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Scale Efficiency and Indian Life Insurance Industry During the Post-Reform Period: An Econometric Study

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Abstract

The sine qua non of an efficient financial system is competitiveness which follows liberalisation. For the Indian insurance sector, tryst with liberalisation began two decades ago with the enactment of the Insurance Regulatory and Development Act, 1999. In view of the impact of liberalisation policy on the efficiency of the Indian life insurance sector, the present article seeks to measure scale efficiency of the individual companies and the industry as a whole during the post-reform period. In an attempt to do so, we apply Economic Frontier Approach (EFA) to estimate Transcendental Logarithmic (Translog) cost function consisting of one output and two input variables, i.e., labour and capital, for a wider time period from 2003–04 to 2015–16. Obtained results are mixed. Though the life insurance industry as a whole has huge scope of scale expansion, most of the individual firms are experiencing scale diseconomies. The present paper also succeeds in establishing a relationship between scale efficiency score and firm's asset size. The outcome suggests a positive relationship between them.

Keywords: Life Insurance, Scale Efficiency, EFA, Translog Function

Introduction

The structural efficiency of an economy primarily hinges on the efficiency of its financial intermediation and, hence, the financial sector, including the insurance business, stands at the centre stage of India's reform exercise. Indeed, the gain of efficiency in India's financial system determines the success of her economic reforms, as argued in, for example, Sensarma (2005), Das *et al*. (2005), and Dutta and Sengupta (2011).

The Indian life insurance sector belonged entirely to the public sector since 1956, but the Insurance Regulatory and Development Act, 1999, has liberalised the entry of new firms in the industry, enabling market forces to be infused thereby, and, hence, the gain of efficiency. This is acknowledged *inter alia* in Ranade and Ahuja (1999) and Sadhak (2006). By the force of this act, 23 private life insurance companies have been set up to work side by side with the state-owned Life Insurance Corporation of India (LICI), which occupies 25th position[1] in the world insurance market in terms of the asset size.

As an important constituent of the financial system, insurance companies attract attention in efficiency measurement studies. The present article is an attempt to this end. Among various concepts of efficiency, this study employs the measure of scale efficiency. The objective is to examine whether the industry's average cost structure can be minimised by optimising the scales of various companies. This is especially important in India since it accommodates, on the one hand, very large-scale companies like LICI, and a host of tiny companies, on the other. The objective of this article, therefore, calls for measuring the efficiency for the industry as a whole, as also those for individual companies.

[1] Retrieved from http://www.relbanks.com/top-insurance-companies/worldon 22th January, 2018.

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There are four sections that follow. After reviewing the relevant literature in a nutshell in Section I, we proceed to discuss the methodological framework along with the dataset in Section II, and present the empirical findings in Section III. Section IV concludes.

Section I

Till date, substantial amount of scholarly effort has been devoted to the development of efficiency measures. But no consensus has yet been achieved regarding the appropriate methodology. There exists a rich efficiency literature on insurance although pertaining largely to the U.S. economy. A few scholars have tried it for other developed countries like the U.K., Canada, Austria, etc. Indian insurance sector also does not remain virgin in this respect, but most of the studies are based upon DEA approach notwithstanding the paramount importance of parallel approaches.

In efficiency literature, disagreement prevails not only on concept, but also for the associated measures. Several efficiency measures can be grouped under two broad categories, parametric or econometric approach and non-parametric or mathematical programming approach. Stochastic Frontier Analysis (SFA), Thick Frontier Analysis (TFA), Distribution Free Approach (DFA), etc., are different forms of parametric approach. Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH) fall under the non-parametric approach. Other approaches to measure efficiency are Goal programming, developed by Aigner and Chu (1968), Malmquist productivity index, developed by Fare et al. (1994), Semi-parametric approach, Bayesian procedure, etc.

According to Farrell (1957), a firm's overall efficiency can be segregated into two basic components, technical efficiency and allocative efficiency. Technical efficiency arises when a given level of output is produced with the minimum quantities of input under certain technology, whereas allocative efficiency is attained at the output level where price is equal to the marginal cost of production. Overall technical efficiency can be further decomposed into two sub-categories, i.e., scale efficiency and pure technical efficiency. A firm is said to be scale efficient when it operates under constant returns to scale (CRS), whereas pure technical efficiency is obtained under the variable returns to scale (VRS), when the firm maximises its output with given level of input. The ratio of overall technical efficiency and pure technical efficiency is scale efficiency. Primarily, for any firm, the goal is to attain most productive scale size (MPSS), a yardstick introduced by Banker (1980) and defined as a production size at which the average productivity of the production unit is maximum. It represents that scale size where all possible scale gains due to increasing returns to scale have been exploited, but decreasing returns to scale have not set in. MPSS can be referred to as a benchmark for the success of any industry or firm.

However, in earlier studies, such as in Houston and Simon (1970) and Geehan (1977), a simple linear relationship is tried under parametric approach. Thereafter, the Cobb-Douglas function and the CES function gain popularity among scholars as these are linear in logarithms. The study of Clark (1984) falls in this group. But these functions cannot measure variation in returns to scale. Under these specifications, the estimated relationship indicates either monotonically increasing or decreasing returns to scale. To overcome this weakness, recent studies use Transcendental Logarithmic (Translog) Function. Such a function is used by William S. Reece (1992), Karl C. Ennsfellner et al. (2004), etc.

One of the pioneer works in the insurance field is Houston and Simon (1970). It uses cross-section data for 237 life insurance companies in California in 1962, and obtains a downwards slopping long-run average cost curve indicating strong economies of scale. Pritchett (1971) studies data for 30 life insurance companies for three consecutive years 1965–1967, and also obtains increasing returns to scale. In a later study by Pritchett (1973) where a combination of cross-section and time-series data is used, he obtains L-shaped LAC curve. The Houston-Simon model is reworked by Geehan (1977) for the Canadian Life Insurance industry. He gets, however, an ambiguous answer to the question of the existence of returns to scale. Benefits like lower average cost, lower premium, better utilisation of inputs, etc., are achieved through scale expansion and, hence, these allure firms for mergers. This proposition along with the existence of scale efficiency is investigated by McIntosh, (1998) for the panel of the Canadian life insurance companies during the sample period from 1988 to 1991. The author formulates and estimates inter-temporal product differentiation oligopoly model. His findings support the existence of scale economies in the short run, and also that mergers would be beneficial during the phase of increasing returns to scale. Aoba (2006) uses the Cobb-Douglas production function under the parametric approach. Panel data of 22 Japanese life insurance companies are analyzed. His results indicate that regulation on the price of insurance adversely affects overall efficiency. Cummins *et al*. (2006), on the other hand, studies the effect of deregulation on the efficiency of the Spanish insurance industry. He uses the DEA technique. Results suggest that almost half of the firms are operating under increasing returns to scale (IRS) signifying potential for future scale efficiency gains. However, a substantial portion of large firms are experiencing scale diseconomies. Barros *et al*. (2006) attempts to measure technical efficiency of the Portuguese life insurance industry over the period from 1995 to 2003 with the help of stochastic cost frontier model based on the EFA. This study is significant as it introduces homogeneous Cobb-Douglas cost frontier model which accepts duality between production and cost function. Some of his results indicate the existence of constant returns to scale while others do not. Such empirical contradictions prevail over the literature.

Measuring efficiency for service industry gets complicated in the absence of precise definitions of input(s) and output(s) along with the existence of varied approaches. Different definitions of insurance output(s) and input(s) lead to empirical contradictions and give rise to theoretical debates. In an attempt to solve the problem, Barnett (1980) first constructed an index number using the user cost as the price of the asset. This methodology is adopted by Hancock (1985), Weiss (1986), and Fixler and Zieschang (1991). Reece (1992) applies output price indices for the U.S. life insurance industry from 1976 to 1986. This study defines output as a complete set of financial services. He also proposes the construction of Tornqvist index, which is weighted geometric mean of the price ratios for each of N products with the weights being proportion of revenues contributed by the products. Ennsfellner *et al*. (2004), in their study on the Austrian insurance industry, consider three output-variables for life and health insurance, *viz*., incurred benefits, changes in reserve and total invested assets, and two output-variables for non-life insurance (*viz*., claims incurred and total invested assets). Borges *et al*. (2008) use labour and equity capital as inputs along with multiple outputs, *viz*., invested assets, losses incurred, reinsurance reserve and other reserves. A recent study by Dutta and Sengupta (2011), however, chooses operating expenses, commission paid and net benefits paid as inputs and net premium revenues as output.

Efficiency studies on the Indian insurance sector are slanted towards DEA approach. Sinha and Chatterjee (2009) measure cost efficiency scores, as proposed by Tone (2002), of the Indian life insurance firms for five consecutive years, from 2002–03 to 2006–07 adopting output variables, such as benefits paid and net premium, and input variables, like operating expenses and commission expenses. Their analysis provides mixed results on the trend of cost efficiency. The results of a study by Sinha (2007) exhibit that private life insurers are way behind LICI on the basis of technical efficiency scores. He uses Malmquist Total Factor Productivity Index to assess total factor productivity growth of the Indian life insurance industry from 2002–03 to 2004–05. A similar study is conducted by Chakraborty and Sengupta (2012), but it ranges over a longer sample period from 2003–04 to 2009–10. Their analysis is based on Malmquist Total Factor Productivity score of selected life insurance companies, and reflects that LICI is marginally ahead of its private counterparts. Simultaneously, company-wise catch-up efficiency and frontier-shift efficiency scores have been assessed under the DEA approach with operating expenses and commission expenses as inputs and net premium income and number of new products launched during the year as output indicators. Studies by Tone and Sahoo (2011) and Dutta and Sengupta (2011) also adopt the DEA model to evaluate cost efficiency of LICI and all life insurance companies, respectively. Findings of the former show significantly heterogeneous cost efficiency scores of LICI over a long stretch of 19 years. The latter one uses a panel dataset of 14 life insurance companies from 2004 to 2009 to measure efficiency scores with multiple inputs like operating expenses, commission and net benefits paid and single output, net premium revenues. Another recent study by Dash and Muthyala (2018) also considers the cost efficiency as measured by the DEA approach for top 15 life insurance companies of India with multiple input and output variables over the period from 2010 to 2017. Its findings show that LICI is the most efficient firm consistently followed by SBI Life and ICICI Prudential. Similar findings are also obtained by Nandi (2014). This study utilises the output-oriented DEA technique to evaluate the relative performance efficiency of top 13 Indian life insurance companies individually, year-wise and sector-wise for a period from 2002–03 to 2011–12 with two inputs, commission paid and operating expenses and two outputs, premium and net benefit involved. Year-wise results indicate a consistent performance of LICI. Company-wise and sector-wise performance measures also signify LICI as the most efficient one, followed by private sector life insurance companies, SBI Life and ICICI Prudential. On the yardstick of revenue efficiency as well, performance of LICI is consistent. This is the finding of Kamlesh's (2017) study which uses the DEA with the dataset of 13 Indian life insurance companies. Commission expenses and operating expenses are adopted as inputs to produce output in terms of number of policies priced at sum assured per policy. Kaur (2015) evaluates LICI's performance during the pre- and post-reform periods and analyses private life insurance companies' performance since their inception. The analysis with the help of financial ratios, DEA analysis, Malmquist Index and Mann-Whitney Test substantiate LICI's exhibition of higher efficiency, profitability and productivity throughout the study period from 1993–94 to 2010–11 along with the fact that LICI's performance in terms of profitability and efficiency has improved during the post-reform period. As far as the private insurance companies are concerned, it is primarily the net incurred claims to affect the profitability. The study suggests the overall improvement of the performance of life insurance industry with the implementation of liberalisation policy. For the Indian non-life insurance firms, Venkateswarlu and Rao (2015) use cross-efficiency and super-efficiency DEA models over the period from 2008–09 to 2012–13. Their analysis indicates mixed results. Iqbal (2015) measures the technical, pure technical and scale efficiency of 25 general insurance companies of Pakistan with the help of DEA technique. According to the findings, most of the insurance companies are scale inefficient due to excess labour cost and decline in claim settled amount.

Only a few studies such as Gowd *et al*. (2012) and Mushtaq (2014) use econometric tools to analyse the performance of the Indian life insurance industry. Statistical tools like co-efficient of variation, ANOVA and Trend Analysis are used to this end. Their results support an improvement in LICI's performance in the post-liberalisation period. In this context, a study by Kamat *et al*. (2016) is worth noting. A linear multiple regression equation under Fixed-Effect Model (FEM) is developed, and the liquidity ratio, solvency ratio, premium growth and age of the firm are regressed on Return on Assets (ROA) to evaluate financial performance of 24 life insurance companies for a sample period from 2009 to 2014. Their results indicate that profitability of life insurers shares a significant positive relationship with liquidity, solvency and age, whereas profitability is negatively related with premium growth.

The present study is an addition to the existing efficiency literature in the Indian context. It aims to measure the scale efficiency scores on the basis of the translog cost equation for the life insurance industry as a whole and for the individual companies also. It further attempts to establish relationship between scale efficiency score and firm's asset size.

Section II

To measure the scale efficiency, the present study uses the EFA, which requires the selection of functional relationship among the variables under study. Here, it is based on the Transcendental Logarithmic (Translog) cost function, which uses less restrictive assumptions as to substitution possibilities across inputs and outputs than what are needed for the Cobb-Douglas and CES functions. The Translog specification of cost function is

$$LnC = \alpha_0 + \sum_i^n \alpha_i lny_i + \sum_j^m \beta_j lnp_j + 1/2\sum_i^n\sum_k^n \sigma_{ik} lny_i lny_k + 1/2\sum_j^m\sum_h^m \gamma_{jh} lnp_j lnp_h + \sum_i^n\sum_j^m \Omega_{ij} lny_i lnp_j + \varepsilon \quad ....(1)$$

For equation (1), restrictions of symmetry and linear homogeneity are imposed on the input prices.

The choice of variables, however, depends on the role that the insurance industry plays. Unlike manufacturing firms which are always producer by nature, researchers face dilemma to establish the characteristics of financial services; in particular, whether they should be treated as producer or as intermediary. Input(s) and output(s) vary from purely physical to purely financial on the basis of the chosen nature of financial services. Studies such as Cummins and Weiss (1993), Berger and Humphrey (1997) and Cummins *et al*. (1999) have treated such firms as producer, and adopted the production approach to measure efficiency. Berger and Humphrey (1992) describe it as a value-added approach. According to Brockett *et al*. (2005), if 'production approach' is adopted in case of insurance firms, then 'payment of losses' is most likely to be treated as output. The study by Cummins *et al.* (1999) falls under this category, where the 'present value of real losses incurred' is used as a proxy of output. Jeng and Lai (2005) are also of the opinion that payment of losses does represent an important output under the production approach. In that case, they raise the concern that a firm which faced heavy loss due to flawed underwriting practice or natural calamities should not be labelled as the most efficient one. Apart from this, 'losses paid' as output measure may lead the firm to ignore other desirable goals. In this context, a recent study by Ertugrul *et al*. (2016) is worth mentioning. In its view, the choice of input and output variables depends upon the activity that the academicians are going to inspect. For those who advocate insurance as financial intermediation, insurance firms with the purpose of promised indemnification, sell contingent claims to policyholders in exchange of premiums and invest the proceeds in a portfolio of assets to meet the unforeseen claims, to bear the management expenses and safeguard the interest of investors (see, Brockett *et al.* 2005). According to Sealey and Lindley (1977), insurance firms act as mediators to channelize the fund from surplus to deficit sector and generate profit in the due process. Berger and Humphrey (1997) also support the intermediation approach over the production approach while evaluating the performance of the firm.

Due to the above-mentioned shortcomings associated with the production approach, the present study regards the insurance industry as an intermediary. Chakraborty and Sengupta (2012), in their non-parametric analysis, have chosen net premium income and number of products as outputs, whereas Dash and Muthyala (2018) have disaggregated the net premium income in individual single premium, individual single non-premium, group single premium and group non-single premium to use them as multiple outputs. Nandi (2014) and Sinha and Chatterjee (2009) employ net premium and benefits paid as output proxies.

For the analysis of life insurance companies within the intermediary framework, we consider that total funds are initially generated, which are invested afterwards among different classes of assets to earn income. Hence, total invested funds and income from there are the primary concern for the regulator, policyholders, investors and the insurer. It assures the regulator and safeguards the interests of others. It does not only represent the outcome of intermediary activity, but also carries the essence of risk-pooling and risk-bearing activity of life insurance firms. Hence, the present study adopts 'investments and income from investment' as the output variable. Here, by total investment, we mean the investment of Life Fund, Pension and General Annuity and Group Fund, and Unit Linked Insurance Plan Fund. Although disagreement prevails on the choice of output variables, consensus is found on the input selection. Most of the studies have recognised labour and capital as inputs, whereas some studies have incorporated business services too and others have bifurcated capital into debt and equity. This study employs labour and capital as inputs. In general, the importance of labour needs not to be reemphasised and insofar as the insurance industry is concerned, labour in the form of agents is the most effective and active medium to induce the prospective investors for policy purchase. Simultaneously, the role of share capital is crucial too as it provides the sense of security and acts as a buffer when net premium along with the interest and dividend upon its investment falls short to meet the predictable or actual claims. Table 1 presents an overview of the inputs, prices associated with inputs and the output used in this study.

'Operating expenses related to insurance business' is used to surrogate Cost (C), the single dependent variable in the present analysis. Labour is priced with commission per agent (W). Here, the term 'agent' includes both individual and corporate agents. So far as the price of capital (R) is concerned, 'income from investments per rupee of share capital' is calculated. Output (Q) is represented by the aggregate of all funds and income generated from investments of those funds. Life insurance companies categorise total accumulated fund under three broad headings: (1) Life Fund, (2) Pension and General Annuity Fund, and (3) Unit Linked Fund. These funds are invested in several central government securities, state government securities, other approved securities, infrastructure investments, etc., and income from these investments is recorded in Policyholders Account.

Table 1: Inputs, Output and Their Descriptions

Inputs and Output	*Descriptions*
Cost (C)	Operating Expenses (related to insurance business)
Inputs	
Labour	Insurance agents (Individual and Corporate)
Capital	Share Capital
Inputs Prices	
Price of Labour (W)	Commission per agent = Commission / Total Agents
Price of Capital (R)	Income from Investments per rupee of Share Capital = Income from Investments (as it appears in Shareholders Account) / Share Capital
Output	
Investments and income from investments (Q)	Total of all Funds (Life Fund, Pension and General Annuity & Group Fund and ULIP Fund) + Income from Investments (as it appears in Policyholders Account)

On the basis of these output and input variables, the following translog equation (without intercept) is obtained:

$LnC = \beta_{Q}lnQ + \beta_{R}lnR + \beta_{W}lnW + ½\beta_{QQ}(LnQ)2 + ½\beta_{RR}(lnR)2 + ½\beta_{WW}(lnW)2 + \beta_{QR}lnQlnR + \beta_{RW}lnRlnW + \beta_{WQ}lnWlnQ + \varepsilon$ ....(2)

The cost efficiency with the output expansion is judged by the measure of scale economies, which represents the percentage change in operating expenses for the percentage change in the output. Hence, scale economies can be represented as follows:

Scale economies $(\delta lnC/\delta lnQ) = \beta_{Q} + \beta_{QQ}lnQ + \beta_{QR}lnR + \beta_{WQ}lnW$ ....(3)

A greater than, equal to and less than unity value of the above equation represent scale diseconomies, constant returns to scale and scale economies, respectively.

Data are secondary in nature and have been collected from annual reports published by the IRDA from 2003–2004 to 2015–16 and *Handbook on Indian Insurance Statistics* from 2013–2014 to 2015–16. The data largely cover Policyholders Account, Balance Sheet and Shareholders Account. The list of all existing life insurance companies along with their registration date and market share on the basis of total premium during 2015–16 is provided in Annexure I. An unbalanced panel data set of 23 firms[2] containing altogether 255 observations is prepared for econometric analysis. Firm-wise summary statistics of cost, output and prices of input variables are presented in Annexure II, III, IV and V, respectively. Annexure VI summarises the data required for estimation. Table 2 presents year-wise summary of cost, output and various prices (average for all firms). During the sample period, the number of firms varies due to the entry of new firm(s). So far as cost and output figures are concerned, more or less they follow increasing trend. The mean of the prices of capital during the sample period is 0.253273 with a standard deviation of 0.073528. The price of labour, however, shows significant fluctuations. The years 2008–09 and 2009–10 witnessed unusually high price of labour especially due to two, among others, new entrants in 2008–09, Canara HSBC OBC Life Insurance Co. Ltd. and Star Union Dai-ichi Life Insurance Co. Ltd. The Canara HSBC OBC Life Insurance Co. Ltd. pursues business with the help of very few corporate agents only and the Star Union Dai-ichi Life Insurance Co. Ltd. does appoint individual agents but those are very few in numbers. These lead to unusual rise in the price of labour. Due to the same reason, the price of labour is high in some other years too.

Table 2: Year Wise Data Base On Cost, Output and Prices of Input Variables: Average for All Firms

(₹ in Lakhs)

Year	*Number of existing firms*	*Cost*	*Output*	*Price of Capital*	*Price of Labour*
2003–04	12	52711	3185570	0.21269	0.327269
2004–05	14	58682.9	3322614	0.182241	5.428674
2005–06	15	64073.6	3533314	0.166003	0.839607
2006–07	16	84911.5	4077154	0.241527	0.452326
2007–08	18	112815.3	4580926	0.236282	0.485727
2008–09	22	117417.8	4310281	0.314244	175.7591
2009–10	23	125728.9	5912454	0.324298	211.3244
2010–11	23	143227.3	6741723	0.380182	96.3755
2011–12	23	128675.6	7241157	0.143573	52.49031
2012–13	23	136651.5	8211816	0.204174	48.59229
2013–14	23	162234.3	9308001	0.24258	54.13789
2014–15	22	165332.6	11317347	0.298266	55.97761
2015–16	21	177813.2	12639633	0.346491	87.45859

Before proceeding to the regression analysis, the stationarity test is undertaken as non-stationary time series may lead to spurious regression results. The present study tests stationarity of dependent and independent variables using Augmented Dicky & Fuller (ADF) test which is based on the following equation:

$\Delta Y_t = \alpha + \beta t + (\rho\text{-}1) Y_{t-1} + \sum_{i=1}^{k} \Phi_i \Delta Y_{t-i} + e_t$ ….(4)

where Y_t is natural logarithmic value of the variable: Δ a is the first difference operator; t denotes time trend; k is the lag length and e_t denotes pure white noise disturbance term. In the present analysis, variables are considered as stationary if the null hypothesis of the existence of unit root is rejected at 5% significance level. The results of ADF test suggest that variables of all 23 companies are integrated to level, i.e., I(0), except the price of labour (W) for the PNB Metlife India Insurance Co. Ltd. and the

[2] Edelweiss Tokio Life Insurance Co. Ltd. has been excluded as number of observations is insufficient for analysis.

cost variable of the Shriram Life Insurance Co. Ltd. The number of observations is reduced for these two companies to store stationarity at level. The 5% probability threshold is considered for this purpose barring the cost data of three companies which are stationary at 10% significance level. Theoretically, co-integration is to be pursued for a set of integrated series. As all the series are stationary at the considered level, co-integration does not exist by definition.

Section III

The translog equation for 22 private life insurance companies and LICI is estimated on the basis of the linear regression method. Though India's insurance sector was liberalised in 1999, the present study is based upon time series from 2003–04 to 2015–16 because of insufficient data during the initial period.

Table 3 presents test statistics for goodness-of-fit like R^2, Adjusted R^2, Mean Square Error (MSE), F-statistics, and Durbin-Watson (dw) statistics for the estimated parameters of the Translog model for the industry as a whole, as also for each of the individual companies. It shows that R^2 and Adjusted R^2 values are very high for the industry and for all the companies, and their standard error ranges from 0.05066 to 0.29618. These statistics, along with high significance levels of F statistics, indicate high goodness-of-fit for those estimations. Insofar as the Durbin-Watson (dw) statistic for auto correlation is concerned, it should be noted that one of the basic assumptions of this statistic is that the regression model includes the intercept term. But as this study does not include intercept term, the conventional DW table does not serve the purpose. For a regression model without intercept, Farebrother (1980) provides minimal bounds in the place of the conventional bounds. The dw statistics indicate that the estimation is not inflicted by the problem of serial correlation.

Table 3: Company-Wise Relevant Statistics for Tranlog Model

Sl. No.	*Name of Life Insurance Companies*	*R-squared*	*Adj. R-squared*	*Mean Squared Error (MSE)*	*F (Sig.)*	*dw*
Entire Industry		0.9999	0.9999	0.11588	42430.7 (0.0000)	2.055289
1	ABLIC (Bajaj Allianz Life Insurance Co. Ltd.)	0.9999	0.9999	0.07972	88365.39 (0.0000)	2.677905
2	BSLIC (Birla Sun Life Insurance Co. Ltd.)	0.9999	0.9997	0.2521	8396.12 (0.0000)	1.94142
3	HSLIC (HDFC Standard Life Insurance Co. Ltd.)	0.9999	0.9999	0.18396	16354.18 (0.0000)	2.247801
4	IPLIC (ICICI-Prudential Life Insurance Co. Ltd.)	0.9999	0.9999	0.17759	18724.63 (0.0000)	2.032324
5	IVLIC (Exide Life Insurance Co. Ltd.)	0.9999	0.9999	0.0795	78134.24 (0.0000)	2.516023
6	LIC (Life Insurance Corporation of India)	0.9999	0.9999	0.0747	(0.0000)	2.366415
7	MNLIC (Max Life Insurance Co. Ltd.)	0.9999	0.9999	0.07838	89358.84 (0.0000)	2.269758
8	MIIC (PNB Metlife India Insurance Co. Ltd.)	0.9999	0.9999	0.16238	17146.86 (0.0000)	3.049206
9	OKMLIC (Kotak Mahindra OM Life Insurance Co. Ltd.)	0.9999	0.9998	0.20586	11727.29 (0.0000)	2.122109
10	SBLIC (SBI Life Insurance Co. Ltd.)	0.9999	0.9999	0.12536	33055.81 (0.0000)	2.193143
11	TALIC (TATA-AIA Life Insurance Co. Ltd.)	0.9998	0.9996	0.28865	6170.83 (0.0000)	1.877767
12	ASAC (Reliance Nippon Life Insurance Co. Ltd.)	0.9998	0.9996	0.29618	6126.22 (0.0000)	1.490647
13	ALIC (AVIVA Life Insurance Co. Ltd.)	0.9999	0.9998	0.21916	9746.92 (0.0000)	1.640804
14	SILIC (Sahara India Life Insurance Co. Ltd.)	0.9999	0.9998	0.19475	8092.87 (0.0000)	1.715531
15	SLICL (Shriram Life Insurance Co. Ltd.)	0.9999	0.9999	0.08053	42076.76 (0.0000)	2.503234
16	BALIC (Bharti AXA Life Insurance Co. Ltd.)	0.9999	0.9999	0.13922	20064.59 (0.0000)	2.554987
17	IDFLIC (IDBI Federal Life Insurance Co. Ltd.)	0.9999	0.9999	0.05066	(0.0000)	1.896511
18	FGILIC (Future Generali Life Insurance Co. Ltd.)	0.9999	0.9997	0.26801	4505.15 (0.0000)	1.875857
19	CHOLIC (Canara HSBC OBC Life Insurance Co. Ltd.)	0.9999	0.9999	0.05263	(0.0000)	2.932644
20	DPLIC (DHFL Pramerica Life Insurance Co. Ltd.)	0.9999	0.9999	0.17057	9460.99 (0.0001)	2.085815
21	ARLIC (Aegon Life Insurance Co. Ltd.)	0.9999	0.9998	0.20725	6829.93 (0.0001)	2.675191
22	SUDLIC (Star Union Dai-ichi Life Insurance Co. Ltd.)	0.9999	0.9999	0.0663	59873.82 (0.0000)	2.873407
23	IFLIC (India First Life Insurance Co. Ltd.)	0.9999	0.9999	0.06477	56914.59 (0.0032)	2.723603

Table 4: Estimated Parameters and Their Relevant Statistics for All Life Insurance Companies

Sl. No.	Name of the Insurance Companies	LnQ			$(LnQ)^2$			LnQlnR			LnWlnQ		
		Coeff.	S.E	t (Sig.)	Coeff.	S.E	t (Sig.)	Coeff.	S.E	t (Sig.)	Coeff.	S.E	t (Sig.)
Entire Industry		0.0776	0.6462	0.12 (0.908)	0.0341	0.0321	1.06 (0.323)	0.5685	0.1506	3.78 (0.007)	-0.3364	0.0942	-3.57 (0.009)
1	ABLIC	–0.2672	0.9537	–1.08 (0.317)	0.0585	0.0359	4.33 (0.003)	–0.3586	0.0549	–9.04 (0.000)	–0.1367	0.0603	–3.19 (0.015)
2	BSLIC	0.9907	0.5848	1.69 (0.134)	–0.0025	0.0342	–0.07 (0.943)	–0.1807	0.4203	–0.43 (0.680)	–0.0562	0.1438	–0.39 (0.708)
3	HSLIC	2.5055	0.7956	3.15 (0.016)	–0.0809	0.0422	–1.92 (0.097)	0.1165	0.0638	1.82 (0.111)	0.2556	0.2073	1.23 (0.257)
4	IPLIC	2.9938	0.8464	3.54 (0.010)	–0.1064	0.0431	–2.47 (0.043)	–0.209	0.0928	–2.25 (0.059)	0.5036	0.2191	2.30 (0.055)
5	IVLIC	1.4902	0.231	6.45 (0.000)	–0.0319	0.0136	–2.34 (0.052)	–0.0208	0.0338	–0.61 (0.558)	–0.0109	0.0652	–0.17 (0.872)
6	LIC	6.5049	1.8434	3.53 (0.010)	–0.2537	0.0816	–3.11 (0.017)	0.2663	0.1094	2.43 (0.045)	1.0039	0.3321	3.02 (0.019)
7	MNLIC	3.1816	0.5162	6.16 (0.000)	–0.1201	0.0283	–4.24 (0.004)	–0.0465	0.032	–1.45 (0.190)	0.3389	0.0967	3.50 (0.010)
8	MIIC	1.3646	0.6026	2.26 (0.064)	–0.0289	0.0328	–0.88 (0.412)	0.1671	0.1487	1.12 (0.304)	–0.0579	0.1115	–0.52 (0.622)
9	OKMLIC	1.6950	0.6804	2.49 (0.042)	–0.8147	0.0415	–1.34 (0.223)	–0.1746	0.1192	–1.46 (0.186)	0.252	0.163	1.55 (0.166)
10	SBLIC	0.9443	0.3809	2.48 (0.042)	–0.0062	0.0202	–0.31 (0.766)	–0.0081	0.0539	–0.15 (0.884)	–0.0334	0.0625	–0.53 (0.610)
11	TALIC	2.0938	0.5404	3.87 (0.006)	–0.0694	0.0305	–2.27 (0.057)	0.1397	0.194	0.72 (0.495)	0.156	0.1322	1.18 (0.277)
12	ASAC	1.3920	0.5939	2.34 (0.052)	–0.0303	0.0358	–0.85 (0.424)	0.0435	0.0849	0.51 (0.624)	0.0504	0.1905	0.26 (0.799)
13	ALIC	2.5371	0.8064	3.15 (0.020)	–0.0972	0.0435	–2.24 (0.067)	–0.505	0.5287	–0.96 (0.376)	0.3407	0.114	2.99 (0.024)
14	SILIC	3.7387	0.5866	6.37 (0.001)	–0.1827	0.0365	–5.01 (0.002)	0.9223	0.3148	2.93 (0.026)	0.2537	0.1136	2.23 (0.067)
15	SHLICL	0.1974	0.1596	1.24 (0.304)	0.0373	0.0107	3.48 (0.040)	0.1535	0.1693	0.91 (0.431)	–0.2422	0.1278	–1.90 (0.154)
16	BALIC	1.3996	0.835	1.68 (0.169)	–0.0392	0.0502	–0.78 (0.479)	0.1479	0.3829	0.39 (0.719)	–0.2195	0.2596	–0.85 (0.446)
17	IDFLIC	0.7058	0.3183	2.22 (0.113)	–0.0012	0.0204	–0.06 (0.958)	1.1529	0.1282	8.99 (0.003)	–0.5289	0.0565	–9.37 (.003)
18	FGILIC	4.5155	0.639	7.07 (0.006)	–0.2202	0.0432	–5.10 (0.015)	1.1986	0.5474	2.19 (0.116)	0.5728	0.3113	1.84 (0.163)
19	CHOLIC	–1.2294	1.4417	– 0.85 (0.484)	0.093	0.0714	1.30 (0.323)	–0.4651	0.3294	–1.41 (0.294)	–0.0641	0.0725	–0.88 (0.470)
20	DPLIC	0.3701	0.7824	0.47 (0.683)	0.0354	0.0491	0.72 (0.54)	0.0289	0.1483	0.19 (0.864)	–0.3298	0.2212	–1.49 (0.274)
21	ARLIC	6.8762	3.9916	1.72 (0.227)	–0.3597	0.2419	–1.49 (0.275)	1.0014	0.644	1.56 (0.260)	1.6955	1.3283	1.28 (0.330)
22	SUDLIC	0.2402	1.0116	0.24 (0.834)	0.0317	0.0554	0.57 (0.625)	0.0333	0.0731	0.46 (0.694)	–0.0897	0.0836	–1.07 (0.396)
23	IFLIC	1.5384	0.8651	1.78 (0.326)	–0.0328	0.0537	–0.61 (0.651)	–0.1718	0.404	–0.43 (0.744)	–0.0265	0.0668	–0.40 (0.759)

Table 4 presents estimated values of the parameters and their relevant statistics for the industry as a whole, and also for individual companies. So far as the LnQ variable is concerned, its significance ranges from 0.000 to 0.064 for 12 companies and, for the rest, from 0.113 to 0.326, excepting for the estimations involving entire industry, CHOLIC, DPLIC and SUDLIC. For the whole industry and these three companies, LnQ is insignificant. For the industry, as also all the companies excepting two, the estimated values of LnQ are positive, but it is negative for LnQ^2 for around 78 percent of the total insurance companies, though positive for the industry as a whole. This variable is highly significant from the view point of t-test mainly for ABLIC, LIC, MNLIC and SILIC with low S.E for all 23 companies and the industry. Similar results are obtained for the joint variable LnQLnR, with low standard error and significant t-statistic for the whole industry and some companies. So far the variable LnWLnQ is concerned, it is significant for the industry as a whole, as also for ABLIC, LIC, MNLIC, ALIC, SILIC and IDFLIC ranging from 0.003 to 0.067. For ABLIC, IPLIC, LIC, MNLIC, ALIC, SILIC and IDFLIC, the t-statistic is significant for most of the variables.

On the basis of estimated parameters, the scale efficiency for the industry and each of the 23 firms has been calculated. While doing so, negative values of scale efficiency scores have been obtained for four companies, ABLIC, IDFLIC, CHOLIC and DPLIC, which are theoretically unacceptable. Hence, these four companies have been left out for further analysis. Scale efficiency of the industry as a whole is worked out at 0.14795311 which indicates that India's life insurance industry enjoys substantial scale economies so that there is enough scope for its further expansion. Table 5 presents the scale efficiency scores for 19 life insurance companies. It shows that scale efficiency measures are less than one for eight companies representing 42% of the total. The values range from 0.1336 to 0.8927. These signify that with the increase in the scale of production, the average cost increases at lower proportions. Hence, they will benefit by increasing the scale of production. On the other side, the rest 58% of total life insurance companies which consist of 11 companies are falling under 'Scale Diseconomies' group and their scale measures vary widely from 1.0733 to 3.6003[3]. LICI also falls under this group. Its exceptionally high scale efficiency score of 6.5225407 may be outcome of internal and external diseconomies. As increase in cost is more than that of the output, they are facing scale diseconomies. No firm is scale efficient, i.e., a score equal to one.

[3] ARLIC has been excluded due to its unusually high scale efficiency score.

Table 5: Scale Efficiency Based on Translog Model

Scale Economies		*Scale Efficient*		*Scale Diseconomies*	
Insurance Companies	*Scale Efficiency*	*Insurance Companies*	*Scale Efficiency*	*Insurance Companies*	*Scale Efficiency*
BSLIC	0.5378321904			HSLIC	2.0864008287
IVLIC	0.8926887508			IPLIC	2.3045994484
MIIC	0.7752450263			LIC	6.5225407
SBLIC	0.6557719138			MNLIC	2.5715803143
SHLICL	0.268630747			OKMLIC	1.3480396576
BALIC	0.1335999545			TALIC	1.530806377
SUDLIC	0.2302814068			ASAC	1.0733157009
IFLIC	0.4957884516			ALIC	1.7449634066
				SILIC	3.6003415834
				FGILIC	3.214636002
				ARLIC	6.5620543078
Total Number of Insurance Companies		Total Number of Insurance Companies			
8 (42%)		0 (0%)		11 (58%)	

For further analysis, insurance companies are classified into three groups on the basis of total assets: small, medium and large. Companies with total assets less than Rs.100 billion are considered as small-sized companies. There are seven companies in this category, SILIC, FGILIC, SHLICL, BALIC, SUDLIC, IFLIC and ARLIC. The medium-sized companies having assets in the range of Rs. 100–350 billion accommodate seven companies, namely, BSLIC, IVLIC, MIIC, OKMLIC, TALIC, ASAC and ALIC, and those with assets more than Rs. 350 billion include five companies, HSLIC, IPLIC, MNLIC, SBLIC and LIC. Table 6 presents this classification along with the mean of scale efficiencies for each group. While calculating average scale efficiency score for small-sized firms, ARLIC and SILIC are excluded as their presence leads to an abrupt hike in average efficiency score.

Table 6: Scale Efficiency Results by Firm Size

Small sized firms (Total Assets ‹ 100 Billion)			*Medium sized firms (100 Billion ‹ Total Assets ‹ 350 Billion)*			*Large sized firms (Total Assets › 350 Billion)*		
Insurance Companies	*Total Assets*	*Scale Efficiency*	*Insurance Companies*	*Total Assets*	*Scale Efficiency*	*Insurance Companies*	*Total Assets*	*Scale Efficiency*
SILIC	13.3068	3.600341583	ALIC	103.7698	1.744963407	MNLIC	376.3109	2.571580314
SHLICL	28.603	0.268630747	IVLIC	109.1072	0.892688751	HSLIC	766.4649	2.086400829
FGILIC	40.7338	3.214636002	MIIC	155.0322	0.775245026	SBLIC	834.2907	0.655771914
BALIC	56.0495	0.133599955	ASAC	170.9029	1.073315701	IPLIC	1047.6625	2.304599448
SUDLIC	62.3242	0.230281407	OKMLIC	175.8097	1.348039658	LIC	21940.7202	6.5225407
IFLIC	94.7616	0.495788452	TALIC	203.8954	1.530806377	Mean of scale efficiency = 2.828179		
ARLIC	34.3331	6.562054308	BSLIC	323.9361	0.53783219			
Mean of scale efficiency = 0.868587*			Mean of scale efficiency = 1.128984					

** Includes five insurance companies i.e. 71.43% of the group*

From Table 6, it is evident that with the increase in asset size, the average scale efficiency of the groups also increases signifying that the scale economies depend upon the asset size. Smaller firms enjoy more scale economies as compared to medium and larger firms. Though the medium-sized firms do not enjoy scale economies, the increase in cost due to the increase in output for these firms is comparatively less than that for large-sized firms.

Scatter plot between scale efficiency scores and total assets, as provided in Fig. 1, represents that scale efficiency of most of the firms is positively associated with total assets barring few like SILIC, FGILIC, BSLIC, SBLIC, etc., which are scattered randomly. Hence, with the increase in total assets firms move towards scale diseconomies.

Section IV

To complement the economic reform initiated in 1991, the Indian insurance industry was liberalised in the year 1999 as per the recommendations of the Malhotra Committee. Among others, one of the elementary objectives behind liberalisation was to foster efficiency. This paper attempts to contribute to this field by ascertaining scale efficiency scores of the industry as a whole and individual life insurance companies during the post-reform period with the help of robust econometric tools.

Scale efficiency score of the industry indicates that the Indian life insurance industry enjoys substantial scale economies and prospect of further expansion is huge. But, so far the individual companies are concerned, the findings portray a diverse picture. Around 58% of total life insurance companies are experiencing scale diseconomies. Hence, an urgent measure needs to be executed either to reduce operating cost by efficient utilisation of factors involved or improve output level by adopting cost effective and well-diversified investment policy. Rest of the firms are enjoying scale economies and have option for expansion. No firm is scale efficient, i.e., efficiency score equals to unity. The empirical findings also highlight positive relationship between asset sizes and scale efficiency scores. Larger firms are experiencing diseconomies of scale whereas smaller firms are enjoying scale economies.

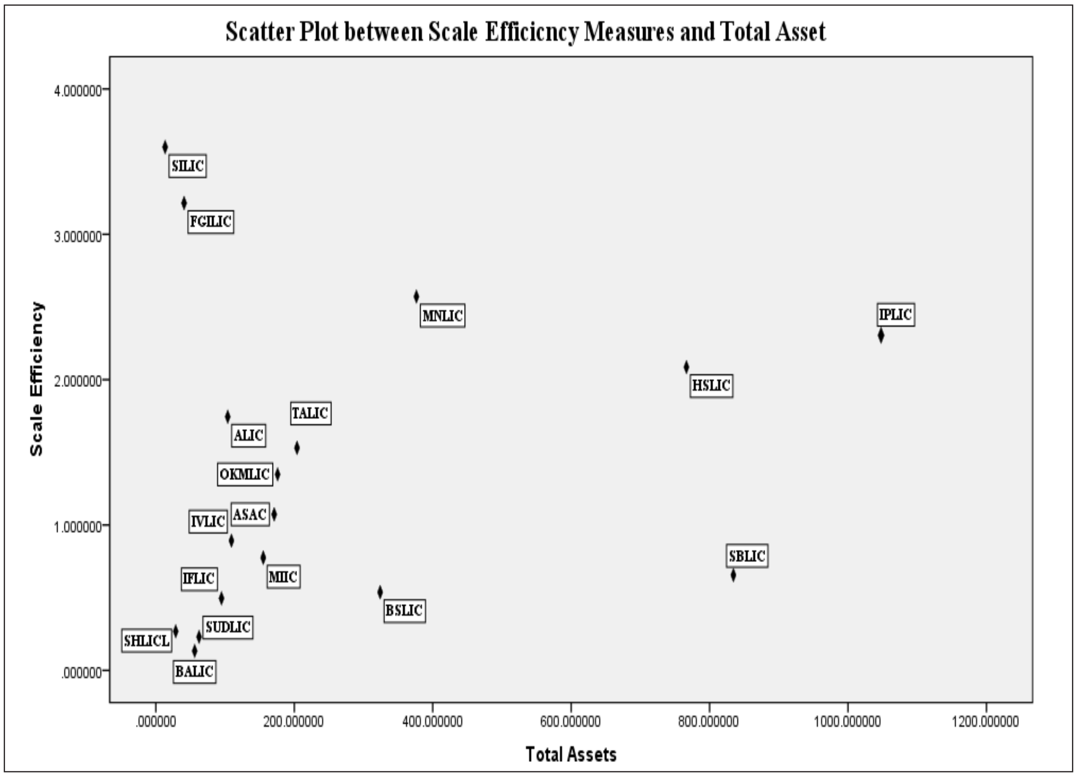

Fig. 1

While interpreting the results, the limitation of comparatively small data set is to be kept in mind. Long time series data lead to more statistically significant results. But as the study is based on post-reform period, we cannot escape this limitation. Nevertheless, the year of inception of different life insurance companies is dissimilar, which leads to different stages of business development. This is one of the major reasons behind different levels of output and asset size. Future research on this topic with larger data set will validate the findings of the present study. Adoption of production approach, profit function, economic cost, and inclusion of other input and output variables are the promising avenues for further research.

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Annexure

Annexure: I

List of Currently Operating Life Insurance Companies in India

Sl. No.	*Name (Abbreviation)*	*Date of Registration*	*Market Share (% based on Total premium)*
1	Bajaj Allianz Life Insurance Co. Ltd. (ABLIC)	03.08.2001	1.6071
2	Birla Sun Life Insurance Co. Ltd. (BSLIC)	31.01.2001	1.5206
3	HDFC Standard Life Insurance Co. Ltd. (HSLIC)	23.10.2000	4.4456
4	ICICI-Prudential Life Insurance Co. Ltd. (IPLIC)	24.11.2000	5.2227
5	Exide Life Insurance Co. Ltd. (formerly ING Vysya) (IVLIC)	02.08.2001	0.5578
6	Life Insurance Corporation of India (LIC)	01.09.1956	72.6118
7	Max Life Insurance Co. Ltd. (MNLIC)	15.11.2000	2.5116
8	PNB Metlife India Insurance Co. Ltd. (MIIC)	06.08.2001	0.7706
9	Kotak Mahindra OM Life Insurance Co. Ltd. (OKMLIC)	10.01.2001	1.0824
10	SBI Life Insurance Co. Ltd. (SBLIC)	29.03.2001	4.3128
11	TATA-AIA Life Insurance Co. Ltd. (TALIC)	12.02.2001	0.6756
12	Reliance Nippon Life Insurance Co. Ltd. (formely AMP Sanmar) (ASAC)	03.01.2002	1.1986
13	AVIVA Life Insurance Co. Ltd. (ALIC)	14.05.2002	0.4069
14	Sahara India Life Insurance Co. Ltd. (SILIC)	06.02.2004	0.0428
15	Shriram Life Insurance Co. Ltd. (SHLICL)	17.11.2005	0.2785
16	Bharti AXA Life Insurance Co. Ltd. (BALIC)	14.07.2006	0.3293
17	IDBI Federal Life Insurance Co. Ltd (IDFLIC)	19.12.2007	0.3378
18	Future Generali Life Insurance Co. Ltd. (FGLIC)	04.09.2007	0.1615
19	Canara HSBC OBC Life Insurance Co. Ltd (CHOLIC)	08.05.2008	0.5614
20	DHFL Pramerica Life Insurance Co. Ltd (DPLIC)	27.06.2008	0.2508
21	Aegon Life Insurance Co. Ltd. (ARLIC)	27.06.2008	0.1367
22	Star Union Dai-ichi Life Insurance Co. Ltd (SUDLIC)	26.12.2008	0.3563
23	India First Life Insurance Co. Ltd. (IFLIC)	05.11.2009	0.5362
24	Edelweiss Tokio Life Insurance Co. Ltd. (ETLIC)	10.05.2011	0.0845

Source: Handbook on Indian Insurance Statistics 2015-16

Annexure: II

Firm Wise Summary Statistics of Cost

(₹ in Lakhs)

Sl. No.	*Name of Life Insurance Companies*	*Number of Observations*	*Mean*	*Maximum*	*Standard Deviation*	*Minimum*
1	ABLIC (2004-2016)	13	121138.3	200434	61023.71	13237
2	BSLIC (2004-2016)	13	80455.81	132675	43741.8	14446
3	HSLIC (2004-2016)	13	110285.4	187183.1	58878.62	9817
4	IPLIC (2004-2016)	13	173890.3	291994	83178.88	28728
5	IVLIC (2004-2016)	13	40080.57	65633.37	16272.02	9891
6	LIC (2004-2016)	13	1317128	2376070	686072.2	504233
7	MNLIC (2004-2016)	13	98811.28	160896	50413.04	16273
8	MIIC (2004-2015)	12	42557.92	68199	22789.88	4465

Sl. No.	Name of Life Insurance Companies	Number of Observations	Mean	Maximum	Standard Deviation	Minimum
9	OKMLIC (2004-2016)	13	45429.67	79412.74	23252.37	8984
10	SBLIC (2004-2016)	13	71630.99	145812.9	45864.61	5735
11	TALIC (2004-2016)	13	57424.09	107119	30950.25	11504
12	ASAC (2004-2016)	13	104437.5	192297	64864.61	5219
13	ALIC (2005-2016)	12	48091.4	77390	19199.89	14357
14	SILIC (2005-2016)	12	2907.539	4026	1294.242	177
15	SLICL (2006-2014)	9	9856.778	18677	6331.763	659
16	BALIC (2007-2016)	10	47805.8	66071	17388.81	8607
17	IDFLIC (2008-2016)	9	16478.44	22594.97	6650.28	1004
18	FGILIC (2008-2016)	9	27975.13	46047	12418.62	3309
19	CHOLIC (2009-2016)	8	23546.5	27332.96	4283.213	14893
20	DPLIC (2009-2016)	8	20111.04	34298.31	9808.333	4055
21	ARLIC (2009-2016)	8	28502.96	40631	7331.498	16213
22	SUDLIC (2009-2016)	8	15210.24	25944.89	8153.995	2436
23	IFLIC (2010-2016)	7	17312.71	22894	5518.909	6822

Annexure: III

Firm Wise Summary Statistics of Output

(□ in Lakhs)

Sl. No.	Name of Life Insurance Companies	Number of Observations	Mean	Maximum	Standard Deviation	Minimum
1	ABLIC (2004-2016)	13	2645660.88	5061666	1987498.3	25980
2	BSLIC (2004-2016)	13	1573124.93	3535424	1220983.27	62850
3	HSLIC (2004-2016)	13	2831776.1	7925186	2779854.14	49643
4	IPLIC (2004-2016)	13	5279055.75	11660043	3963059.47	161447
5	IVLIC (2004-2016)	13	462192.421	994298.47	360612.189	9712
6	LIC (2004-2016)	13	112057658	216611579	59475273.2	37780487
7	MNLIC (2004-2016)	13	1368931.79	3709487.38	1317297.87	25461
8	MIIC (2004-2015)	12	554780.667	1471642	521690.066	12140
9	OKMLIC (2004-2016)	13	750189.788	1769027	621189.206	20315
10	SBLIC (2004-2016)	13	3392111.27	8279663.5	3076354.13	39806
11	TALIC (2004-2016)	13	1017033.6	2341091	835478.103	28099
12	ASAC (2004-2016)	13	1090417.52	2049093	887598.656	10896
13	ALIC (2005-2016)	12	581087.477	1054439	367519.665	29332
14	SILIC (2005-2016)	12	78891.8333	124711	46775.5275	14257
15	SLICL (2006-2014)	9	126300.667	210108	85087.7001	12978
16	BALIC (2007-2016)	10	170016.7	361661	125353.085	12075
17	IDFLIC (2008-2016)	9	254975.904	489715.14	171600.006	15801
18	FGILIC (2008-2016)	9	161290.791	297868	109573.06	14106
19	CHOLIC (2009-2016)	8	583383.669	1162574	413842.087	51873
20	DPLIC (2009-2016)	8	70829.6163	209947.93	75376.1867	8174
21	ARLIC (2009-2016)	8	103814.701	197554	69305.2586	7577
22	SUDLIC (2009-2016)	8	326368.845	600201.76	222608.151	13409
23	IFLIC (2010-2016)	7	471615.494	931543.46	366682.521	50745

Annexure: IV

Firm Wise Summary Statistics of the Price of Input Variable: Price of Capital (□)

Sl. No.	Name of Life Insurance Companies	Number of Observations	Mean	Maximum	Standard Deviation	Minimum
1	ABLIC (2004-2016)	13	1.626722	5.009356	1.74695	0.058961
2	BSLIC (2004-2016)	13	0.036079	0.07815	0.022228	0.015298
3	HSLIC (2004-2016)	13	0.040009	0.100723	0.027462	0.017033
4	IPLIC (2004-2016)	13	0.134415	0.418608	0.15022	0.012108
5	IVLIC (2004-2016)	13	0.023985	0.052294	0.011713	0.011392
6	LIC (2004-2016)	13	2.492908	6.752	2.323046	0.3183
7	MNLIC (2004-2016)	13	0.057311	0.141004	0.049135	0.009912
8	MIIC (2004-2015)	12	0.023161	0.04775	0.010405	0.008778
9	OKMLIC (2004-2016)	13	0.076447	0.214486	0.063112	0.021674
10	SBLIC (2004-2016)	13	0.123187	0.31779	0.089514	0.032829
11	TALIC (2004-2016)	13	0.032585	0.08432	0.021816	0.006134
12	ASAC (2004-2016)	13	0.060553	0.131453	0.046772	0.013497
13	ALIC (2005-2016)	12	0.026507	0.043359	0.009762	0.012553
14	SILIC (2005-2016)	12	0.081213	0.168578	0.034333	0.035431
15	SLICL (2006-2014)	9	0.102851	0.1532	0.040163	0.02888
16	BALIC (2007-2016)	10	0.013771	0.038733	0.011389	0.006718
17	IDFLIC (2008-2016)	9	0.033976	0.046288	0.009475	0.019224
18	FGILIC (2008-2016)	9	0.017597	0.028108	0.006914	0.008698
19	CHOLIC (2009-2016)	8	0.034696	0.05925	0.015741	0.013971
20	DPLIC (2009-2016)	8	0.071326	0.171951	0.060969	0.024663
21	ARLIC (2009-2016)	8	0.010579	0.023433	0.005803	0.005822
22	SUDLIC (2009-2016)	8	0.074795	0.11632	0.033251	0.0208
23	IFLIC (2010-2016)	7	0.065629	0.078154	0.014481	0.0351

Annexure: V

Firm Wise Summary Statistics of the Price Of Input Variable: Price of Labour (□ in Lakhs)

Sl. No.	Name of Life Insurance Companies	Number of Observations	Mean	Maximum	Standard Deviation	Minimum
1	ABLIC (2004-2016)	13	0.321953	0.596932	0.173893	0.087292
2	BSLIC (2004-2016)	13	0.51099	2.360183	0.586472	0.197001
3	HSLIC (2004-2016)	13	0.483875	0.955876	0.292552	0.204164
4	IPLIC (2004-2016)	13	0.354276	0.518725	0.095156	0.224561
5	IVLIC (2004-2016)	13	0.32	0.450468	0.090498	0.145025
6	LIC (2004-2016)	13	0.964403	1.457801	0.310995	0.52149
7	MNLIC (2004-2016)	13	1.222014	1.81259	0.45827	0.499649
8	MIIC (2004-2015)	12	0.522888	0.941898	0.211037	0.210576
9	OKMLIC (2004-2016)	13	0.446143	1.307124	0.270485	0.285036
10	SBLIC (2004-2016)	13	1.138267	2.789657	0.701363	0.401615

Sl. No.	Name of Life Insurance Companies	Number of Observations	Mean	Maximum	Standard Deviation	Minimum
11	TALIC (2004-2016)	13	0.344062	0.679747	0.160791	0.12571
12	ASAC (2004-2016)	13	0.21879	0.398634	0.100471	0.071794
13	ALIC (2005-2016)	12	0.590288	1.202671	0.245056	0.392807
14	SILIC (2005-2016)	12	6.016727	66	18.93865	0.068177
15	SLICL (2006-2014)	9	0.45075	0.889324	0.279726	0.062164
16	BALIC (2007-2016)	10	0.223426	0.404834	0.115658	0.045271
17	IDFLIC (2008-2016)	9	0.666134	1.032224	0.316726	0.131673
18	FGILIC (2008-2016)	9	0.20068	0.363636	0.077441	0.090176
19	CHOLIC (2009-2016)	8	2039.988	4067.4	1153.03	1100.4
20	DPLIC (2009-2016)	8	0.464723	1.317413	0.397059	0.069565
21	ARLIC (2009-2016)	8	0.268423	0.434336	0.112651	0.09456
22	SUDLIC (2009-2016)	8	55.01364	338	115.922	1.032175
23	IFLIC (2010-2016)	7	106.1085	728	274.2438	0.724619

Annexure: VI

Data Base for the Estimation, Average Over the Sample Period: Number of Agents, Commission, Income From Investments and Share Capital

Sl. No.	Name of Life Insurance Companies	Number of Observations	Number of Agents (in Lakhs)	Commission (□ in Lakhs)	Income from Investment (□ in Lakhs)	Share Capital (□ in Lakhs)
1	ABLIC (2004-2016)	13	147068.2	52252.66308	24513.5385	15047.31
2	BSLIC (2004-2016)	13	92422.31	27647.46846	5804.07692	142362.5
3	HSLIC (2004-2016)	13	94860.23	40558.18154	6249.15385	146135.6
4	IPLIC (2004-2016)	13	158694.5	53297.05231	18991.5385	130256.6
5	IVLIC (2004-2016)	13	35836.54	10273.55077	2609.07692	108248.3
6	LIC (2004-2016)	13	1188492	1148596.122	2438.92308	4153.846
7	MNLIC (2004-2016)	13	35896.54	43588.94308	10123.3077	140526.1
8	MIIC (2004-2015)	12	25937.08	13900.66667	2434.58333	127113.8
9	OKMLIC (2004-2016)	13	34586.85	12880.65231	3614	42302
10	SBLIC (2004-2016)	13	47628.92	41637.67308	10896.9231	80384.62
11	TALIC (2004-2016)	13	53783.77	15652.15	4636.46154	135195
12	ASAC (2004-2016)	13	112675.2	28633.59923	6113.30769	92263.15
13	ALIC (2005-2016)	12	21000.42	11287.33167	4230.5	149593.3
14	SILIC (2005-2016)	12	10305.5	1454.3325	1769.75	21318.67
15	SLICL (2006-2014)	9	11296.56	4215.555556	1535.44444	14722.22
16	BALIC (2007-2016)	10	17734	4203.7	1233.2	137471.9
17	IDFLIC (2008-2016)	9	7905.556	5817.513333	2224.88889	64397.33
18	FGILIC (2008-2016)	9	27872.56	5276.534444	1642.55556	104650
19	CHOLIC (2009-2016)	8	4.625	9241.82875	2632.5	77500
20	DPLIC (2009-2016)	8	3725.125	1659.195	2333.75	29575
21	ARLIC (2009-2016)	8	6857.75	1890.0025	913.125	101349.3
22	SUDLIC (2009-2016)	8	3146.5	5731.5	1843.875	23750
23	IFLIC (2010-2016)	7	2222.286	2904.485714	2943.42857	43571.43