CHAPTER III
Research Methodology Chapter

3.1. Introduction

Research methodology is a way to systematically solve the research problem. The purpose of this chapter is to show why this current study has been undertaken, how the problem has been defined, in what way and why the hypotheses have been formulated, what data have been collected and what particular method has been adopted, and why particular technique of analyzing of data has been used.

The large volume of numerical (quantitative) information gives rise to the need for systematic methods which can be used to organize, present, analyze, and interpret the information effectively.

From the 1980s, researchers in developed and developing countries expressed a renewed interest in information about cash flows. One aspect of that interest focused on the assertion of the Financial Accounting Standards Board (FASB 1978), which pointed out that “enterprise earnings based on accrual accounting generally provides a better indication of an enterprise’s present and continuing ability to generate favorable cash flows than information limited to cash flows alone.”. This assertion was questioned, both directly and indirectly, in research that compared the predictive ability of accrual-based information to that of cash flow information in three different settings: (1) Bankruptcy prediction, (2) Predicting security returns, and (3) Predicting operating cash flows.

The cash flow prediction studies ask whether net income (aggregated earnings) alone, operating cash flow alone or a combination of operating cash flow and accrual components of earnings is a better predictor of future operating cash flow.
They have used single as well as multiple models for showing association between the cash flows from operation data of each year and the aggregated earnings (earnings alone), the cash flows from operation (alone), and combination of flows from operation and components of earnings previous years.

Investors as well as creditors are clearly concerned about a firm’s future cash flows. A primary objective of financial reporting is to provide information to help investors, creditors, and others assess the amount, timing and uncertainty of prospective cash flows. The problem is, however, that prospective cash flows are elusive and difficult to pinpoint, because the term literally means all prospective flows of cash. A researcher who wants to find a number that represents prospective cash flows encounters many problems.

Prior studies have led to conflicting results. Some research in a single variable testing model has concluded that the predictive ability of earnings outperforms that of cash flows in forecasting future cash flows. In contrast, some findings showed conflicting results in which cash flows are the better predictor of future cash flows. However a study rejected both conclusions and claimed that neither earnings nor cash flows are a good predictor of future cash flows.

In addition to single variable testing, some researchers have focused on multiple variables, such as the components of earnings including cash flow and accrual accounting data. They concluded that each accrual component reflected different information relating to future cash flows. In contrast of them a study concluded that accruals do not improve upon current cash flow in predicting future cash flows.

Moreover, most research has focused narrowly on operating cash flow, earnings and accrual components of earnings. Those previous studies have ignored the potential of other cash flow variables, particularly cash flow ratios.
Prior studies carried some issues in cases of deriving cash flows from operation in their models, how comparing predictive accuracy of their models, their time span and sample size. Also they did not concern about some questions such as whether predictive ability of the variables are the same across the different industries, and also whether predictive ability of the variables are different in the indexed companies (small-cap, mid-cap,…) in compare with no indexed companies. Moreover no study focused on different predictive accuracy measures to compare their capabilities to test of hypothesis. In addition the prior studies did not concern about cyclical manners of models as tools or clue to show turning points of industries or economic conditions.

With purpose of contributing to this field of study, this current work conducted based on the following questions:

1. Are past earnings significant predictors of future cash flows of Selected Indian Companies listed on Bombay stock exchange?
2. Are past cash flows significant predictors of future cash flows of Selected Indian Companies listed on Bombay stock exchange?
3. Are past cash flows and accrual components of earnings significant predictors of future cash flows of Selected Indian Companies listed on Bombay stock exchange?
4. Are three prediction models, earnings, cash flows and cash flows and accrual components of earnings models different in predictive powers?
5. Are past cash flow ratios significant predictors of future cash flows of Selected Indian Companies listed on Bombay stock exchange?

According to the existing conflict on FASB assertion and above research questions the research hypothesizes have been formulated as bellow:
1. (Past) earnings have significant predictive power in estimating future cash flows of Selected Indian Companies listed on Bombay stock exchange.

2. (Past) cash flows have significant predictive power in estimating future cash flows of Selected Indian Companies listed on Bombay stock exchange.

3. (Past) cash flows and accrual components of earnings have significant predictive power in estimating future cash flows of Selected Indian Companies listed on Bombay stock exchange.

4. Predictions based on three different models do not suggest the same directions of future cash flows.

5. Ratios calculated based on past cash flows are significant predictors of future cash flows.

The major purpose of this research is to test hypotheses. This research intends to test whether aggregated earnings, cash flows from operation, accrual accounting data, and cash flow ratios can be used to predict future cash flows of firms by using secondary data and also evaluate FASB assertion. The models are analyzed to test hypotheses and obtain results.

This chapter will continue with following sections as below:

In section 3.2, competing researches which already designed to deal with the FASB assertion have discussed. Selected research design for this study has explained in section 3.3. Section 3.4 has determined the source of data. Section 3.5 has described time period of the study. Section 3.6 has shown Sample Selection. Section 3.7 has explained method of Statistical Analysis, correlation analysis (to check condition to use the regression technique), procedure to verify of each regression model, analytical techniques, definition of dependent variable in this study. Section 3.8 has shown method for conducting regression technique for testing first three hypotheses. Section 3.9 has described hypothesis and the models for testing them. Sub-section
3.9.1 has shown first hypothesis and related earnings model, independent variable and measurement in earnings model, and hypothesis testing plan for the first hypothesis. Sub-section 3.9.2 has shown second hypothesis and related cash flows model, independent variable and measurement in cash flows model, and hypothesis testing plan for the second hypothesis. Sub-section 3.9.3 has shown third hypothesis and related combined model, independent variable and measurement in combined model hypothesis testing plan for the third hypothesis. Sub-section 3.9.4 has shown forth hypothesis and evaluation of the predictive ability of the models in and out of sample, and hypothesis testing plan for the forth hypothesis. Sub-section 3.9.5 fifth hypothesis and related ratios model, independent variable and measurement in ratios model, and hypothesis testing plan for the fifth hypothesis. Section 3.10 has explained the validity of the study, and finally, the conclusion of the chapter is provided in Section 3.11.

3.2. Competing researches which already designed to deal with the FASB assertion

Apart from bankruptcy investigation, studies on comparative abilities of Accruals Earnings measures & Cash Flows measures in line of prediction of Future cash flows can be categorized in different ways, for instance, they can divided based on how they have constructed their predictive models, in the case of using dependent variable in the model they can categorize in two main approaches:

1. The research which examined the comparative abilities of accruals earnings & cash flows in predicting Securities Prices as a proxy of future cash flows.

2. The studies that compared the accruals earnings measures & cash flows measures as Predictors of future cash flows from operations (as well as finding the association between Accruals, future cash flows & future earnings).
As the focus of current study was on the second category, it also can be divided in three main groups in the case of using the independent variables in their models: (1) Aggregated (earnings) based models; (2) Cash based models, and (3) Combined based models.

In these models independent variables in each model can be from past year (t-1), two years ago (t-2), and three years ago (t-3) which named as one-year lag, two-year lags, three-year lags respectively.

These models also can be use in whole (pool) year analysis as well as yearly analysis of designed hypothesis.

The following figure (figure 2.1) demonstrated the categories in studies related to cash flows prediction which shows studies on cash flows prediction used different statistical methods, cross sectional and time series method. In using on cross sectional method the studies applied pooled cross sectional sample as well as sample which derived from cross sectional sample by industry.

The studies also have taken different type of data, annuals data as well as quarterly data in different forms of numbers, absolute, algorithmic, and deflated numbers.

In case of comparing predictive ability of competing models, the researchers have used in- sample testing alone or together with out- of - sample testing in their studies.

Previous studies also differ from selecting the time span and sample size. The following figure will show the different aspects of studies on cash flows prediction.
Studies on comparative abilities of Accruals Earnings measures & Cash Flows measures in line of prediction of Future cash flows based on how they have constructed their predictive models, in the case of using dependent variable in the model they can categorize in two main approaches:

### Based on Dependent Variable in the Model
- The research which examined the comparative abilities of accruals earnings & cash flows in predicting Securities Prices as a proxy of future cash flows.
- The studies that compared the accruals earnings measures & cash flows measures as Predictors of future cash flows from operations.

### Based on Independent Variables in the Model
- **Accruals based Models** (Aggregated Earnings)
- **Mixed based Models** (Disaggregated Earnings)
- **Cash based Models**

#### Based on Break down of Independent Variables or Apply different methods for calculating Independent Variables in the Model
- **Core Vs. noncore**
- **Estimated Vs. Statement**
- **Direct Vs. Indirect**
- **Cash ratios**

#### Based on Break down of Independent Variables or Apply different methods for calculating Independent Variables in the Model
- **Short Vs. Long term**
- **Normal Vs. Abnormal**

#### Based on Using different Statistical Methods
- **Cross Sectional**
- **Pooled Cross Sectional**
- **Cross Sectional By Industry**
- **Firm Specific (Time series)**

#### Based on Using Different Type of Accounting Data
- **Annuals Data**
- **Quarterly Data**

- **Absolute numbers**
- **Algorithmic numbers**

- **Deflated numbers by average assets or equity**
- **Deflated numbers by inflation indexes**

### Comparing Predictive accuracy
- **In sample (using R^2) testing**
- **Out of sample (MAPE) test**

#### Time span
- **Short horizon**
- **Long horizon**

#### Sample size
- **Fewer Firms**
- **More Firms**

#### Control for:
- Size of firms, Life cycle stages, Geographical location, Ownership, & Economic cycle
3.3. Selected research design for this study

Based on viewing the previous studies; this study chose the design which aim to contribute in more than two decades working that concentrated on the topic which compare the abilities of accruals earnings measures and cash flows measures in line of prediction of Future cash flows by using cash flows from operations (derived from cash flows statement prepared based on indirect method). In temping to resolve some lack in some previous studies the current study on cash flows prediction has following general characters:

3.4. Source of Data

This current study designed to use the annual accounting data of selected Indian companies listed on Bombay Stock Exchanges which needed in the current study from Center for Monitoring Indian Economy (CMIE) data base (14, May, 2009), called “Prowess” which available in Research center of Sinhgad Institute of management of Pune University in India.

3.5. Time Period of the Study

This study designed to use past year (t-1), two years ago (t-2), and three years ago (t-3) annual data of independent variable in each model which is named as one-year lag, two-year lags, three-year lags respectively.

The study selected the time period from 1998 to 2008 as main time span to collect the data and to complete the year lag data, the annual data 1995 to 1997 also add to main data. Thus the testing period will be as bellow:
<table>
<thead>
<tr>
<th>Year of prediction</th>
<th>One-year lag (t-1)</th>
<th>Two-year lags (t-1+t-2)</th>
<th>Three-year lags (t-1+t-2+t-3)</th>
</tr>
</thead>
</table>

3.6. Sample Selection

The study designed to select sample from non financial firms available on CMIE data base according to following criteria, that means the non financial firms which satisfy the criteria will be in the sample.

- Availability of cash flow from operation data (as dependent variable) for the firm in entire main time span (1998 to 2008) for non indexed firm ( indexed firms usually satisfy this condition but for rare case it will ignore this point for them).

- The firms which their standard value (Z standard) cash flows from operations data (within the time span) are more than $\pm 2$ will exclude from the sample. Outliers will identify
The sample includes 1894 companies listed on the Bombay Stock Exchange between 1998 and 2008 which selected as bellow:

Table 3.2: sample selection procedure

<table>
<thead>
<tr>
<th>Details</th>
<th>Number of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firms listed on BSE on CMIE database</td>
<td>5057</td>
</tr>
<tr>
<td>Exclude the financial firms</td>
<td>(839)</td>
</tr>
<tr>
<td>Exclude the firms which have no cash flow data in entire time span</td>
<td>(2270)</td>
</tr>
<tr>
<td>Exclude the firms which standard value of their cash flows was more</td>
<td>(54)</td>
</tr>
<tr>
<td>than + 2</td>
<td></td>
</tr>
<tr>
<td>The firms which satisfy the criteria</td>
<td>1894</td>
</tr>
</tbody>
</table>

Table 3.3: Detail of selected sample

<table>
<thead>
<tr>
<th>Industry</th>
<th>Small cap</th>
<th>Mid cap</th>
<th>Other index</th>
<th>Non Indexed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food &amp; beverages</td>
<td>33</td>
<td>14</td>
<td>3</td>
<td>110</td>
<td>160</td>
</tr>
<tr>
<td>Textiles</td>
<td>25</td>
<td>1</td>
<td></td>
<td>175</td>
<td>201</td>
</tr>
<tr>
<td>Chemicals</td>
<td>82</td>
<td>41</td>
<td>12</td>
<td>264</td>
<td>399</td>
</tr>
<tr>
<td>Nonmetallic Mineral</td>
<td>25</td>
<td>8</td>
<td>1</td>
<td>66</td>
<td>100</td>
</tr>
<tr>
<td>Metal &amp; Metal products</td>
<td>36</td>
<td>10</td>
<td>7</td>
<td>100</td>
<td>153</td>
</tr>
<tr>
<td>Machinery</td>
<td>56</td>
<td>16</td>
<td>8</td>
<td>151</td>
<td>231</td>
</tr>
<tr>
<td>Transport equipment</td>
<td>20</td>
<td>3</td>
<td>2</td>
<td>63</td>
<td>88</td>
</tr>
<tr>
<td>Miscellaneous Manufacturing</td>
<td>10</td>
<td>4</td>
<td>-</td>
<td>63</td>
<td>77</td>
</tr>
<tr>
<td>Diversified</td>
<td>10</td>
<td>2</td>
<td>1</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>Mining</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Electricity</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Services other than finance</td>
<td>91</td>
<td>39</td>
<td>15</td>
<td>189</td>
<td>334</td>
</tr>
<tr>
<td>Construction</td>
<td>33</td>
<td>22</td>
<td>5</td>
<td>41</td>
<td>101</td>
</tr>
<tr>
<td>Total</td>
<td>427</td>
<td>167</td>
<td>59</td>
<td>1241</td>
<td>1894</td>
</tr>
</tbody>
</table>
3.7. Method of Statistical Analysis

The main job of this study was to check the fit of models to predict accurate future cash flows. The $R^2$ measures the amount to which the models explain or account for the amount of variability in the dependent variable. To find the more accurate model in Indian context, based on in-sample comparing test, the $R^2$ is suggested by previous studies. To derive the $R^2$ of the competing models, running the regression technique is required. This study has employed the ordinary least squares approaches to estimate their regression models. To evaluate the forecasting performance of the models, both within-sample (the $R^2$) and out-of-sample forecasting tests [The mean absolute percentage errors of prediction (MAPE), Theil’s U-statistics which used by Kim and Kross (2005), and Young's test (Z-statistic) to select the more accurate model based on the explanation of Dechow (1994) about non nested model selection] are employed.

In a statistical investigation the important concern is to use the right technique for right data and to answer to right question. To apply right technique, need to check the condition for that technique. Thus, descriptive statistics (to check rightness of data) and correlation analysis (to check condition to use the regression technique) are conducted for this mater.

3.7.1. Correlation analysis (to check condition to use the regression technique)

If there is no correlation among each dependent and independent variable, the regression should not be conducted. However, the high correlation among independent variables indicates the presence of multicollinearity. A measure of the correlation is represented by correlation coefficients. The coefficient provides both the direction and strength of the relationship between a pair of variables. In this
research, the strength of association between all pairs of variables was statistically measured by Pearson’s correlation coefficient.

3.7.2. Procedure to verify of each regression model

As regression technique has selected for this study, the procedure to verify of each regression model is as bellow:

1. Are the coefficients significant as a group? (i.e. is the whole model significant?) => F-test

2. Test for individual regression coefficients
   => t-test (should be performed only if the F-test is significant)

3. How much variation does the regression equation explain?
   => Coefficient of determination (R2)

4. The null hypothesis (H0) to verify is that there is no effect on CFO

   The alternative hypothesis (HA) is that this is not the case

   \[ H_0: \alpha = \beta = 0 \]

   \[ HA: \text{at least one of the coefficients is not zero} \]

Empirical F-value and the appropriate p-value are computed by SPSS. Thus (Sig. < 0.05), we can reject H0 in favor of HA. This means that the model that has been estimated is not only a theoretical construct, but exists and is statistically significant.

3.7.3. Analytical techniques

This study has employed the ordinary least squares approaches to estimate their regression models. To evaluate the forecasting performance of the regression models, both within-sample and out-of-sample forecasting tests are employed.
This research utilized quantitative methods in which the data is analyzed based on statistical techniques, which include descriptive statistics, Pearson’s correlation and regression analysis.

The descriptive statistics provide an initial summary data of the essential features of the sample. The correlation analysis is used to fundamentally examine the relationship between dependent and independent variables. Regression analysis, simple linear, multiple, and stepwise regressions, are applied to test the prediction models depending upon the ability of predictor variables to explain future cash flows. All analytical techniques use the computer software package Statistical Processing for Social Scientists (SPSS) Version 11.5.

3.7.4. Definition of dependent variable in this study

Prior studies could be divided in two groups based on how the studies derived the cash flow from operation variable in their works. First group contains those studies which did not use the cash flows statement for derived the cash flow from operation in their works, such as the studies of Bowen, Burstahler and Daley (1986 in USA); Greenberg, Johnson & Ramesh (1986 in USA); Espahaodi (1988 in USA); Murdoch and Krause (1989 in USA); Arnold and et al (1991 in UK); Percy and Stokes (1992 in Australia); Finger (1994 in USA).

The rest of the studies such as McBeth (1993 in US);; Seng (1997 in New Zealand); Kim and Kross (2005 in USA); Zhao and et al (2006 in Australia); Farshadfar and et al (2008 in Australia), and Lorek and Willinger (2009 in USA) have used the cash flows statement for derived the cash flow from operation in their works.

In the analysis, Future cash flows are investigated as the dependent or criterion variable caused by independent variables.
Future cash flows of firms are defined as net cash flows from operations (CFO) reported in cash flow statements for the year $t$, represented by the symbol of CFO $t$. under the indirect method form and reported by adjusting earnings for non-cash items and for changes in current assets and current liabilities.

### 3.8. Method for conducting regression technique for testing first three hypotheses.

Simple and multiple regression models were performed between cash flow from operations year $t$, CFO $t$ as the dependent variable and year lags of the independent variables in each model.

For three models the analysis conducted as bellow

<table>
<thead>
<tr>
<th>Analysis for hypothesis</th>
<th>Index wise analysis</th>
<th>Industrial wise analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis based on whole (pool) sample</td>
<td>Poole analysis</td>
<td>Yearly analysis</td>
</tr>
<tr>
<td></td>
<td>Yearly analysis</td>
<td>Poole analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yearly analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yearly analysis</td>
</tr>
</tbody>
</table>

Figure 3.1: Summary of conducted analysis for first three hypotheses

In pooled-year analysis, all data for dependent and independent variables of the ten years prediction period of 1998 to 2007 was pooled and analyzed together.

For the yearly analysis, the regression model was processed to analyze each set of prediction years separately. The analysis was performed for eleven prediction years spanning 1998 to 2008. In each prediction year, three sets of data were analyzed including a set of the one-, two- and three year lags of earnings.
This study designed to test the research hypothesis based on character of the firms share (stock) in Bombay Stock Exchanges (BSE) which demonstrated by CMIE database as bellow:

- BSE small-cap (non financial cases)
- BSE mid-cap (non financial cases)
- Other share in BSE 500 which are not small-cap or mid-cap (non financial cases)
- Non indexed firms (which are not included in the above indexes)

This study also designed to test the research hypothesis (earnings model, cash flows model, combined model, and ratios model) in a whole (pool) sample which contained varieties of firm from spectrum of industries listed on Bombay Stock Exchanges (BSE) as well as a cross sectional sample which divide base on different sectors of industries that allows to compare the abilities of independent variables in different industry which will give us a detail picture about cash flows prediction possibility and importance of accounting figures in each industry.

This study designed to test the research hypothesis in whole (pool) sample and cross sectional sample by industry in two different bases: pooled-year based, yearly based as well.
3.9. Hypothesis and the models for testing them

3.9.1. First hypothesis and related earnings model

Past earnings have significant predictive power in estimating future cash flows of Selected Indian Companies listed on Bombay stock exchange.

Table 3.4: Models for first hypothesis

<table>
<thead>
<tr>
<th>HYPO</th>
<th>Models</th>
<th>Regression equation</th>
<th>Type of regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Earnings models</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-year lag</td>
<td>CFO_{n,t} = \alpha_0 + \beta_1 \text{EARN}_{n,t-1} + \epsilon</td>
<td>Simple</td>
<td></td>
</tr>
<tr>
<td>Two-year lags</td>
<td>CFO_{n,t} = \alpha_0 + \beta_1 \text{EARN}<em>{n,t-1} + \beta_2 \text{EARN}</em>{n,t-2} + \epsilon</td>
<td>Multiple</td>
<td></td>
</tr>
<tr>
<td>Three-year lags</td>
<td>CFO_{n,t} = \alpha_0 + \beta_1 \text{EARN}<em>{n,t-1} + \beta_2 \text{EARN}</em>{n,t-2} + \beta_3 \text{EARN}_{n,t-3} + \epsilon</td>
<td>Multiple</td>
<td></td>
</tr>
</tbody>
</table>

Independent variable and measurement in earnings model

Net income before extraordinary items and discontinued operations derived from income statements for the previous years is used as the measure of past earnings.

Earnings of firms are defined as net income before extraordinary items and discontinued operations reported on income statements for year t-i symbolized by EARN_{t-i}. 
Hypothesis testing plan– First hypothesis

First hypothesis is concerned with the first research question. The statistical results of the earnings model (Model 1) were used to test the hypothesis. The null hypothesis states that there is no relationship between year-lags of earnings and future cash flows, while the alternate hypothesis expresses a significantly positive relationship between year-lags of earnings and future cash flows. The results of statistical tests would indicate whether or not support has been found for the alternate hypothesis. The significant level was established at the 0.05 level, that is, the null hypothesis would be rejected and the alternate hypothesis would be accepted if the F-statistic shows the significant level equal or less than 0.05 (p ≤ 0.05). If the alternate hypothesis is accepted, First research hypothesis is substantiated.

3.9.2. Second hypothesis and related cash flows model

Past cash flows have significant predictive power in estimating future cash flows of Selected Indian Companies listed on Bombay stock exchange.

<table>
<thead>
<tr>
<th>HYPO</th>
<th>Models</th>
<th>Regression equation</th>
<th>Type of regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cash flows models</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>One-year lag</td>
<td>$\text{CFO}<em>{n,t} = \alpha_0 + \beta_1 \text{CFO}</em>{n,t-1} + \epsilon$</td>
<td>Simple</td>
</tr>
<tr>
<td></td>
<td>Two-year lags</td>
<td>$\text{CFO}<em>{n,t} = \alpha_0 + \beta_1 \text{CFO}</em>{n,t-1} + \beta_2 \text{CFO}_{n,t-2} + \epsilon$</td>
<td>Multiple</td>
</tr>
<tr>
<td></td>
<td>Three-year lags</td>
<td>$\text{CFO}<em>{n,t} = \alpha_0 + \beta_1 \text{CFO}</em>{n,t-1} + \beta_2 \text{CFO}<em>{n,t-2} + \beta_3 \text{CFO}</em>{n,t-3} + \epsilon$</td>
<td>Multiple</td>
</tr>
</tbody>
</table>
Independent variable and measurement in cash flows model

The definition of past cash flow variable is net cash flow reported on statements of cash flows for the previous years.

Cash flow is defined as net cash flows from operations reported on the cash flow statements for year t-i, denoted by CFOt-i.

Hypothesis testing plan – Second hypothesis

Second hypothesis is concerned with the second research question. The null hypothesis states that there is no relationship between year-lags of cash flows and future cash flows while; the alternate hypothesis expresses a significantly positive relationship between year-lags of cash flows and future cash flows. Similarly to the earnings model, the significant level was established at the 0.05 level. The null hypothesis would be rejected and the alternate hypothesis would be accepted if the F test of the cash flows model (Model 2) show that the variance in future cash flows has been significantly explained by the year-lags of cash flows at the significant level equal or less than 0.05 (p ≤ 0.05). If the alternate hypothesis is accepted, second research hypothesis is substantiated.
3.9.3. Third hypothesis and related combined model

Past cash flows and accrual components of earnings have significant predictive power in estimating future cash flows of Selected Indian Companies listed on Bombay stock exchange.

Table 3.6: Models for third hypothesis

<table>
<thead>
<tr>
<th>HYPO</th>
<th>Models</th>
<th>Regression equation</th>
<th>Type of regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mixed models</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-year lag</td>
<td>$CFO_{n,t} = \alpha_0 + \beta_1 CFO_{n,t-1} + \beta_2 ACC_{n,t-1} + \varepsilon$</td>
<td>Simple</td>
<td></td>
</tr>
<tr>
<td>Two-year lags</td>
<td>$CFO_{n,t} = \alpha_0 + \beta_1 CFO_{n,t-1} + \beta_2 ACC_{n,t-1} + \beta_3 CFC_{n,t-2} + \beta_4 ACC_{n,t-2} + \varepsilon$</td>
<td>Multiple</td>
<td></td>
</tr>
<tr>
<td>Three-year lags</td>
<td>$CFO_{n,t} = \alpha_0 + \beta_1 CFO_{n,t-1} + \beta_2 ACC_{n,t-1} + \beta_3 CFC_{n,t-2} + \beta_4 ACC_{n,t-2} + \beta_5 CFC_{n,t-3} + \beta_6 ACC_{n,t-3} + \varepsilon$</td>
<td>Multiple</td>
<td></td>
</tr>
</tbody>
</table>

Independent variable and measurement in combined model

The accrual components of earnings are obtained from cash flow statements for the previous years. Earnings can be disaggregated into cash flow and the component of accruals. Accrual component include: change in accounts receivable; change in accounts payable; change in inventory; change in other short-term assets and liabilities and depreciation and amortization.
CFO = EARN-ACC

ACC = EARN-CFO

or

ACC = Δ AR + Δ INV + Δ AP + DEP + Δ OTH

Whereas,

Δ AR = Change in accounts receivable during the period

Δ INV = Change in inventories during the period

Δ AP = Change in accounts payable during the period

DEP = Depreciation and amortization during the period

Δ OTH = Change in other current assets and liabilities during the period

This research investigated the predictive ability of the aggregated accrual components of earnings for the year lags (t-i), was denoted as ACC,t-i.

**Hypothesis testing plan – Third hypothesis**

Third hypothesis is concerned with the third research question. The null hypothesis states that there is no relationship between cash flows and accrual components of earnings and future cash flows, while the alternate hypothesis expresses a significant relationship between year-lags of cash flows and accrual components of earnings and future cash flows. The null hypothesis would be rejected and the alternate hypothesis would be accepted if the F-statistic of cash flows and accrual components of earnings model (Model 3) shows the significant level equal or less than 0.05 (p ≤ 0.05). Third research hypothesis is substantiated when the alternate hypothesis is accepted.
3.9.4. Forth hypothesis and evaluation of the predictive ability of the models in and out of sample.

Predictions based on three different models do not suggest the same directions of future cash flows.

This study designed to test the forth hypothesis, comparing predictive ability of competing models (first, second, and third hypothesis) by using In-sample and Out-of-sample tests which it requires to do following procedures in each test.

1. **In-Sample test for comparing predictive ability of competing models**

The adjusted $R^2$ value has been employed by previous prediction research to evaluate the explanatory power between models, such as Barth, Cram and Nelson (2001), Quirin et al (1999), Greenberg, Johnson and Ramesh (1986), and McBeth (1993). The model producing a high adjusted $R^2$ value is a good explanatory model and it can be an important predictive model.

2. **Out-Of-Sample test for comparing predictive ability of competing models**

In addition to adjusted $R^2$, current study employed the analysis of residuals involving the mean absolute percentage error to evaluate the predictive abilities of the prediction models.

The mean absolute errors generate from the out-of sample period. That is, the sample split into two parts. The first sample, the estimated sample, to create regression equations of each prediction model and the second sample, the-out-of sample, to test the estimated equation of the three models; earnings, cash flows and cash flows and accrual components of earnings models (first, second, and third hypothesis).

After calculating the predicted values of cash flows from the out-of sample, the $r^2$, mean absolute percentage errors of prediction (MAPE) and Theil’s U-statistics used by Kim and Kross (2005) calculate for the out-of-sample period. A
model producing relatively low MAPE would be considered to be a better predictor than model yielding higher MAPE. The MAPE is calculated as below:

\[
\text{MAPE} = \text{mean} \mid \frac{\text{actual} - \text{predicted}}{\text{actual}} \mid
\]

The U statistic can range from zero to one, with zero implying a perfect forecast. Thus, models generating better predictions should have lower U statistics. Theil’s U is defined as the square root of

\[
\Sigma (\text{actual} - \text{predicted})^2 / \Sigma (\text{actual})^2.
\]

To calculate the statistic for doing out-of-sample test the original sample (1998 to 2008) will split into two parts:

1. **1998 to 2005**: to create regression equations of each prediction model

2. **2006 to 2008**: to test the estimated equation of the three models; earnings, cash flows and cash flows and accrual components of earnings models (first, second, and third hypothesis).

Based on explanation of Dechow (1994) about non nested model selection, in out-of-sample testing, this study also applied Voung’s test (Z-statistic) to select the more accurate model. The formulas are as bellow

\[
Z = \frac{1}{\sqrt{n}} \frac{LR}{\sigma^2},
\]

\[
LR = \log \left( \frac{L(R_E)}{L(R_{CFO})} \right) = \log [L(R_E)] - \log [L(R_{CFO})]
\]

\[
= \frac{n}{2} \left( \log (\hat{\sigma}_E^2) - \log (\hat{\sigma}_E^2) \right) + \sum_{i=1}^{n} \left( \frac{1}{2} \frac{(e_i)^2}{\sigma_i^2} - \frac{1}{2} \frac{(e_i)^2}{\hat{\sigma}_i^2} \right).
\]
**Hypothesis testing plan – Forth hypothesis**

Forth hypothesis intends to answer forth research question. Adjusted $R^2$ values, correlations between actual and predicted cash flows, and mean absolute percentage errors of each model were used to evaluate the predictive ability of each model. The comparisons of these values were used to test the hypotheses.

**3.9.5. Fifth hypothesis and related ratios model**

*Ratio based analysis of past cash flows is significant predictor of future cash flows of Selected Indian Companies listed on Bombay stock exchange.*

<table>
<thead>
<tr>
<th>HYPO</th>
<th>Models</th>
<th>Regression equation</th>
<th>Type of regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># 5 One-year lag</td>
<td>$\text{CFO}<em>{n,t} = \alpha + \beta_1 \sum</em>{i=1}^{10} \text{CFR}_{t-1} + \varepsilon$</td>
<td>stepwise procedure</td>
</tr>
</tbody>
</table>

Since there were many cash flow ratios considered to be predictors in the model, variable selection technique was used to choose which cash flow ratios are important. Stepwise regression was selected to examine each cash flow ratio. Each predictor variable is considered for addition prior to developing the regression equation. In the procedure, each possible predictor variable in simple regression was examined. Then the explanatory variable providing the largest partial F statistic was chosen to add to the model. Finally, the stepwise procedure generated suitable equations for the model.
Independent variable and measurement in ratios model

1) Cash flow sufficiency ratios

Cash flow sufficiency ratios are aimed at assessing a company’s relative ability to generate sufficient cash to meet its cash flow needs. All ratios indicate whether a company’s cash flows are sufficient for the payment of debt, acquisitions of assets and payment of dividends. These ratios are cash flow adequacy, debt coverage, and repayment of borrowing and dividend payment ratios.

- **Cash flow adequacy ratio**

The cash flow adequacy ratio is an attempt to assess the entity’s ability to produce sufficient operating cash flows to cover its main cash requirement, specifically, the payment of debt, the acquisition of assets, and the payment of dividends.

\[
\text{Cash flow adequacy} = \frac{\text{Cash flow from operations}}{\text{Repayment of borrowings + Assets acquired + Dividends paid}}
\]

- **Debt coverage ratio**

The debt coverage ratio shows the ability of a company to generate cash flow from operating activities to pay its long-term debt commitment.

\[
\text{Debt coverage ratio} = \frac{\text{Total debt}}{\text{Cash flow from operations}}
\]

- **Repayment of borrowings ratio**

This ratio indicates the ability of a firm to generate cash from operating activities for the purpose of covering long-term debt commitments in the current year.

\[
\text{Repayment of borrowings ratio} = \frac{\text{Repayment of borrowings}}{\text{Cash flow from operations}}
\]

- **Dividend payment ratio**

The dividend payment ratio presents the ability of a company to generate cash from operating activities for the purpose of covering dividend commitments to both
ordinary and preference shareholders. If the ratio is greater, it means that the company paid a smaller portion of its cash from operating activities in dividend payments.

\[
\text{Dividend payment ratio} = \frac{\text{Dividends paid}}{\text{Cash flow from operations}}
\]

- **Reinvestment ratio**

The reinvestment ratio presents the ability of a company to generate cash from operating activities for the purpose of covering asset acquisition payments.

\[
\text{Reinvestment ratio} = \frac{\text{Payment for property, plant and equipment}}{\text{Cash flow from operations}}
\]

2) **Cash flow returns ratios**

This group is sometimes called efficiency ratios. It shows the ability of a company to generate operating cash flows. Cash flow efficiency ratios are used to assess the relationship between items in the income statement and balance sheet with cash flow from operations as disclosed in the cash flow statement. These ratios are as follows.

- **Cash flow on revenues ratio**

This ratio is aimed at showing the ability of the company to turn revenue into cash. The higher ratio is the better the ability. This ratio employs information provided by the statement of cash flow and the income statement. It is computed by dividing cash from operating activities by revenues.

\[
\text{Cash flow to revenues} = \frac{\text{Cash flow from operations}}{\text{Revenues}}
\]

- **Cash flow to net income ratio**

This ratio is sometimes called the operating index. It compares the company’s profit with cash flow from operations and attempts to provide an index of the cash-generating productivity of operations. It is calculated as cash flows from operations divided by profit after income tax.
Operations index  =  \frac{\text{Cash flow from operations}}{\text{Profit}}

• **Cash flow return on assets ratio**

This ratio attempts to measure the company’s return on assets in terms of the cash flow generated from operations.

\[
\text{Cash flow return on assets ratio} = \frac{\text{Cash flow from operations} + \text{Income tax paid} + \text{Interest paid}}{\text{Average total assets}}
\]

• **Cash flow return on stockholders’ equity ratio**

This ratio shows the ability of the company to generate a sufficient cash return for stockholders.

\[
\text{Cash flow return on stockholders’ equity ratio} = \frac{\text{Cash flow from operations}}{\text{Average Stockholders’ Equity}}
\]

• **Cash flow per share ratio**

This ratio indicates the operating cash flow attributable to each common share. It is defined as cash available to common stockholders divided by the weighted average number of common shares outstanding.

\[
\text{Cash flow per share ratio} = \frac{\text{Cash flow from operations} - \text{Preferred Dividends}}{\text{Average number of shares of Common Stock outstanding}}
\]
Hypothesis testing plan – Fifth hypothesis

This hypothesis involves testing the predictive power of cash flows ratios in predicting future cash flows. The null hypothesis states that the cash flow ratios do not provide a good predictor for predicting future cash flows of Indian listed companies. In other words, the alternate hypothesis states that cash flow ratios provide a good predictor for predicting future cash flows of Indian listed companies. The results of the stepwise analysis were used to test the hypothesis.

3.10. The validity of the study

External validity refers to the extent to which the result of a study may be generalized to other samples. Accounting data used in this study are historical which may have caused a low level of external validity. That is, the result of a particular study at a point in time may not be generalized to other periods of time. In the analysis, this study attempted to eliminate this disadvantage by using data for many years which cover a period from 1998 to 2008. Data of each year were analyzed separately to observe whether the economic condition caused a different result.

3.11. Conclusion on Research Methodology Chapter

This chapter provided the methodology used in this study including FASB assertion and its influence to develop competing hypothesis, competing research design to approve the FASB assertion, properties of the research design which chose the (operating) cash flows data as a dependent variable in their study, source of data, time period of the study, sample selection, method of statistical analysis, testing predictive accuracy, analytical techniques, definition of dependent variable in this study, hypothesis and the models for testing them. This research deals with testing hypotheses and chiefly focuses on quantitative methods. The basic method used to
collect data was the use of secondary data, which suited the data needs in this research. That is, accounting data reported on financial statements of firms were selected to measure variables.

Additionally, the measurement of variables was defined to test the four prediction models of this research. The four prediction models consisted of earnings, cash flows, cash flows and accrual components of earnings and cash flow ratios models. These models were tested by regression analysis. The study was designed to use an adjusted $R^2$ reflecting the explanatory power of the model in comparing regression models. Furthermore, the study planned to evaluate the predictive power of the models by using a mean of absolute percentage errors and Theil’s U-statistics used by Kim and Kross (2005) generated from the sample data. Moreover, based on explanation of Dechow (1994) about non nested model selection, in out-o-sample testing, this study also applied Young’s test (Z-statistic) to select the more accurate model. Finally, the validity issue of the research was discussed in support of the research design, which reduces the possible low level of external validity of the research. In the next chapter, the data analysis and results of the analysis are provided.