

Chapter IV  
Methodology

#### 4.1: Literature review

The role of financial institutions and financial intermediaries in fostering the economic growth [Levine and Zervos<sup>1</sup> (1998), Levine<sup>2</sup> (1997), King and Levine (1993) (a)<sup>3</sup> and (b)<sup>4</sup> Levine<sup>5</sup> et al. (2000), and Beck<sup>6</sup> et al. (2000)] by improving the efficiency of capital accumulation, encouraging savings and ultimately improving the productivity of the economy has been well accepted by now. Recently, the research has shifted from established link between financial development and economic growth to understand factors that affects the overall financial services, thereby the underlying factors that lead to improve the financial development. Insurance is one of the important financial services that can trigger the growth in an economy by channelising the long-term savings for the productive purpose and providing a shield before the risk associated with any activity related to productivity, assets or life. Recent studies show that the insurance industry can improve the economic growth [Outreville<sup>7</sup> (1990 b), Browne and Kim<sup>8</sup> (1993), Browne<sup>9</sup> et al (2000), Catalan<sup>10</sup> et al, (2000), Ward and Zurbruegg<sup>11</sup> (2000), Beck and Webb<sup>12</sup> (2002) and Esho<sup>13</sup> et al (2004)] through financial intermediation, risk aversion and generating employment.

Despite the findings of several influencing factors affecting the life insurance demand and the promotion of life insurance development, there is meek guidance for the policy makers to focus on specific factor/s to foster the life insurance development and thereby financial development which improves the economic development. No such study has yet been published so far on Indian life insurance market *after the implementation of reforms* in this sector in 1999 and to the best of author's knowledge this is first such an attempt to measure the effects of life insurance reforms empirically. The only published literature available on Indian life insurance industry is the study of Sadhak<sup>14</sup> (2006) who has shown certain naive statistical relationship among lead factors. The objective of this study is to determine the factors which affect the demand for life insurance in the post reform period and doing so, provide guidance for the policymakers on how to promote life insurance development in India and there by economic development.

#### **4.2: Objective of the study**

The basic objective of this study is to analyze the effects of life insurance sector reforms on the total development of life insurance industry in India. To achieve this objective the present study has been organized in the following manner:

*first, we will examine the effects of life insurance reforms on overall development of life insurance consumption in India and try to find out whether the reforms in the life insurance sector has actually improved the life insurance demand in India or not and the overall development of the life insurance industry itself.*

*And in the second stage, we will examine the potential determinant factors (economic and non-economic) of life insurance demand in the post reform period in India.*

#### **4.3: Data Source**

All the data series are annual aggregate data for the period starting from 1991 to 2008 and secondary in nature. All the annual data are collected from, annual reports of LIC and IRDA, Handbook of Statistics on Indian Economy, RBI; Human Development Reports of UNDP, World Development Indicators of the World Bank, IFS data base from IMF, CIA fact book on India, UNCTAD reports, various issues and reports from Swiss Re. life insurance penetration, density and new policy issue data are collected from sigma issues, annual reports of LIC and annual reports of IRDA. All the economic variables are collected from RBI and IMF whereas the non-economic data are collected from UNDP and the World Bank.

#### **4.4: Sample Size**

The financial sector reforms was started in India with the implementation of new economic policy in 1991 by the then finance minister Dr. Man Mohan Singh who is the

present Prime Minister of India. Insurance sector reforms are the part of the total financial sector reforms initiative. The first step towards insurance sector reforms was the setting up of the Malhotra Committee in 1992-93 and consequently the opening of the life insurance sector in 1999 and setting up of an independent regulatory body IRDA. This study focuses on to find out the relationship between economic and non-economic factors and the consumption of life insurance in India in the post reform period which consists of the annual data series from 1991 to 2008.

#### **4.5: Empirical methodology**

The present study will extensively use various statistical methods to address the *problem under concern*. We intend to employ time series analysis for the purpose of assessing the gain in efficiency in India's insurance sector after liberalisation. Since the economic liberalisation took place in India in 1991 and insurance reforms started only in 1992, time series analysis may involve the problems of small sample. We will, therefore, alternatively use OLS to measure the gain in efficiency.

The methodology adopted for this study includes different econometric models which would evaluate the implications of life insurance sector reforms on the development of life insurance industry in India along with the determinant factor affecting life insurance demand. **In the first section**, we will measure the effects of life insurance reforms on the overall progress of life insurance industry. But there is no such accepted measure is available to quantify the reforms in the life industry to be used in our model. Therefore, we will construct a composite index of life insurance reforms which can be used in our study to find out the existing relationship between reforms and the development of the life market in India. To construct the index, (detailed given in the next chapter) which has been named as **Life Insurance Reforms Index (LIRI)**, we will consider only those fundamentals which are post reform phenomenon, i.e., those elements which manifest the reforms initiatives in this sector. Total life insurance premium volume (LIP) will be used to measure the development of life insurance business in India. **In the second section**, different economic and non-economic variables

have been used in our econometric model. However, before going on to time series regression analysis, it is imperative to investigate the univariate properties of all the variables under consideration. Formally, Augmented Dickey Fuller (ADF) and/or Philips Perron (PP) unit root test is going to be used to check the stationary properties of the variables whether the variables are stationary or non-stationary because using non-stationary time series variable in the regression may give spurious results<sup>15</sup>. Non-stationary variables may be used in our model provided the series are co-integrated in the same order. Therefore Engle-Granger co-integration will be employed to verify co-integration among the variables. We also check the short run dynamics of our model by using the VAR-VECM technique.

#### **4.6: Unit Root Test**

Unit root tests are conducted to verify the stationary properties of the time series data to avoid the spurious results of the regression<sup>16</sup> if the series are non-stationary. A series is said to be stationary if the mean and autocovariances do not depend on time. Any series which is not stationary is said to be non-stationary series. Generally, stationarity of the macro-economic variable data series are non-stationary by nature and the stationarity is attained by differencing the data once or twice in some cases. A series is said to be integrated of order (d), if it has to be differenced by (d) times before it becomes stationary. If a series need to differenced once (i.e., first difference) to make the series stationary then series is said to integrated of order one, denoted as  $I(1)$ <sup>17</sup>.

##### **4.6.1: Dickey-Fuller Unit Root Test**

Dickey and Fuller<sup>18</sup> (1979) have shown that under the null hypothesis i.e.  $\delta = 0$ , the estimated t value of the co-efficient of  $Y_{t-1}$  in equation  $\Delta Y_t = \delta Y_{t-1} + u_t$  follows the ( $\tau$ ) *tau statistics*. The Dickey-Fuller Unit Root Test is based on the following three regression forms:

1. Without Constant and Trend 
$$\Delta Y_t = \delta Y_{t-1} + u_t \quad (4.1)$$

2. With Constant 
$$\Delta Y_t = \alpha + \delta Y_{t-1} + u_t \quad (4.2)$$

## 3. With Constant and Trend

$$\Delta Y_t = \alpha + \beta T + \delta Y_{t-1} + u_t \quad (4.3)$$

The hypothesis is:

$H_0: \delta = 0$  (Unit Root) [time series is non-stationary]

$H_1: \delta \neq 0$  [time series is stationary].

Decision rule:

If  $t^* > \text{ADF critical value}$ ,  $\implies$  not reject null hypothesis, i.e., unit root exists.

If  $t^* < \text{ADF critical value}$ ,  $\implies$  reject null hypothesis, i.e., unit root does not exist.

#### 4.6.2: Augmented Dickey Fuller (ADF) Test

In DF test it is assumed that the error term  $u_t$  is uncorrelated. But in case it is found to be correlated then there will be confusion to determine whether the series are stationary or not. Dickey and Fuller have addressed this problem and developed a test which is known as Augmented Dickey Fuller (ADF) unit root test. In this test Dickey and Fuller have augmented the above three equation by adding the lagged values of the dependent variable  $\Delta Y_t$  as follows

$$\Delta Y_t = \alpha + \beta T + \delta Y_{t-1} + \sum_{i=1}^m \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (4.4)$$

Where  $\varepsilon_t$  is a pure white noise error term and  $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$ ,  $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$  etc. Here, we also test whether  $\delta = 0$  and ADF test follows the same asymptotic distribution as the DF statistics<sup>19</sup>.

#### 4.6.3: Phillips-Perron Unit Root Test

ADF test correct the serial correlation problem in the error term by adding the lagged difference terms of the regressand, but Phillips and Perron<sup>20</sup> (1988) have proposed a nonparametric method to correct a wide variety of serial correlation and heteroskedasticity situations in the error term without adding any lagged difference terms. PP test follows the same asymptotic distribution as the ADF statistics. The unit root test

and the order of the integration would be performed on both the original series and the differences of the series using both the ADF and PP tests.

#### **4.7: Co-integration Test**

The purpose of the co-integration test is to determine whether a set of non-stationary series is co-integrated or not. Co-integration tells us about the presence of any long run relationship among two or more variables. The concept of co-integration was first developed by Engle and Granger<sup>21</sup> in 1987. Engle and Granger points out that if the linear combination of two or more non-stationary series is stationary then the non-stationary time series are said to be co-integrated. For two series to be co-integrated, both need to be integrated of the same order,  $I$  or above. If both the series are stationary or integrated of order zero, i.e.  $I(0)$ , there is no need to do co-integration test as the standard time series would then be applied. If the variables are not integrated of the same orders, it is easy to conclude that the series are not co-integrated. However, if some variables are  $I(1)$  and some are  $I(2)$ , we still can continue with co-integration analysis and able to determine whether the variables are Multicointegrated<sup>22</sup>. But lack of co-integration means there is no long run relationship among the variables. There are basically two tools are available to determine the co-integration i.e. long run relationships among variables and they are:-

- (1) Engle-Granger's (1987) Residual Based Test, and
- (2) Johansen and Juselius's<sup>23</sup> (1990) Maximum Likelihood Test.

In this study the Engle-Granger's (1987) residual based test will be used to determine the long run relationship among the variables.

The two non-stationary series with the same order of integration may be co-integrated if there exists some linear combination of the series that can be tested for stationarity i.e.  $I(0)$ . Engle and Granger propose a two-step procedure to test Co-integration between two time series.

$$X_t = \alpha + \beta Y_t + U_t \quad (4.5)$$

$$Y_t = \alpha + \beta X_t + V_t \quad (4.6)$$

First, Co-integration regression is estimated by OLS, and then in the second stage, the residuals from the regression are tested for stationarity. DF unit root test will be applied on these residuals to determine their order of co-integration. If the test statistics indicates that the residuals are stationary, i.e.  $I(0)$ , then there is a Co-integration between  $X_t$  and  $Y_t$  i.e. they have long run equilibrium.

In case of more than two variables, all time series are subjected to unit root analysis to determine the order of integration among them and if all the variables are integrated in the same order then a co-integrating regression equation will be estimated as follows.

$$Y_t = \alpha_t + \beta_1 X_t + \beta_2 W_t + \beta_3 Z_t + \beta_4 V_t + e_t \quad (4.7)$$

This can be rewrite as,

$$e_t = Y_t - \alpha_t - \beta_1 X_t - \beta_2 W_t - \beta_3 Z_t - \beta_4 V_t \quad (4.8)$$

Since,  $e_t$  must be stationary, this means that the linear combination of the non-stationary (integrated) variables given in the right hand side must also be stationary<sup>24</sup>. Stationarity of the error term ( $e_t$ ) will be checked by both the ADF unit root test and Philip-Perron unit root test. If the residuals  $e_t$ , from the above equation, found to be  $I(0)$  i.e. stationary then the variables are said to be co-integrated and they have a long run relationship among themselves.

#### **4.8: Vector Error Correction Model (VECM)**

Even if there exists a long run equilibrium relationship between the two series, there may be disequilibrium in the short run. Engel-Granger (1987) identifies that the co-integrated variables must have an ECM (Error Correction Model) representation and a VAR model can be reformulated by the means of all level variables. The Vector Error Correction specification restricts the long run behaviour of the endogenous variables to converge to their co-integrated relationships while allowing a wide range of short run dynamics, hence, one can treat the error terms (ET) as the "equilibrium error"<sup>25</sup>. Through the co-integration term, the deviation from the long run equilibrium is corrected gradually



in the course of a series of short run adjustments. Indeed VECM is a special type of restricted VAR model<sup>26</sup>. Therefore, VECM gives us important information about the short run relationships between these two co-integrated variables. The general form of this modified equation by employing variables of our study is presented below,

$$\Delta X_t = \alpha_1 + \beta_1 ET_{1t-1} + \sum_{i=1}^n \delta_i \Delta X_{t-i} + \sum_{i=1}^n \gamma_i \Delta Y_{t-i} + \varepsilon_t \quad (4.9)$$

$$\Delta Y_t = \alpha_2 + \beta_2 ET_{2t-1} + \sum_{i=1}^n \theta_i \Delta Y_{t-i} + \sum_{i=1}^n \lambda_i \Delta X_{t-i} + \omega_t \quad (4.10)$$

Where,  $\Delta$  denotes first difference operator,  $\varepsilon_t$  and  $\omega_t$  are white noise error terms,  $ET_{1t-1}$  and  $ET_{2t-1}$  are error correction terms which is the long run effect and lagged independent variables are short run effect. That is, changes in the dependent variables are effected by the  $ET$ ,  $\Delta X_{t-i}$ , and  $\Delta Y_{t-i}$ .

#### 4.9: The causal relationship

Engel–Granger (1987) identifies that if co-integration exists between two variables in long run then there must be either unidirectional or bi-directional Granger causality between these two variables. The basic design behind the test is to check whether the lagged values of one variable do or do not affect the present value of another variable or the same variable itself. The Granger causality test model for two variables can be represented as follows,

$$X_t = \sum_{i=1}^n \alpha_i X_{t-i} + \sum_{i=1}^n \beta_i Y_{t-i} + \varepsilon_{1t} \quad (4.11)$$

$$Y_t = \sum_{i=1}^n \theta_i Y_{t-i} + \sum_{i=1}^n \delta_i X_{t-i} + \varepsilon_{2t} \quad (4.12)$$

Where,  $X_t$ ,  $Y_t$  are the two variables under study,  $\alpha, \beta, \theta, \delta$  are coefficients on each variables and  $\varepsilon_{1t}$  and  $\varepsilon_{2t}$  are the error terms of the model. It is found that granger test statistics follows chi-square distribution instead of F-distribution. Therefore, we would follow the chi-square distribution in determining the direction of causality.

In determining the factors which affects the life insurance demand in India, the initial estimation equations (comprising all the potential factors) are subject to subsequent simplification by removing the most insignificant variable from the equation. This process will repeat until further deletion of any insignificant variables from the equation causes autocorrelation in the residuals. Every equation will, therefore, be tested for the presence of residual serial correlation before and after the simplification process. If the serial correlation is not present in the residuals then most insignificant variable form the equation will be removed. If the residual serial correlation is detected as a consequence of removing the most insignificant variable from the estimation equation, indicates that the variable should not be removed from the equation at that stage and the initial estimation equations need to be re-specified to get the final regression equation<sup>27</sup>.

#### **4.10: Testing for Autocorrelation**

In time series regression there is a possible lack of independence in the residuals and it is also possible to have correlation between residuals more than one time period apart. An alternative approach to check the autocorrelation is to compute the autocorrelation function or ACF and plot them as correlogram. But this measure gives us a rough guide as to the significance of each correlation. The more accurate test is the Durbin-Watson test (DW test) for autocorrelation<sup>28</sup>. The DW test statistics is computed as follows,

$$DW = \frac{\sum_{t=2}^n (e_t - e_{t-1})^2}{\sum_{t=1}^n e_t^2} \quad (4.13)$$

The numerator comprises total sum of square of differences between successive errors and the denominator is simply the sum of squared errors. The DW statistics ranges in value from 0 to 4, with an intermediate value of 2. The rule of thumb is that the DW

stat close to 2 represents that there is no residual serial correlation. In fact, the DW test statistics is very close to  $2(1-r^2)$  where  $r$  is the autocorrelation at lag one.

#### 4.11: Testing Normality

Several tests are available to test the normality such as, histogram of residuals, normal probability plot, the Jarque-Bera<sup>29</sup> (JB) normality test etc. a histogram of residuals is the simplest graphical presentation used to learn the shape of the distribution but empirically more accurate test is the JB test. This test is based on OLS residuals and uses the following test statistics,

$$JB = n \left[ \frac{s^2}{6} + \frac{(k-3)^2}{24} \right] \quad (4.14)$$

Where,  $n$  = sample size,  $s$  = skewness coefficient and  $k$  = kurtosis coefficient. For a normally distributed variable,  $s=0$  and  $k=3$  and in that case JB test statistics is expected to be 0 which follows the chi-square distribution with 2df. If the computed  $p$  value of the JB statistics is very low then one can reject the null hypothesis that the residuals are normally distributed. But if the test statistics is reasonably high one can not reject the hypothesis<sup>30</sup>. The JB statistics at 5% significance level will be used to make decision regarding normality of the residuals.

In addition to secondary data the present study will also require primary data especially to measure the indices like consumer satisfaction / dissatisfaction, awareness for the life insurance etc. Necessary field survey will be undertaken among the existing policy-holders and also prospective policy-holders. To undertake the field survey, necessary questioners will be prepared to evaluate the awareness of common people in India along with the perception towards life insurance companies and their offerings in the post reform years. Since the primary data will be collected from different strata of our society, closed ended questioners will be prepared to achieve our basic objectives keeping in mind all the qualities of a good questionnaire<sup>31</sup>. Appropriate statistical tools<sup>32</sup> will be employed for this purpose. In this study we will use the statistical software E-views to evaluate the econometric results of the pre estimated models of this study.

## References

- (1) Levine, R. and S. Zervos, (1998), "Stock Markets, Banks and Economic Growth", *American Economic Review*, Vol. 88, No.3, pp. 537-558.
- (2) Levine, R., (1997), "Financial Development and Economic Growth: Views and Agenda", *Journal of Economic Literature*, June, Vol. 35, No. 2, pp 688-726.
- (3) King, R. G., and R. Levine., (1993a), "Finance and Growth: Schumpeter Might be Right", *Quarterly Journal of Economics*, Vol. 108, No.3, pp. 717-737.
- (4) King, R. G. and Levine, R., (1993b), "Finance, Entrepreneurship and Growth: Theory and Evidence", *Journal of Monetary Economics*, Vol. 32, pp. 513-542.
- (5) Levine, R., N. Loayza. and T. Beck. (2000). "Financial Intermediation and Growth: Causality and Causes", *Journal of Monetary Economics*, Vol. 46, No.1, pp. 31-77.
- (6) Beck, T., Levine, R. and Loayza, N., (2000), "Finance and the Sources of Growth", *Journal of Financial Economics*, Vol. 58, No.1-2, pp. 261-300.
- (7) Outreville, J. F., (1990b), "The Economic Significance of Insurance Markets in Developing Countries", *Journal of Risk and Insurance*, Vol.18, No.3, pp. 487-498.
- (8) Browne, M. J. and Kim, K., (1993), "An International Analysis of Life Insurance Demand", *Journal of Risk and Insurance*, Vol. 60, No. 4, pp. 616-634.
- (9) Browne, M.J., Chung J., and Frees E. W. (2000) International Property-Liability Insurance Consumption *Journal of Risk and Insurance*, Vol.67, No.1, pp. 73-90.
- (10) Catalan, M., Impavido, G and Musalem, A.R., (August, 2000), "Contractual Savings or Stock Markets: Which leads?" *Financial Sector Development Department*, the World Bank.

- (11) Ward, D., and R. Zurbruegg., (2000), "Does Insurance Promote Economic Growth? Evidence from OECD Countries", *Journal of Risk and Insurance*, Vol. 67, No.4, pp. 489-507.
- (12) Beck, T. and Webb, I., (October 2002), "Economic, Demographic and Institutional Determinants of Life Insurance Consumption across Countries", *Working Paper: World Bank and International Insurance Foundation*.
- (13) Esho, N., Kirievsky, A., Ward, D. and Zurbruegg, R., (2004), "Law and the Determinants of Property Casualty Insurance", *Journal of Risk and Insurance*, Vol. 71, No.2, pp. 265-283.
- (14) Sadhak, H., (2006), "Life Insurance and the Macro Economy", *Economic and Political Weekly*, Vol. 41, No. 11, pp. 1108-1112.
- (15) Gujarati, D.N and Sangeetha., (2007), "*Basic Econometrics*" (Fourth Edition), Tata McGraw-Hill Publishing Company Limited, New Delhi, pp. 821-825.
- (16) Granger, C.W.J. and Newbold, P., (1974), "Spurious Regression in Econometrics." *Journal of Econometrics*, Vol. 2, pp. 111-120.
- (17) Gujarati, D.N and Sangeetha. (2007), op. cit, pp. 821-825.
- (18) Dickey, D. A. and Fuller, W.A., (1979), "Distribution of the Estimators for Autoregressive Time Series with a Unit Root." *Journal of the American Statistical Association*, Vol. 74, pp. 427-431.
- (19) Gujarati, D.N and Sangeetha, (2007), op. cit, p. 836.
- (20) Phillips, P. C. B. and Perron, P., (1987), "Testing for a Unit Root in Time Series Regression." *Biometrika*, Vol. 75, No. 2, pp. 335-346.
- (21) Engle, R and Granger, C. W. J., (1987), "Co-integration and Error correction: Representation, Estimation and Testing", *Econometrica*, vol. 55, pp.251-276.

- (22) Granger, C. W. J and T.H. Lee, (1990), "Multicointegration", *Advances in econometrics* 8, pp. 77-84.
- (23) Johansen, S. and Juselius, K., (1990), "Maximum Likelihood Estimation and Interference on Cointegration with Application to the Demand for Money", *Oxford Bulletin of Economics and Statistics*, Vol.52, pp. 169-210.
- (24) Enders, W., (2004), "*Applied Econometric Time Series*" (Second Edition), John Wiley & Sons, Wiley India (P.) Ltd., pp. 320-321.
- (25) Gujarati, D.N and Sangeetha, (2007), *op. cit.*, p. 843.
- (26) Hossain, S. (2008), "*Ecomnometrics Modelling: Frequently asked questions*", Faculty of Management, Multimedia University, Cyberjaya, [www.sayedhossain.com](http://www.sayedhossain.com).
- (27) Lim, C. C. and S. Haberman, (2004), "Modeling Life Insurance Demand from a Macroeconomic Perspective: The Malaysian Case", *Paper presented at The 8th International Congress on Insurance: Mathematics & Economics, Rome, 2004*. <http://www.ime2004rome.com/fullpapers/Chee%20PAPE.pdf>.
- (28) Makridakis, S., Wheelwright, S.C. and Hyndman, R. J., (2005), "*Forecasting Methods and Applications*" (Third Edition), John Wiley & Sons Inc., Wiley India (P.) Ltd., pp. 259-268.
- (29) Jarque, C.M. and A.K. Bera., (1987), "A Test of Normality of Observations and Regression Residuals", *International Statistical Review*, Vol. 55, pp. 163-172.
- (30) Gujarati, D.N and Sangeetha, (2007), *op. cit.*, p. 150.
- (31) Kotler, P. and Keller, K. L., (2007), "*Marketing Management*" (Twelfth Edition), Prentice-Hall of India Private Limited, New Delhi, India.
- (32) Levin, R. I and Rubin, D. S. (2005), "*Statistics for Management*", (Seventh Edition), Pearson Education Ptc. Ltd., New Delhi; [www.pearsoned.co.in](http://www.pearsoned.co.in).