CHAPTER : 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

The core concept underlying research is its methodology. The methodology controls the study, dictates the acquisition of the data, and arranges them in logical relationships, sets up a means of refining the raw data, contrives an approach so that the meanings that lie below the surface of those data become manifest, and finally issue a conclusion or series of conclusions that lead to an expansion of knowledge. The entire process is a unified effort as well as an appreciation of its component parts.

According to J.W.B. est, “Research is considered to be formal, systematic, intensive process of carrying on the scientific method of analysis. It involves a more systematic structure of investigation usually resulting in some sort of formal record of procedures and report of result or conclusions.”

According to P.M.Cook, “Research is an honest, exhaustive, intelligent searching for facts and their meanings or implications with reference to a given problem. It is the process of arriving at dependable solutions to problem through planned and systematic collection, analysis and interpretation of data. The best research is that which is reliable, verifiable and exhaustive so that it provides information in which we have confidence.”

3.2 RESEARCH STATEMENT

The research statement studied is entitled, “A comparative study of Life Insurance Corporation of India and Private Life Insurance Companies in India”. The present study focuses on the analysis of the performance of public
and all private life insurance companies in India with the help of mean, percentage, ratios, ANOVA, Data Envelopment Analysis and linear trend.

3.3 RESEARCH DESIGN

A Research design is a plan of action to be carried out in connection with a research project. It is the conceptual structure within which research is conducted and it constitutes the blueprint for the collection, measurement and analysis of data. It is the specification of methods and procedures for acquiring the information needed for solving the problem. Decisions regarding what, where, when, how much, by what means concerning an inquiry or a research study constitute a research design.

3.3.1 OBJECTIVES OF THE STUDY

The objectives of the study are as follows:

➢ To understand the concept and mechanism of insurance.

➢ To compare and analyze the financial performance of private sector life insurance companies and Life Insurance Corporation of India.

➢ To predict the volume of new business and total premium of life insurance companies in India.

➢ To compare the cost efficiency of life insurance companies in India.

3.3.2 NATURE OF DATA AND SOURCES OF DATA

Collection of the data is essential part of research. The nature of data which is collected and used for this research is secondary in nature. The relevant and required data has been collected from journals, dailies, annual reports, magazines, literature and websites of selected companies and through various search engines.
3.3.3 SAMPLE SELECTION

All private and public sector life insurance companies in India from 2000-01 to 2009-10 were selected for the study.

The companies selected for the research work are as follows:

(a) **Public Sector:**

Life Insurance Corporation of India.

(b) **Private Sector:**

1. HDFC Standard Life Insurance Co. Ltd.


3. ICICI Prudential Life Insurance Co. Ltd.


5. Birla Sun Life Insurance Co. Ltd.

6. TATA AIG Life Insurance Co. Ltd.

7. SBI Life Insurance Co. Ltd.

8. ING Vysya Life Insurance Co. Ltd.


10. Met Life India Life Insurance Co. Ltd.

11. Reliance Life Insurance Co. Ltd.

12. Aviva Life Insurance Co. Ltd.

13. Sahara India Life Insurance Co. Ltd.

15. Bharti AXA Life Insurance Co. Ltd.

16. Future Generali India Life Insurance Co. Ltd.

17. IDBI Fortis Life Insurance Co. Ltd


19. Argon Religare Life Insurance Co.Ltd.

20. DLF Pramerica Life Insurance Co.Ltd.


22. India First Life Insurance Co.Ltd.

3.3.4 HYPOTHESIS

In order to achieve the objectives of the study, the following hypothesis are framed:

1. Ho: There is no significant difference in the total commission to total premium ratio of the public and private sector life insurance companies.

2. Ho: There is no significant difference in the total commission to total operating expense ratio of the public and private sector life insurance companies.

3. Ho: There is no significant difference in the Actuarial Efficiency ratio of the public and private sector life insurance companies.

4. Ho: There is no significant difference in the current ratio of the public and private sector life insurance companies.

5. Ho: There is no significant difference in the Proprietary ratio of the public and private sector life insurance companies.
6. **Ho**: There is no significant difference in the total investment to total liability ratio of the public and private sector life insurance companies.

7. **Ho**: The cost efficiency score of Life Insurance Companies in India is equal.

**3.3.5 TOOLS AND METHODS OF DATA ANALYSIS**

The present study involves calculation of different ratios to evaluate the financial performance of life insurance companies in India from 2000-01 to 2009-10. It also compares the cost efficiency of all life insurance companies in India during the same period. Prediction of new business and total premium of the life insurance companies has also been done. Various statistical measures like percentage, mean, ANOVA, Data Envelopment Analysis and Linear trend are used in this study.

**3.3.5.1 Data Envelopment Analysis (DEA)**

**3.3.5.1.1 Introduction**

Data Envelopment Analysis (DEA) is a non-parametric linear programming tool generally used for performance evaluation of economic units through the construction of an economic frontier. It was originally developed for performance measurement. The advantage of DEA is that it requires very few prior assumptions on input-output relationship. The DEA method enables extension of the single input-single output technical efficiency measure to the multiple output-multiple input case. In its constant returns to scale form, the DEA methodology was developed by Charnes, Cooper and Rhodes (1978). Banker, Charnes and Cooper (1984) extended the approach to the case of variable returns to scale. The DEA approach constructs the production frontier from piecewise linear stretches resulting in a convex production possibility set.

The principal advantage of the DEA approach stems from the fact that the assumption of a specific functional form of the underlying technology is not necessary. This makes DEA particularly useful when dealing with service
industries, since we have very limited knowledge about the underlying production technology in such cases. Instead of using any functional form, DEA uses linear programming approaches to envelope the observed data as tightly as possible. It only requires that the production possibility set is convex and the inputs and outputs are disposable.

3.3.5.1.2 Concept of Cost Efficiency

Cost efficiency of a productive enterprise is an important indicator of its performance. The cost efficiency of a firm is defined by the ratio of minimum costs to actual costs for a given output. Vector is computed by measuring the distance of its observed (cost) point from an idealized cost frontier.

3.3.5.1.3 Estimation of Cost Efficiency: The Standard Approach

Suppose we have data on r inputs and s outputs for each of the n firms. The i-th firm \((i=1,2,...,n)\) uses a \(r \times 1\) input vector \(x_i= (x_1,x_2,...,x_r)\) to produce a \(s \times 1\) output vector \(y = (y_1,y_2,...,y_s)\) where \(X\) is a \(r \times n\) input matrix and \(Y\) a \(s \times n\) output matrix that represent data for all n sample firms. In the first stage, the following linear programming problem is solved:

\[
\text{Min } \omega^'x_i^*
\]

Subject to \(x_i \geq X\lambda, y \leq Y\lambda, \lambda \geq 0, \Sigma\lambda = 1\) (under variable returns to scale)

Where, \(w_i\) is a \(r \times 1\) input price vector for the i-th firm which corresponds to the input vector \(x_i\) and \(x_i^*\) is the cost-minimizing input vector for the i-th firm which is obtained by the linear programming.

In the second stage, the cost efficiency of the i-th firm is calculated as the ratio of minimum cost to observed cost:

\[
\text{CE} = \frac{\omega^'x_i^*}{\omega^'x_i}
\]

The measure of cost efficiency is bounded between 0 and 1. A cost efficiency of 1 represents a fully cost efficient firm; 1-Cost Efficiency represents the
amount by which the firm could reduce its costs and still produce at least the same amount of output.

**3.3.5.1.4 Estimation of Cost Efficiency: The New Approach**

In the life insurance sector, input and output quantities are expressed in monetary terms. Further, the definition and calculation of input and output prices is rather difficult. Tone (2002) suggested the new approach and calculated cost efficiency by replacing the input vector $x_i$ expressed in physical terms by $z_i$ where $z_i$ is the vector of inputs expressed in monetary terms. This approach further allows us to model input prices $w_i$ being equal to unity for all selected inputs. The new linear programming is, therefore:

$$\text{Min } C = \Sigma z_i$$

Subject to $z_i \geq Z\lambda$, $y \leq Y\lambda$, $\lambda \geq 0, \Sigma \lambda = 1$ (under variable returns to scale)

**3.3.5.1.5 Different Approaches of DEA under the New Approach**

The input and outputs of financial service firms are measured according to three approaches:

1. The asset (intermediation) approach
2. The user-cost approach
3. The value-added approach

**1) The asset (intermediation) approach**

The asset approach treats financial service firms as pure financial intermediaries which borrow funds from their customers which are invested, and transforms them into assets. Interest payments are paid out to cover the time value of the funds used. Applying the asset approach would mean that only the intermediation services provided by life insurance companies are taken
into account without any regard to the risk-pooling and risk-bearing services rendered by them.

(2) The user-cost approach

The user-cost approach determines whether a financial product is an input or an output by analyzing if its net contribution to the revenues of an insurance firm is positive or negative. Accordingly, a product is considered an output, if its financial return exceeds the opportunity costs of funds or if the financial costs of a liability are lower than the opportunity costs. Otherwise, the financial product would be classified as an input. This method would require precise information on product revenues and opportunity costs which can not be obtained for the Indian life insurance companies.

(3) The value-added approach

The term value added is an economic term and is the money value of all intermediate inputs in a firm subtracted from the output. The value-added approach differs from the asset approach and the user-cost approach as it considers all asset and liability categories to have some output characteristics. Those categories which have substantial value-added are then used as the important outputs. An important advantage compared to the user-cost approach consists in the fact that the value added approach uses operating cost data rather than determining the costs implicitly or using opportunity costs. The value added approach is considered to be the most appropriate method to measure output of financial firms and is widely used in service firms.

3.3.5.1.6 Strong points of DEA

- Multiple outputs and inputs possible in the same analysis
- It doesn't require an assumption of a functional form relating inputs to outputs
- Inputs and outputs can have very different units
3.3.5.1.7 Specification of Inputs and Outputs

3.3.5.1.7.1 Measurement of Output

The results of DEA model are sensitive to the inputs and outputs data. Indeed, an accurate selection of the indicators, which are best adapted to the objective of the analysis, is critical to the success the study. In order to use DEA for estimating cost efficiency, it is essential to identify the relevant inputs and outputs of the life insurance sector. Selection of input/output variables, however, is rather difficult for life insurance companies since input prices are often implicit, and many outputs are intangible.

In the present study I have followed the value-added approach and considered two outputs:

(1) Benefits paid to the customers

(2) Net premium mobilized by the insurance companies

3.3.5.1.7.2 Measurement of Input

Life insurers have two important cost components:

(1) Operating expenses

(2) Commission expenses

I have included both of them in the research study.

The mean cost efficiency has been calculated as follows:

\[
\text{Mean Cost Efficiency} = \frac{\text{Total Life Insurer's Efficiency}}{\text{No. of Life Insurers}}
\]
3.3.5.2 Analysis of Variance

3.3.5.2.1 Introduction

The analysis of variance frequently referred to by the contraction ANOVA is a statistical technique specially designed to test whether the means of more than two quantitative populations are equal.

The analysis of variance technique, developed by R.A.Fisher in 1920’s, is capable of fruitful application to a diversity of practical problems. Basically, it consists of classifying and cross-classifying statistical results and testing whether the means of a specified classification differ significantly. In this way it is determined whether the given classification is important in affecting the results. Analysis of variance thus enables us to analyze the total variation of our data into components which may be attributed to various “sources” or “causes” of variation.

The analysis of variance originated in agrarian research and its language is thus loaded with such agricultural terms as blocks (referring to land) and treatments (referring to populations or samples) which are differentiated in terms of seed, fertilizers or cultivation methods. The word treatment in analysis of variance is used to refer to any factor in the experiment that is controlled at different levels or values. The treatments can be different point of sale displays, assembly line techniques, and sales training programmes or, in short, any controlled factor deliberately applied to the elementary units observed in the experiment.

Today, procedure of this analysis finds application in nearly every type of experimental design in natural sciences as well as social sciences. In fact it has come to acquire a place of great prominence in statistical analysis. This is because of the fact that the analysis of variance is amazingly versatile: it can be readily adopted to furnish, with broad limits, a proper evaluation of data obtained from a large body of experiments which involve several continuous random variables. It can give us answers as to whether different sample data
classified in terms of a single variable area are meaningful. It can also provide us with meaningful comparisons of sample data which are classified according to two or more variables.

### 3.3.5.2.2 Assumptions for Analysis of Variance

- Each of the sample is a simple random sample.
- Populations from which the samples are selected is normally distributed.
- Each one of the samples is independent of the other samples.
- The effect of various components are additive.

### 3.3.5.2.3 Classification of Analysis of Variance

The analysis of variance is mainly carried on under the following two classifications:

1. One-way classification
2. Two-way classification

#### 3.3.5.2.3.1 One-way classification

In One-way classification the data are classified according to only one criterion. The null hypothesis is:

\[ H_0 : \mu_1 = \mu_2 = \mu_3 \ldots \ldots = \mu_K \]

\[ H_1 : \mu_1 \neq \mu_2 \neq \mu_3 \ldots \ldots \mu_K \] All the means are not equal

That is, the arithmetic means of populations from which the \( K \) samples were randomly drawn are equal to one another. The steps in carrying out the analysis are:

(a) **Calculate variance between the samples**

The variance between samples (group) measures the differences between the sample mean of each group and the overall mean weighted by the number of
observations in each group. The variance between the samples takes into account the random variations from another. The sum of squares between samples is denoted by SSC. For calculating variance between the samples, we take the total of the square of the deviations of the means of various samples from the grand average and divide this total by the degrees of freedom. Thus the steps in calculating variance between samples will be:

(a) Calculate the mean of each sample i.e. $X_1, X_2$, etc.

(b) Calculate the grand average $\bar{X}$, pronounced “X double bar”. Its value is obtained as follows:

$$\bar{X} = \frac{X_1+X_2+X_3+....}{N_1+N_2+N_3+....}$$

(c) Take the difference between the means of the various samples and the grand average

(d) Square these deviations and obtain the total which will give sum of squares between the samples and

(e) Divide the total obtained in step (d) by the degrees of freedom. The degrees of freedom will be one less than number of samples, i.e. if there are 4 samples then the degrees of freedom will be 4-1=3 or $u=k-1$, where $k$ = number of samples.

(b) Calculate variance within the samples

The variance (or sum of squares) within samples measures those inter-sample difference due to chance only. It is denoted by SSE. The variance within samples (groups) measures variability around the mean of each group. Since the variability is not affected by group differences it can be considered a measure of the random variation of values within a group. For calculating the
variance within the samples we take the total of sum of squares of the deviation of various items from the mean values of the respective samples and divide this total by the degrees of freedom. Thus, the steps in calculating variance within the samples will be:

(a) Calculate the mean of each sample i.e. $\bar{X}_1, \bar{X}_2, \bar{X}_3$, etc.

(b) Take the deviations of the various items in a sample from the mean values of the respective samples

(c) Square these deviations and obtain the total which gives the mean of square within the samples and

(d) Divide the total obtained in step (c) by the degrees of freedom. The degree of freedom is obtained by the deduction from the total number of items the numbers of samples, i.e. $u=N-K$, where $K$ refers to the number of samples and $N$ refers to the total number of all the observations.

(c) Calculate the ratio $F$ as follows:

$$F = \frac{\text{Between column variance}}{\text{Within column variance}}$$

Symbolically,

$$F = \frac{S_1^2}{S_2^2}$$

The $F$-distribution (named after the famous statistician R.A. Fisher) measures the ratio of the variance between groups to the variance within groups. The variance between the samples means is the numerator and the variance within the sample means is the denominator. If there is no real difference from group to group, any sample will be explainable by random variation and the variance
between groups should be close to the variance within groups. However, if there is a real difference between the groups, the variance between the groups will be significantly larger than the variance within groups.

**(d) Compare the calculated value of F with the table value of F for the degrees of freedom at a certain critical level**

If the calculated value of F is greater than the table value, it is concluded that the difference in sample means is significant. On the other hand, if the calculated value of F is less than the table value, the difference is not significant.

**3.3.5.2.3.2 Two - way classification**

In a one factor analysis of variance explained above the treatments constitute different levels of a single factor which is controlled in the experiment. There are, however many situations in which the response variable of interest may be affected by more than one factor. When it is believed that two independent factors might have an effect on the response variable of interest, it is possible to design the test so that an analysis of variance can be used to test for the effects of the two factors simultaneously. Such a test is called a two factor analysis of variance. With the two factor analysis of variance, we can test two sets of hypothesis with the same data at the same time.

In a two way classification the data are classified according to two different criteria or factors.

The sum squares for the source ‘Residual’ is obtained by subtracting from the total sum of squares the sum of squares between columns and rows i.e.,

\[
SSE = SST - [SSC + SSR]
\]

SSC = Sum of squares between columns

SSR = Sum of squares between rows
SSE = Sum of squares due to error

SST = Total sum of squares

MSC = Mean sum of squares between columns

MSE = Mean sum of squares due to error

MSR = Mean sum of squares between rows

The total number of degree of freedom = n-1

Where c refers to number of columns and r refers to number of rows,

Number of degrees of freedom between columns = (c-1)

Number of degrees of freedom between columns = (r-1)

Number of degrees of freedom for residual = (c-1) (r-1)

The total sum of squares, sum of squares for ‘between columns’ or and sum of squares for ‘between rows’ are obtained in the same way as before.

Residual or error sum of squares = Total sum of squares – Sum of squares between columns - Sum of squares between rows.

The F values are calculated as follows:

\[ F(v_1, v_2) = \frac{MSC}{MSE} \]

Where \( v_1 = (c-1) \) and \( v_2 = (c-1) (r-1) \)

\[ F(v_1, v_2) = \frac{MSR}{MSE} \]
The calculated value of F is compared with the table values. If calculated value of F is greater than the table value at pre assigned level of significance, the null hypothesis is rejected, otherwise accepted.

### 3.3.5.3 Linear Trend

#### 3.3.5.3.1 Introduction

The method of fitting a mathematical trend to given time series data, is perhaps the most popular and satisfactory. The form of mathematical equation used for the determination of trend depends upon the nature of the broad idea of trend obtained by graphic representation of data or otherwise. Linear trend is one of the most popular methods of fitting a mathematical trend. The fitted trend is termed as the best in the sense that sum of squares of deviations of observation, from it, are minimized. The principle of least square provides us an analytical or mathematical device to obtain an objective fit to the trend of the given time series. Most of the data relating to economic and business time series confirm to definite laws of growth or decay and accordingly in such a situation analytical trend fitting will be more reliable for forecasting and predictions.

The general form of linear trend is given by the equation $Y_t = \alpha + \beta t$, where \(t\) denotes timely is the trend value of variable at time \(t\) and \(\alpha (>0)\) and \(\beta\) (real number) are constants. The constant \(\alpha\) can be interpreted as the value of trend \((Y_t)\) when \(t=0\) and \(\beta\) gives the change in \(Y_t\) per unit change in time. It should be noted that the rate of change of \(Y_t\) is always constant in case of linear trend. This implies that for equal absolute changes in \(t\), there are correspondingly equal absolute changes in \(Y_t\),

\[
Y = \alpha + \beta X \\
\sum Y = n\alpha + \beta \sum X \\
\sum XY = \alpha \sum X + \beta \sum X^2
\]
\[ Y = \alpha + \beta U \]
\[ \sum Y = n\alpha + \beta \sum U \]
\[ \sum UY = \alpha \sum U + \beta \sum U^2 \]
\[ \sum Y = n\alpha \]

\[ \alpha = \frac{\sum Y}{n}, \]
\[ \sum UY = \beta \sum U^2 \]
\[ \beta = \frac{\sum UY}{\sum U^2} \]

3.3.5.3.2 Merits and Limitations of Linear Trend

3.3.5.3.2.1 Merits of Linear Trend

The merits of this method can be enumerated here:

- This is a mathematical method measuring trend and as such there is no possibility of subjectivness.
- The line obtained by this method is called the line of best fit because it is the line from where the sum of the positive and negative deviations is zero and sum of the squares of the deviations least.
- Trend values can be obtained for all the given time periods in the series.

3.3.5.3.2.2 Limitations of Linear Trend

- Great care has to be exercised in selecting the type of trend curve to be fitted. Carelessness in this respect may lead to fallacious results.
- This method is more tedious and time consuming compared to other methods.
- Predictions are based only on long term variations i.e. trend and the impact of cyclical, seasonal and irregular variations is ignored.
- Being a mathematical method it is not flexible - the addition of even one more observation makes it necessary to do all the computations again.
3.3.5.4 Ratio analysis

3.3.5.4.1 Introduction

Of all the tools of financial analysis available with analyst, the most important and the most widely used tool is Ratio analysis. Simply stated Ratio analysis is an analysis of financial statements done with the help of Ratios. A Ratio expresses the relationship that exists between two numbers taken from the financial statements. Ratio analysis is among the best tools available to analyze the financial performance of a company as it allows intercompany and intra company comparison. Ratio also provides a bird’s eye view of the financial condition of the company. The following ratios have been computed for the present study.

3.3.5.4.2 Ratios

[1] Total commission to total premium = \( \frac{\text{Total Commission}}{\text{Total Premium}} \)

This ratio helps to know the commission paid in relation to the total premium received by an insurance company. It throws lights on the financial management of insurance companies.

[2] Total commission to total Operating Expenses = \( \frac{\text{Total Commission}}{\text{Total Operating Exp.}} \)

This ratio indicates the portion of commission in the total operating expenses of the company. Commission is a major expense for a life insurance company. Major expenses for the insurers are towards employee expenses (inclusive of travel, etc.); training expenses (including agents’ training and seminars); rents, rates and taxes; advertisement and publicity; legal and professional charges; and depreciation expenses. This ratio helps to throw light on the type of insurance policies sold by insurance companies.
[3] Actuarial Efficiency = \frac{\text{Benefits paid to customer}}{\text{Total Premium}}

This ratio shows the actuarial efficiency of life insurance companies. This ratio shows benefits paid to the customer in relation to total premium.


This ratio throws lights on the short term solvency position of the company. It shows the ability of company to honor its short term commitments or obligations. Generally the ratio of 2:1 is considered satisfactory. The ratio changes throughout the year, due to the composition and character of the current assets and current liability and the nature of transaction.

[5] Proprietary Ratio = \frac{\text{Share Holder Fund}}{\text{Total Assets}}

Proprietary ratio indicates the general financial strength of the organization. The ratio measures the cover or protection available to the creditors. Proprietary ratio is a test of the financial and credit strength of the business. It relates shareholders’ funds to total assets. This ratio determines the long term or ultimate solvency of the company. In other words, Proprietary ratio determines as to what extent the owners’ interest and expectations are fulfilled from the total investments made in the business operations.

[6] Total Investment to Total Liability = \frac{\text{Total investment}}{\text{Total liability}}

This ratio establishes the relationship between total investment and total liability. It reflects the efficiency of a company in managing funds and their ability to pay claims.
3.4 SCOPE OF THE STUDY

The scope of present study is confined only to Public and all Private life insurance companies in India from 2000-01 to 2009-10. The study mainly involves analyzing the financial performance and cost efficiency of public and all private life insurance companies in India. Similar studies on this line may be conducted to compare performance of public and private insurance companies in other countries.

3.5 LIMITATIONS OF THE STUDY

The present research work is undertaken to maximize objectivity and minimize the errors. However, there are certain limitations of the study, which are to be taken in to consideration for the present research work.

- The study is based on the analysis of the ten years data only.
- The study fully depends on financial data collected from the published financial statements of companies. This study incorporates all the limitations that are inherent in the financial statements.
- The data for analysis is basically derived from financial statements. They are not adjusted for inflation.