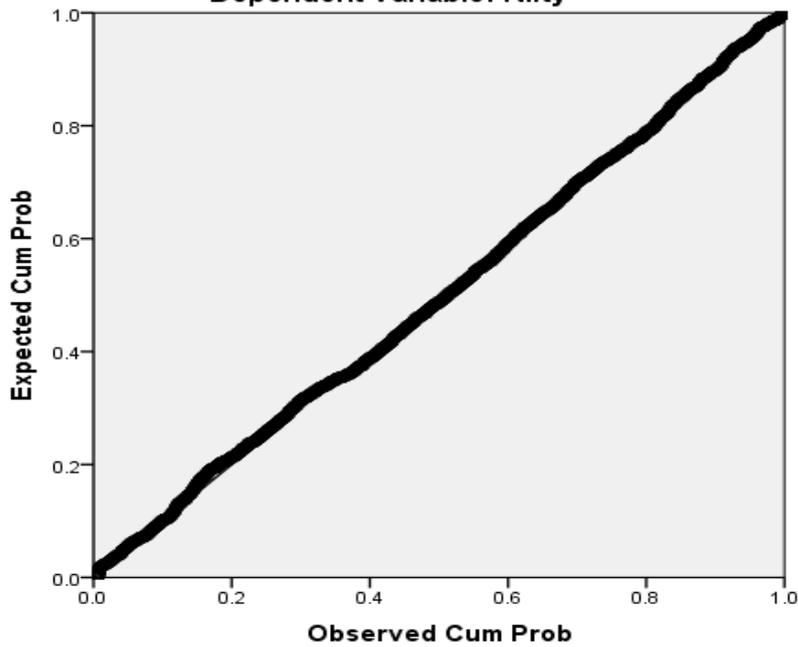
### Histogram

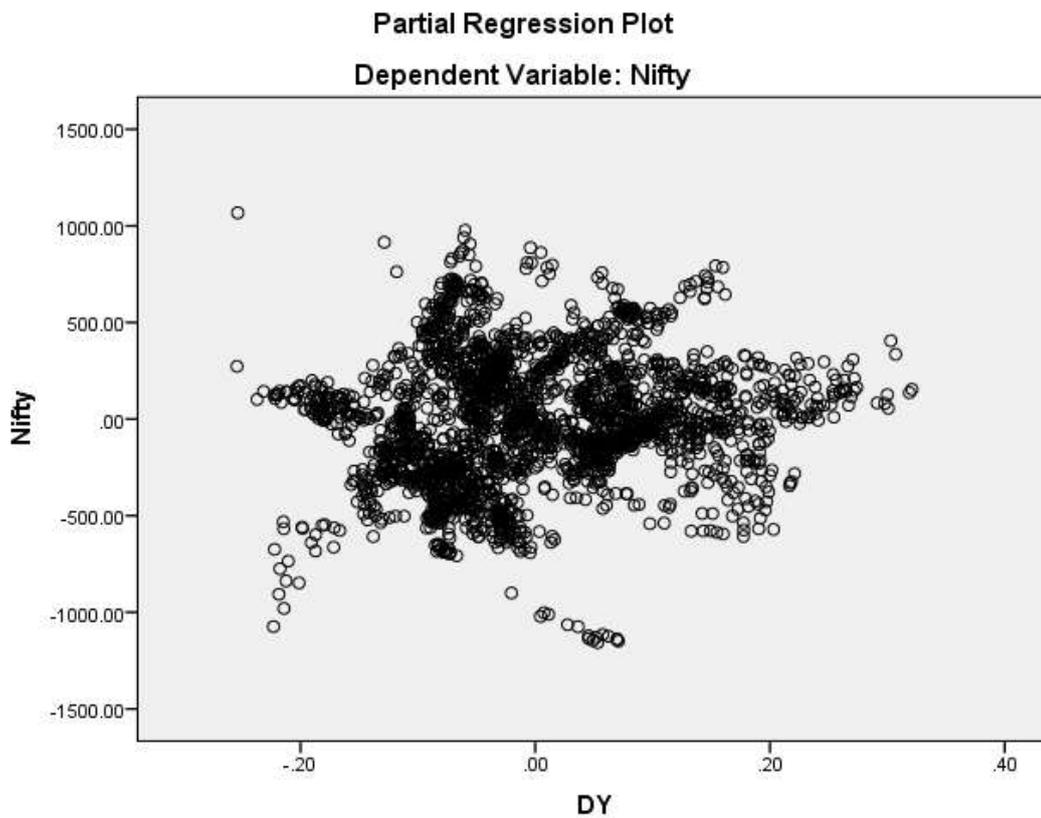
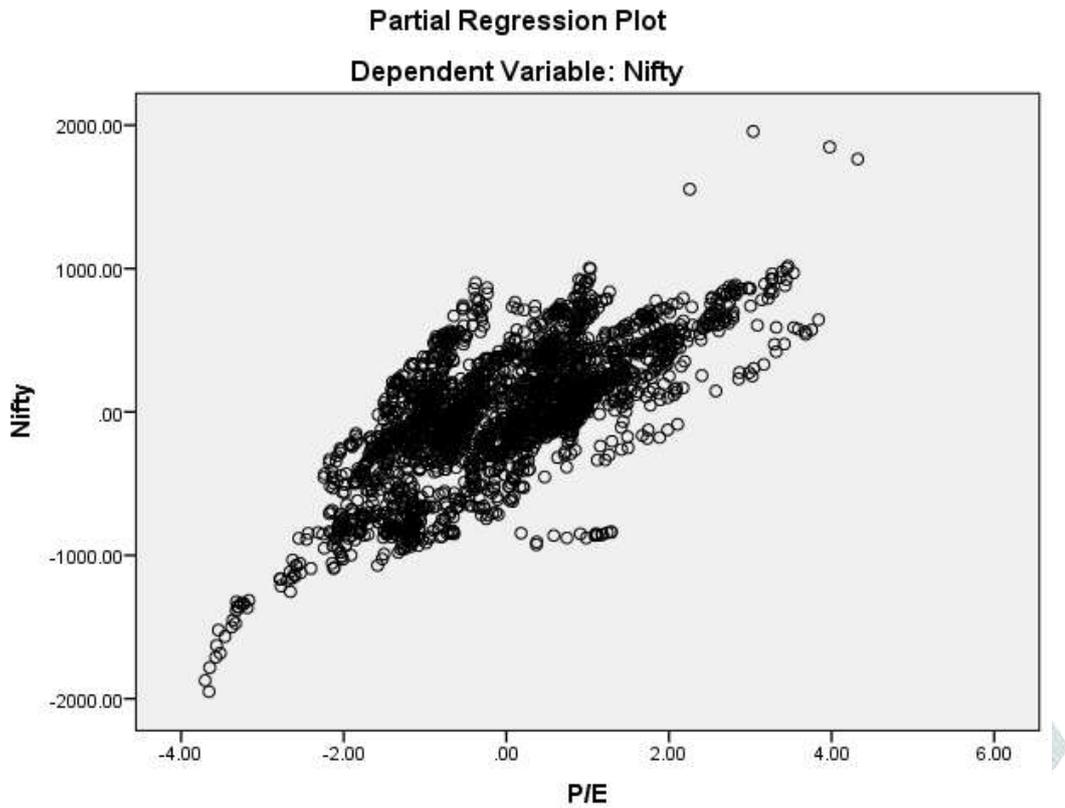
Dependent Variable: Nifty



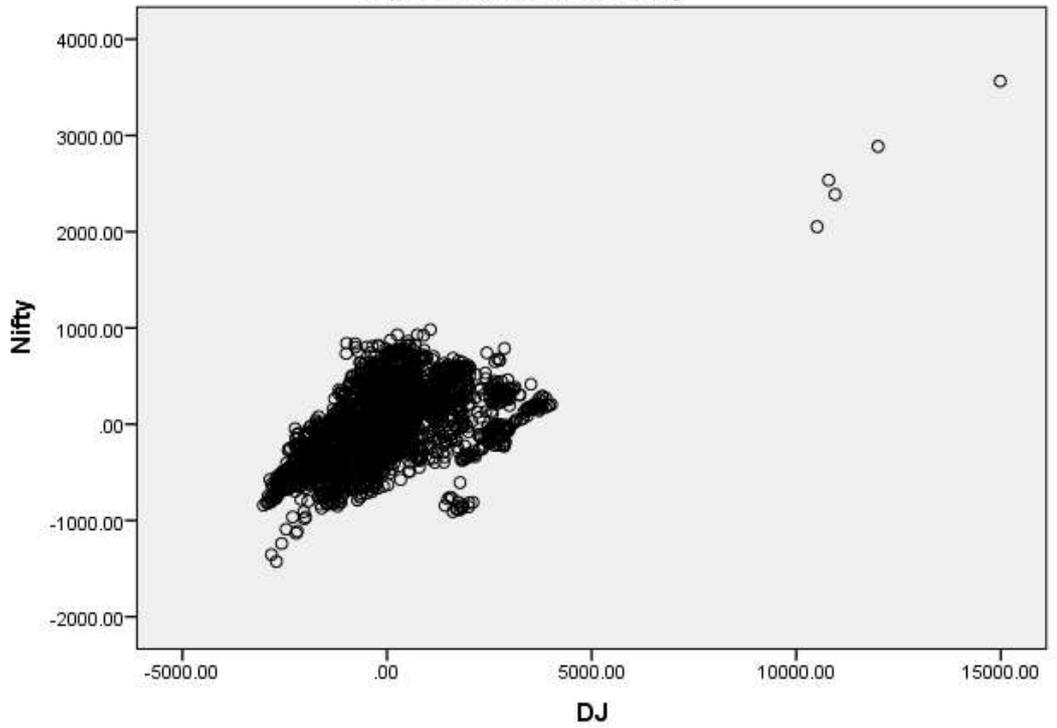
### Normal P-P Plot of Regression Standardized Residual

Dependent Variable: Nifty

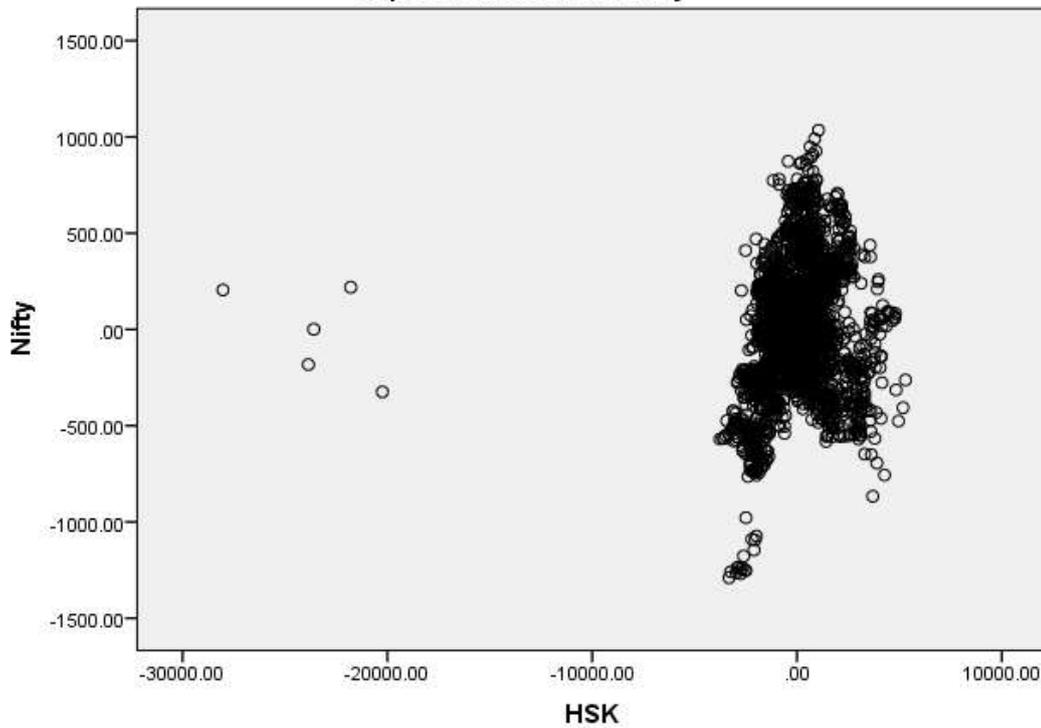


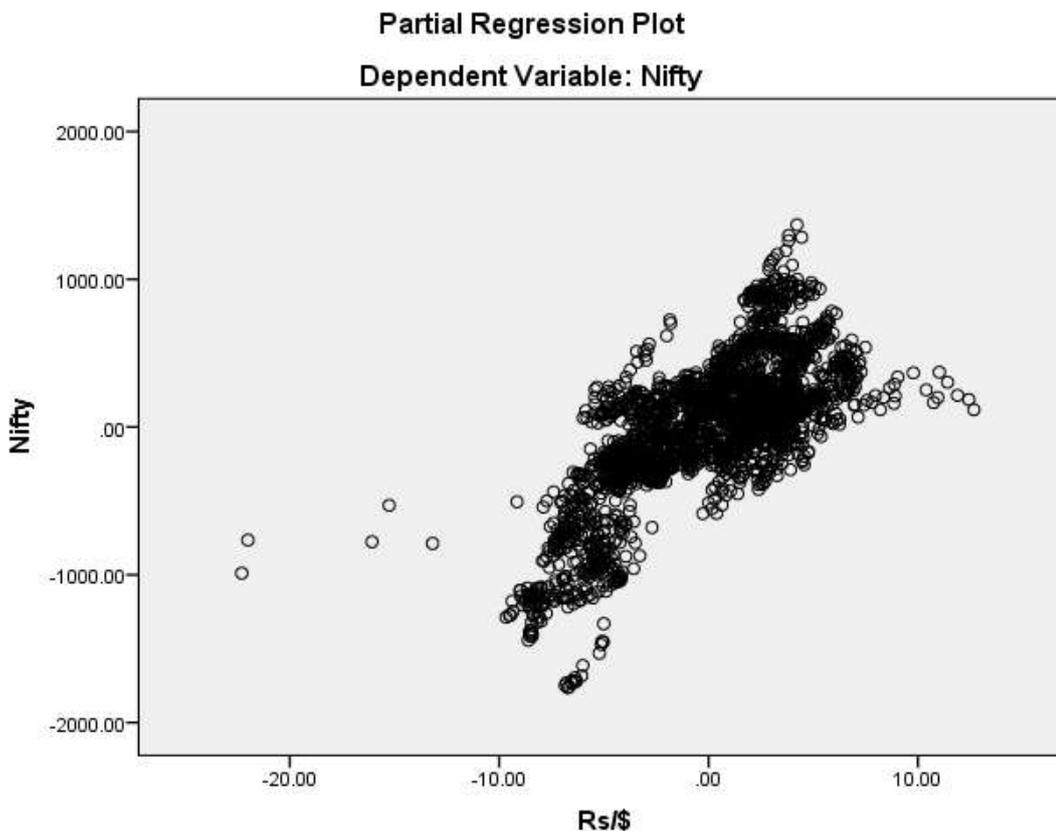


Partial Regression Plot  
Dependent Variable: Nifty



Partial Regression Plot  
Dependent Variable: Nifty





### **Conclusion and directions for future research:**

The investment into a commercial venture with the expectation of achieving a profit, buy and sells in the stock market mostly depends on the predictability. So, the main objective of this paper is to provide statistical models for the better prediction of stock market which might be helpful for investors and traders.

The key challenges are the data of stock markets which are mostly based on certain patterns that might be noisy, unstructured and improperly compiled. Therefore, predicting the stock market depends on different known and unknown components. The total deviation in regression model is the sum of explained deviation and unexplained deviation. But the unexplained deviation cannot be analysed through standard regression model. So the performance of multiple regression analysis technique is less than conclusive and needs to be improved for more precisely predicting stock price performance.

Future scope of this study widens to the identification of different models based on Neural Network to get the solutions by formulating algorithm. Because, it follows different paradigm for computing based on the parallel architecture of Biological Brain. So, Artificial Neural Networks (ANNs) would certainly help to distinguish unknown and hidden patterns in data which can be very effective for share market prediction and stock exchange index prediction. The Technical Analysis, Fundamental Analysis, Traditional time series forecasting are insufficient for stock market prediction. Hence, Standard Supervised Back-propagation Neural Network Learning Methodology where Boltzmann Machine, ADALIN, MADALIN will be used for the research in future.

In a country like India, multidimensional regression analysis could be useful to predict the yield of rice per acre that depends upon quality of seed, fertility of soil, fertilizer used, temperature, rainfall. If one is interested to

study the combined effect of all these variables on rice yield can use this technique and additional advantage of this technique is that it enables us to study the individual influence of these variables on rice yield.

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