

# THE INTERNATIONAL JOURNAL OF BUSINESS & MANAGEMENT

## Factor Analysis Approach to Find out the Relationship between the Macro Economic Variables and Stock Market Return: A Case Study of NSE

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### Abstract:

*The success of the corporate activities is heavily dependent on the economic environment in which it is operating. As the stock exchanges are the barometer of the corporate performance in the country, therefore the economic factors have a direct impact upon the stock market performance. Therefore the stock market reflects the performance of the corporate world as well as the changes in the economic variables. The same thing has been supported in the Asset pricing model (APT) proposed by Ross (1976). According to this theory says that the stock return can also be affected by the many micro and macro-economic variables along with the individual company performance.*

*This paper has applied the factor analysis approach for the study of the impact of the economic variable upon the market return. There is a risk of effect of multi co linearity among the economic variables chosen for the study. As it will be difficult to find out which variable is affecting the market return how much. Therefore factor analysis has been used to reduce the variables into group of factor and later use these group variables to predict theirs effect on the stock market return. For this regression analysis has been used. The factor analysis showed that the major macroeconomic variables that affect the stock market return are the economic efficiency within the country and the foreign exchange of the country. The regression analysis revealed that the variables are explaining about 92% variation in the market return. This will help the investor to design the investment portfolio.*

**Keywords:** Macro economic variables, Facto analysis, regression analysis, stock market return

### 1. Introduction

The success of the corporate activities is heavily dependent on the economic environment in which it is operating. As the stock exchanges are the barometer of the corporate performance in the country, therefore the economic factors have a direct impact upon the stock market performance. Therefore the stock market reflects the performance of the corporate world as well as the changes in the economic variables. The same thing has been supported in the Asset pricing model (APT) proposed by Ross (1976). According to this theory says that thee stock return can also be affected by the many micro and macro-economic variables along with the individuals companies performance.

This paper has applied the factor analysis approach for the study of the impact of the economic variable upon the market return. There is a risk of effect of multicollinearity among the economic variables chosen for the study. As it will be difficult to find out which variable is affecting the market return how much. Therefore factor analysis has been used to reduce the variables into common factor and later use these variables to predict theirs effect on the stock market return. This will help the investor to design the investment portfolio.

### 2. Literature Review

Chen, Roll and Ross (1986) has established in their study that the macroeconomic variables affect the behavior of stock market. Fundamentals factors of the firm and macro-economic environment together plays an important role in determining the stock market volatility. (Roll & Ross, 1980; Chen, 1983) highlighted in their study that generally three to five factors are can be extracted to explain the behavior of macroeconomic relationship with the stock exchange. Fama (1981) in his study has taken all the real economic variables and tried to establish the inter relationship between real economic variables and stock market. Van Rensburg, 2000; Solnik 1987, in their study taken the real economic variables and the financial ratios to study the inter relationship. Kryzanowski & To, 1983; Dhrymes et. al. 1984 has revealed in their study that the major economic variables that affect the stock market return remain same across the time and across various samples. Garret & Priestley, 1997 found out in his study that the exploratory factor analysis is a better technique over the confirmatory factor analysis technique. Mohseni, 2007 reflected in his study that money supply and oil prices are more two important variables in the crude producing countries that were able to explain considerably the variation in the stock market of Iranian economy. Since the less developed countries of South Asia including India are supposed to be relatively less integrated to the world, hence international macro-economic variables have insignificant though positive role in explain the shakiness of stock markets. Moreover, the underdeveloped economies don't have any long run relationship between stock market and the foreign

exchange rate (Smyth & Nandha, 2003). However, many studies have revealed a significant positive relationship between stock market and exchange rates (Smith, 1992; Solnik, 1987; Aggarwal, 1981) while others have reported a significant negative relationship between the stock market and the economic variables (Soenen & Hennigar, 1988).

### 2.1. Scope and Objective of the Study

The investors need to rely upon certain proved things to help them in decision making while going for the investment. The government also needs to know the major areas of the economy which directly affecting the performance of the stock market so that it can take necessary steps for those areas of the economy because of which stock market is badly affected. Keeping these things in mind this paper tries to find out the economic variables which affects the stock market most and to what extent. The scope of the study is limited to the National stock exchange and the Indian economy.

### 2.2. Data and Methodology of Study

For the current study the data source used are mainly secondary in nature. We have taken the monthly data of various economic variables for 15 years starting from April 2000 to March 2015. We have taken the monthly data of various economic variables such as Index of Industrial production, Fiscal deficit, Foreign exchange rate of Indian Rupee with U.S. dollar, broad money supply, whole sales price index, bank rate, gold price, FII gross purchase, FII gross sales and GDP at factor cost. These data has been collected from the website of RBI and Government of India. The stock market return data has been collected from the website of the National Stock Exchange.

For arriving at the conclusion of the study we have used the statistical software **SPSS** (Statistical Package for Social Science). First we have tested the correlation among the variables to found out the variables representing the same aspect of the economy. The purpose of the test is to eliminate the variables which are highly correlated to each other i.e. having  $r$  more than 0.85. Further we conducted the factor analysis to find out the common variables which affects the stock market return combinely. The KMO and Bartlett's Test result shows a value of 0.871, which indicates that the variables taken for the study, are adequate. Therefore we are ignoring the some of the highly correlated study and we are not eliminating them, still we have calculated revised correlated to show the real correlation among the selected variables. Then we conducted the factor analysis and the results of the test give two factors. Then taking those two factors we conducted regression analysis with the stock market return and result of the analysis has been discussed bellow.

### 2.3. Data Analysis

The data after being tested for the adequacy and reliability has been tested for the co linearity among them and has been represented in Table 1.

Correlation Matrix <sup>a</sup>											
	IIP	Fiscal deficit	E. rate	Broad money Bm3	Whole sale price index	Bank rate	Gold Price	FII Gross	FII Gross Sales	GDP at factor cost	
Correlation	IIP	1	0.356	0.458	0.909	0.171	0.403	0.923	0.867	0.851	0.959
	Fiscal Deficit	0.356	1	0.287	0.413	-0.041	0.27	0.438	0.246	0.264	0.414
	Exchange rate	0.458	0.287	1	0.751	-0.211	0.803	0.487	0.352	0.328	0.643
	BM3	0.909	0.413	0.751	1	-0.045	0.655	0.898	0.795	0.765	0.978
	WPI	0.171	-0.041	-	-0.045	1	-0.283	-0.077	0.234	0.276	0.053
	Bank rate	0.403	0.27	0.803	0.655	-0.283	1	0.468	0.375	0.329	0.55
	Gold Price	0.923	0.438	0.487	0.898	-0.077	0.468	1	0.736	0.707	0.917
	FII Gross Purchase	0.867	0.246	0.352	0.795	0.234	0.375	0.736	1	0.968	0.839
	FII Gross Sales	0.851	0.264	0.328	0.765	0.276	0.329	0.707	0.968	1	0.815
	GDP at factor cost	0.959	0.414	0.643	0.978	0.053	0.55	0.917	0.839	0.815	1

Table 1: Correlation matrix among the variables  
Sources- output of analysis

As we can see that all the variables has a high degree of correlation between them which lead to a similar type of factor representation but as the K-M-O test result (0.817) provides a support for the data factor analysis, so the next analysis is done.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		
Bartlett's Test of Sphericity	Approx. Chi-Square	2976.132
	Df	45
	Sig.	.000

Table 2: KMO and Bartlett's Test

	Initial	Extraction
Index of industrial production	1.000	.944
Fiscal deficit	1.000	.232
Exchange rate	1.000	.770
Broad Money (M3)	1.000	.976
Whole sale price index	1.000	.614
Bank rate	1.000	.756
Gold Price	1.000	.829
FII Gross Purchase	1.000	.889
FII Gross Sales	1.000	.885
GDP at factor cost	1.000	.968
Extraction Method: Principal Component Analysis.		

Table 3: Communalities

Table 3 explains the communalities data. It can be observed that all the variables are explaining themselves almost more than 60% variation only fiscal deficit is very less correlated. The Table 4 explains the number of factor that we can extract out of all the variables. It is evident from the table that only two factors explains about 78% of the variations in the economy. Therefore all the selected variables will be grouped under two factors. To decide which variable will come under which factor we will refer to the rotated component matrix. In this matrix the elements of the factors will be selected on the basis of the loading they are putting upon the factors. Variable having higher loading on a factor will come under that factor.

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.173	61.732	61.732	6.173	61.732	61.732	5.446	54.457	54.457
2	1.689	16.892	78.625	1.689	16.892	78.625	2.417	24.168	78.625
3	0.845	8.452	87.077						
4	0.68	6.796	93.873						
5	0.338	3.383	97.256						
6	0.188	1.879	99.135						
7	0.036	0.361	99.496						
8	0.029	0.293	99.789						
9	0.014	0.138	99.927						
10	0.007	0.073	100						
Extraction Method: Principal Component Analysis.									

Table 4: Total Variance Explained

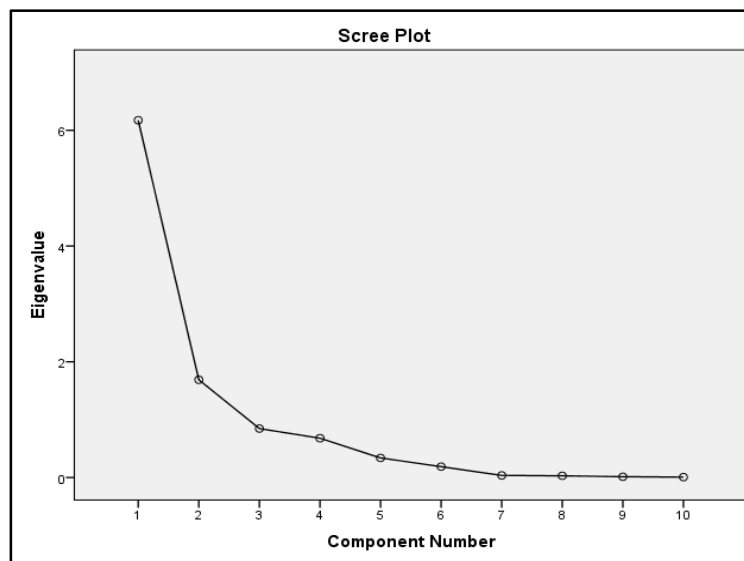


Figure 1

The scree plot clearly reflects the no of factor that has been extracted in the factor analysis process. The elbow of the diagram is exactly visible at second factor.

In the rotated component matrix the variables are represented according to their loading upon the respective factors. The variables having higher loading on any factor is taken as the component of that factor. As per the table -5 it is quite obvious that the factor one has higher number of variables under it and factor two has only two variables influencing it.

<b>Rotated Component Matrix<sup>a</sup></b>		
	Component	
	1	2
Index of industrial production	.957	.167
FII Gross Purchase	.943	
FII Gross Sales	.940	
GDP at factor cost	.914	.365
Broad money (M3)	.851	.501
Gold Price	.835	.363
Fiscal deficit	.349	.331
Bank rate	.331	.804
Exchange rate	.382	.790
Whole sale price index	.351	-.701
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.		
a. Rotation converged in 3 iterations.		

Table 5

<b>Component Transformation Matrix</b>		
Component	1	2
1	.915	.403
2	.403	-.915
Extraction Method: Principal Component		

Table 6

The factors so identified can be named on the basis of the common characteristic of the constituent variables. The common variables and their corresponding name are given in the Table 6.

<b>Variables</b>	<b>Factors</b>	<b>Name of the factor</b>
Index of industrial production	<b>Factor-1</b>	<b>Fiscal Policies</b>
FII Gross Purchase		
FII Gross Sales		
GDP at factor cost		
Broad money (M3)		
Gold Price		
Fiscal deficit		
Whole sale price index		
Bank rate	<b>Factor - 2</b>	<b>Monetary Policies</b>
Exchange rate		

Table 7: Factors Identified

The factors so identified has been named as fiscal policies which contains IIP,FIIGP,FIIGS, GDP at factor cost, BM3, gold price, fiscal deficit and WPI. And the second factor is monetary policies which contains bank rte and exchange rate.

Identifying the major factors followed by the estimation of its impact on the return on the stock market. For the study of the impact the regression analysis has been done. To generate the regression equation the NSE Nifty has been taken as dependent variable and the identified two factors are taken as independent variable. The results of the analysis has been presented in the Table 8 and Table 9

**Regression**

Model Summary <sup>b</sup>							
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square	F	df1
1	.964 <sup>a</sup>	.930	.929	570.871	.930	1174.177	2

Table 8

Model Summary <sup>b</sup>			
Model	Change Statistics		Durbin-Watson
	df2	Sig. F Change	
1	177 <sup>a</sup>	.000	.576

Table 9

In the Table 8 it is clear with the R value of 0.964 and R<sup>2</sup> value of 0.930 indicates that the return on the NIFTY. Both the factors together can explain up to 93 percent variation in the return of the NIFTY. And the values are very significant. In the table – 10 the values of the coefficient has been given and both values of the coefficients are significant.

Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardiz	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3779.494	42.550		88.82	.000
	A-R factor score 1 for	2008.249	42.669	.937	47.06	.000
	A-R factor score 2 for	492.377	42.669	.230	11.53	.000

Table 10

a. Dependent Variable: Nifty closing

**Charts**

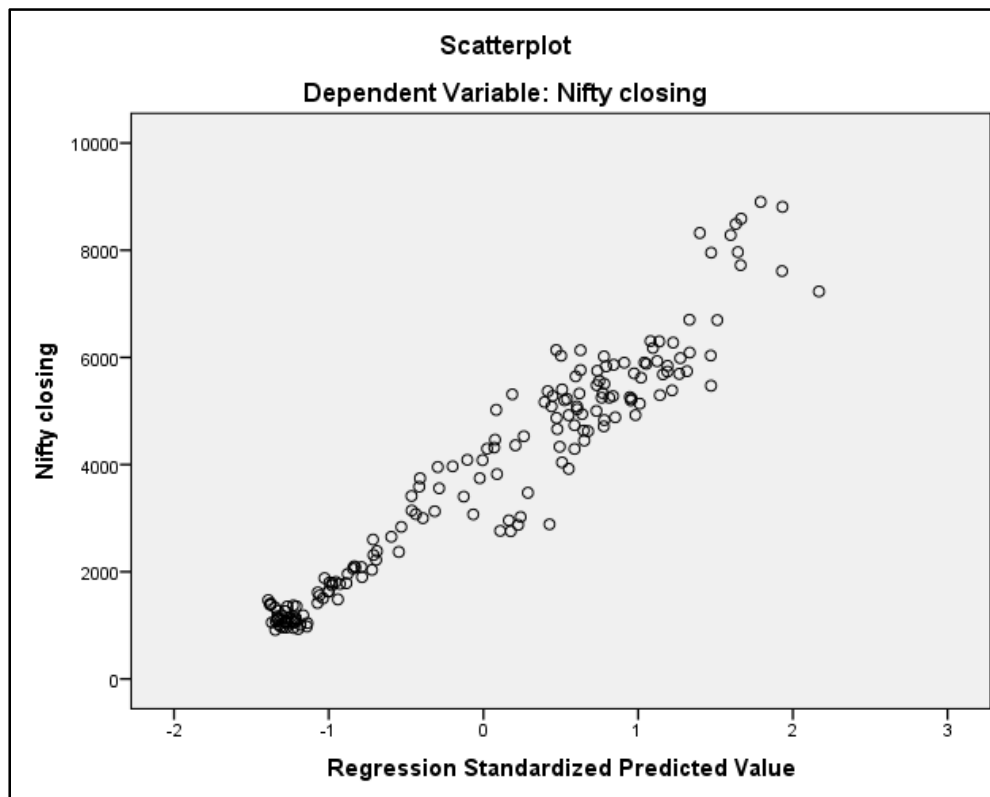


Figure 2

### 3. Conclusions

The analysis will be very useful in the prediction in the movement of the NIFTY given the movement in the in the variables and the corresponding factor. The result establishes the common saying that the stock exchange is the barometer of the economy of the country. The current result will help the investors to plan their investment according to the movement in the economic variables. This study has only taken 10 variables from the economy. But a greater research can be done by taking more detailed components representing the economic activities.

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