Summary, Findings, Implications and Problems for Further Investigations

7.0. Introduction

The subject matter of the present research plan greatly relates to ‘Investment Analysis and Portfolio Management’. This simply reflects the relationship between the performance of economic variables and the growth of the market. Once the relationship is established, the growth of the national economy can be used to estimate, forecast and for making predictions about the growth of an industry and company operating in the industry. The share market index is a barometer of the changes taking place in the prices of stocks. The raising share prices increase the share market index and vica-versa. The share prices, on the other hand, are affected by the earning potential of the company. It this discussion, the crucial question then is to answer the sensitivity of the stock market performance with variations in economic variables as they have a direct cause and effect relationship with the market. Off late, an increasing attention is being paid to the relationship between the share market index and the variations resulting in the microeconomic variables.

For the statistical analysis of the relationship existing between variations in microeconomic variables and stock market indices, a large number of techniques like exponential smoothing, autoregressive moving average, simple correlation and
regression, multiple and partial correlations are some of the models used in the literature. Sometimes time series models are also used for forecasting a target variable and using past trends in the data itself to make predictions about its future behaviour.

7.1. Statistical Background

However, most of the techniques like simple and multiple correlation and regression along with partial correlations models are used in the statistical analysis of the variables.

In the present research plan too, simple and multiple regression models are used to develop a reliable, sensitive and sustainable relationship between stock market index and some of the prominent macroeconomic variables.

In this regard, the secondary data on Ten (10) macroeconomic variables in the two triennium blocks, [(1994-1997) and (2003-2006)] has been used in the statistical analysis of the newly developed multiple regression model.

As per the framework of the proposed research plan, we observe that the study relates to economic analysis of the activities in two triennium economic blocks. As such, Sensex and Nifty, representing secondary market performance have been taken as the two dependent variables. In the statistical analysis of the concerned data, these dependent variables are denoted as:

\[ Y_1 : \text{Nifty in I Triennium block (1994-1997)} \]

\[ Y_2 : \text{Sensex in I Triennium block (1994-1997)} \]

\[ Y_3 : \text{Nifty in III Triennium block (2003-2006)} \]

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\[ Y_4: \text{Sensex in II Triennium block (2003-2006)} \]

The 10 independent variables in the study are:

\[ X_1: \text{Growth rate of GDP} \]

\[ X_2: \text{Industrial growth rate} \]

\[ X_3: \text{Agriculture and monsoon} \]

\[ X_4: \text{Saving and investment} \]

\[ X_5: \text{Government budget and deficits} \]

\[ X_6: \text{Inflation} \]

\[ X_7: \text{Interest rates} \]

\[ X_8: \text{Cash reserve ratio} \]

\[ X_9: \text{Balance of payment} \]

\[ X_{10}: \text{Foreign capital flow (FDI + FII)} \]

7.2. Research Plan

After establishing the basis structure, the present study proposes a new methodology useful for developing a new statistical technique based on a simple/multiple regression model. For proper understanding of the research plan, a new concept of resembling and diverging variable has been introduced. The concept comes from the fact that for each of the dependent variables, all the independent variables do not have the explanatory power, i.e., these variables are unable to explain the variations in the concerned dependent variables. As
such such variables be either dropped or eliminated from the the basic multiple regression model so that the resulting regression model be reliable in estimating or predicting about the dependent variables.

In this connection, the concepts or resembling and diverging variable have been introduced to meet the objective.

7.3. Resembling and Diverging Variables

For the introduction of resembling and diverging variables, we first go to answer the basic question: Is there a linear relationship between $Y$ and any of the independent variable $X_i$ ($i = 1, 2, 3, \ldots, 10$). In this concern, one goes for the independent variables which have the explanatory power and also for those who do not have this properties. Individual t-test is used for making such classifications. Accordingly, the set of resembling independent variables are put in Class I and the remaining diverging variables are classified into Class II. Thus, after going for the individual t-test for all the 10 independent variables, one case easily form the two classes, which are

Class I : $(X_1, X_2, X_4, X_6$ and $X_8)$ and

Class II : $(X_3, X_5, X_7, X_9$ and $X_{10})$

7.4. Full and Optimized Multiple Regression Model

Here, it is a notable feature of these classes that these are similar in both the triennium blocks.

After forming the two classes a multiple regression model consisting of resembling variables is formed, which is of the form:

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\[ Y = B_0 + B_1X_1 + B_2X_2 + B_4X_4 + B_6X_6 + B_8X_8 \]  \hspace{1cm} (7.1)

While the complete regression model was of the form
\[ Y = B_0 + B_1X_1 + B_2X_2 + \ldots + B_{10}X_{10} \]  \hspace{1cm} (7.2)

The model in (7.1) is observed to have some nice statistical properties. This model is being called an optimized one when tested on the basis of descriptive and inferential properties.

For the obtained secondary data, the proposed optimized model is observed to be highly sensitive, sustainable and reliable in making estimates, forecasts and predictions about the dependent variable.

The complete statistical analysis of the full and multiple optimized regression models has been the subject matter of Chapter 3 in which properties of the optimized model have been highlighted and compared with the initial or basic regression model.

Next, one turns to Class II consisting of diverging variables which do not have any explanatory power, i.e., these variables are not capable of explaining the variation in the concerned dependent variable. Still, for comparing the statistical properties of the regression model made up of diverging variables, is the subject matter of Chapter 4. The model made up of diverging variables is of the form
\[ Y = B_0 + B_3X_3 + B_5X_5 + B_7X_7 + B_9X_9 + B_{10}X_{10} \]  \hspace{1cm} (7.3)

The statistical analysis of the models with four (4) dependent variables \( Y_1, Y_2, Y_3 \) and \( Y_4 \) has been presented in this Chapter. All the four models as in (7.3) have been statistically analysed with descriptive and inferential properties.
of these models. It is observed, however, that these models do not have the much needed statistical properties and their use is forbidden for the good of the model.

7.5. Descriptive and Inferential Properties

In this regard, the multiple correlation R is observed to be insignificant. Obviously, the value of the coefficients of determination, R², is also inadequate for these models. The S.E.'s of estimate for all these four models involving diverging variables is quite large when compared with for regression models consisting of resembling variables.

As a next step, the proposed models in Chapter 3 and Chapter 4 have to be tested statistically in respect of their sensitivity, sustainability and reliability. In the process, the statistical analysis of the multiple regression model consisting of resembling variables has been presented in Chapter 5. Estimates of the four dependent variables for these models are observed to be highly sensitive, sustainable and reliable in making predictions with smaller S.E.'s of these models.

After formulating and testing the concerned H₀: the P-value for all the four models is much lesser then size of type I error, α = 0.05 and hence very reliable. This all again speaks of some nice properties of these proposed models.

On the other hand, the four multiple regression models consisting of diverging variables do not have such statistical properties. Accordingly, these models are neither sensitive nor sustainable. Null hypothesis have been formulated and tested for all these models and observed that the corresponding P-values are
much higher than $\alpha = .05$, as such, they have insignificant coefficients and hence highly unreliable in making estimates, projections and predictions for all the involved dependent variables. This analysis and its presentation is the subject matter of Chapter 6.

After analysing the roll of resembling variables in respect of sensitivity, sustainability and reliability of the multiple regression models consisting of the resembling variables only. Alongwith this analysis it was observed that the following variables have the explanatory power for all the models with $Y_1, Y_2, Y_3$ and $Y_4$ as the dependent variable in the two triennium economic blocks. Obviously, these variables are capable of defining the variations in the dependent variable. Here, at this point, we can name these variables for retaining the same in regression models so that these models may provide estimates or predictions about dependent variables with optimized statistical properties. Here, the resembling variables $X_1$ (GDP), $X_2$ (Industrial growth rate), $X_4$ (Saving and investment), $X_6$ (Inflation) and $X_8$ (Cash reserve ratio) are observed to have a capability of defining a linear relationship with all the dependent variables. Thus, these variable do explain the variations resulting in the dependent variables. This all has been amply explained in Chapter 3 and Chapter 5 of the thesis. On the other hand, the diverging variables $X_3$ (Agriculture and monsoon), $X_5$ (Govt. Budget and deficits), $X_7$ (Interest rates), $X_9$ (Balance of payment) and $X_{10}$ (Foreign capital flow (FDI + FII)) have no such relationship with the dependent variables in the model. Such analysis has been the subject matter of Chapter 4 and Chapter 6 respectively.
These models have been completely analysed by using their descriptive and inferential statistical properties based on the following measures:

1. Multiple correlation coefficient $R$.
2. Multiple coefficient of determination, $R^2$.
4. 95% confidence interval for the coefficients involved.
5. $P$-value of the relevant hypothesis formulation and testing.

After using simple/multiple regression models, we defined two important Classes as Class I and Class II and their analysis.

**7.6. Partial Correlations and Resembling and Diverging Variables**

Yet another model used in the analysis of resembling and diverging variables is based on the concept of partial correlation.

Initially, let us define the concept of partial correlation which is based on the relationship between a dependent variable and any of the resembling variable when the effect of some or all the diverging variables are put in the category of control variables. After getting such partial correlations between any $Y$ and any of the resembling variables $X_1, X_2, X_4, X_6$ and $X_8$ with varying controlled diverging variables are shown in Tables (5.01-5.07). While analysing the information in Table 5.01, all the partial correlations were observed to be insignificant, (do not differ from zero) which was not a good sign so far the statistical ground was concerned. In this table, it was observed that all the
P-values > \( \alpha = 0.05 \). In this case all the diverging variables were in the control group.

As a next step, \( X_7 \) was also dropped and still all the partial conclusions were insignificant, see Table 5.02. Then we proceed to analyse the partial correlations when the diverging variable \( X_{10} \) is also dropped from the analysis and consequently all the partial correlations become significant (other than zero). The trend continues as more and more diverging variables are dropped from the analysis. See Tables (5.01-5.07). Here the concerned P-values < \( \alpha = 0.05 \), hence significant. For confirming the trends in the very useful property of the partial correlations, we calculated the partial correlations between the dependent variable \( Y_2 \) and any of the independent resembling variable like \( X_1, X_2, X_4, X_6 \) and \( X_8 \) when some or all diverging variables are eliminated from the controlled group. See Tables (5.08-5.10). This all has been amply analysed in Chapter 5. More so, the properties of the partial correlations supports our analysis that only the variables having a significant linear relation be retained in the optimized data. Since, dropping information on the diverging variables also help us in the introduction of the nice property in the partial correlations that they should bear a significant linear relationship between the dependent variables including in the analysis.

On the other hand, when we proceed to analyse the trends in partial correlations between a dependent variable \( Y_1 \) and any of the diverging variables \( X_3, X_5, X_7, X_9 \) and \( X_{10} \) when some information on resembling variables \( X_1, X_2, X_4, X_6 \) and \( X_8 \) is dropped from the control group, one observes that
such partial correlations are insignificant (do not differ from zero) as their
p-values > α = 0.05 (highly insignificant) and their character still remains the
same even if some other dependent variable Y₂ is included in the analysis.
The complete analysis of such partial correlations has been the subject matter
of Chapter 6. See Tables (6.01-6.10).

7.7. Implications of the Research Plan

As per the objective of the research plan, we have to see the impact
of the macroeconomic fundamentals on the secondary market performance in the
two triennium economic blocks. After receiving a large literature, it was decided
to develop a reliable multiple linear regression models for capturing the variations
in some important dependent variables.

Thus, it was observed that a suitable multiple regression model should
be developed which is highly reliable in providing the estimates, projections and
predictions on the dependent variables which are named as Sensex and Nifty
in both the triennium economic blocks [(1994-1997) and (2003-2006)]. For getting
this objective, it has been observed and implemented that:

1. All the independent variables in a linear multiple regression model
do not have the explanatory power. That is these are unable to
explain the variations in the dependent variables.

2. F-test was conducted for the relevant H₀ which forced us to go
for individual t-tests. These tests on the corresponding coefficients
of the independent variables ensured the significance of the null
$H_0$: and this became the basis of classifying the independent variables into two categories.

3. In one category, the variables having explanatory power were kept and rest were belonging to the second category which included variables which do not have the explanatory power. The first category consisted of the set of resembling variables and those belonging to second category were called the diverging variables. Both the classes were homogeneous as the variables in this class are similar in nature.

4. For obvious independent reasons, only the variables in Class I, i.e., the set of resembling independent variables be retained in the formation of a reliable multiple linear regression model.

5. The independent variables in Class II consists of diverging variables only should not be used in such model formation.

6. The optimized model has been statistically tested and has shown to have some nice properties. It has justified its goodness when even compared with the basic model.

7. The statistical analysis of all the three multiple regression models has justified the development of optimized model. The three models can be named as

(a) Full basic multiple linear regression model consisting of all the independent variables.
(b) Optimized multiple linear regression model consisting of resembling independent variables only.

(c) Multiple linear regression model consisting of diverging independent variables only.

These three linear models have been analysed statistically by using the secondary data on all the variables and optimized linear regression model is observed to have some good statistical properties when compared with other multiple regression models.

(d) Lastly, partial correlation models too here been analysed in the case of optimized multiple regression model.

(e) Statistical analysis of these models has been the matter of Chapters 3-6.

7.8. Research Problems for further Investigation

A large number of models have been developed to establish a relationship between the dependent variable and the set of independent variables. In the present plan the importance is given to the models in which independent variables have the explanatory power. Based on such developments, the following problems are proposed to be taken up so that the concerned model too be optimized.

(a) The first such problem, structural or sectional econometric models require that some precise rules be followed with respect to the selection of explanatory variables (or may be called resembling
variables). Obviously, by going through the present study, the proposed problem can be undertaken on the same ground. However, if the explanation of an independent variables contribution to the dependent variable behaviour is not significant statistically, then related independent variables may be used together for improving the model's predictive capabilities. In such cases, all the correlated variables may be grouped together so that the predictive power of the model is increased.

(b) The second such problem concerns to time series econometric models used only for forecasting. These models too are not able to explain the nature of relationship between explanatory independent variable and the dependent variable. This relationship has been defined without any precision.

(c) After optimizing the linear multiple regression model by the introduction of resembling variables, a very reliable relationship was developed between the macroeconomic fundamentals and secondary market performance, one can take up the concept of "economic stabilization" which can also be taken up by the introduction of macroeconomic variables. The economy does not always work smoothly. Often we experience fluctuations in the levels of economic activity. When the economy is in recession then the levels of national income, output and employment are far below their full potential. These is a lot of idle productive capacity and available
machines and factories are not working in their full capacity. As a result, unemployment of labour increases. On the other hand, at times, inflation occurs in the economy. Thus, in a free market economy there is a lot of economic instability. Consequently, the Government has to take some steps (regarding policy making) to cure depression and inflation by using the tools of macroeconomic policy. These tools are concerned fiscal and monetary policy. Thus, the role of fiscal and monetary policies play an important role in economic stabilization. Consequently, the variations in the independent variable defining variations in fiscal and monetary policies too play an important role in defining variations in the only dependent variable inflation (or deflation) for achieving the goal of economic stabilizations.

In view of above discussion, one can go to develop a multiple regression model using inflation (or deflation) as dependent variable and variables defining fiscal and monetary measures. Here also one can go to classify the independent variable in Class I and Class II. The variables in Class I will be called resembling, i.e., having an explanatory power or the variable capable to explain the variations in the dependent variable. The variables in Class II will be called diverging and the same will be dropped from the model and its analysis. This relationship can help the policy makers for achieving the economic stability by observing and analysing the related variables concerned with the fiscal and monetary policy.