

PERFORMANCE EVALUATION OF LIFE INSURANCE COMPANIES IN INDIA: AN APPLICATION OF DEA MODEL

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Last few years have seen insurance re-evaluating their operating models, modifying products to bring them in line with new regulations, increasing their focus on customer needs and being more efficient. The issue of efficiency is the key concern in the insurance sector. Efficiency measurement helps to identify the inefficient and efficient insurers in the market to improve competition, profitability and confidence of the policyholders and the way to improve the performance of the life insurers. For this reason, an attempt has been made to measure the performance efficiency of life insurance companies in India with the help of Data Envelopment Analysis. The efficiency of twelve life insurance companies in India has been measured during the period of 2008-09 to 2012-13. Variables taken for the study include equity capital and labor (Commission Expenses) as inputs and net premium as output.

Key words: Data Envelopment Analysis, Efficiency, Life Insurance

INTRODUCTION

Insurance is a risk transfer mechanism whereby the individuals or the business enterprise can shift some of the uncertainties of life on the shoulder of the other. All the people will desire to live a cleaner, healthier and comfortable life. A small error or lapse may cause many side effects and cause death or disability.

To meet this requirement different enterprises (especially insurance companies) produce and provide goods and services, make innovations and inventions, while assuming far greater risk. In India, insurers in general and LIC in particular act as a major financial intermediary and contribute to the development of savings and capital market. Life insurance is a long-term and capital intensive business with a long break-even period, about a decade or so. Most private players have accumulated losses, not due to

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inefficiency but due to the nature of this business. Over the past few years the Indian life insurance industry has undergone de-growth and market consolidation despite being one of the top 10 insurance markets in the world. India, given its demography, has always been an attractive market for global insurers who have always been keen to expand their business in the country. The FDI limit for insurance in India is among the lowest globally. China, Indonesia and Malaysia have an FDI limit of 50, 80 and 51 per cent respectively. Japan, South Korea, Vietnam, Hong Kong and Taiwan allow 100 per cent FDI. Insurance education helps a consumer to understand their needs and risks, ascertain availability of insurance for managing risks, appreciate their value of possessing an insurance product and to know about the do's & don'ts before and after purchase of an insurance policy (IRDA Annual Report 2012-13)¹. IRDA, as insurance sector regulator, has been playing a pro-active role in promoting insurance education since its inception and has adopted multi-pronged approach to enhance consumer awareness on various tenets of insurance. IRDA's strategy of publicity and consumer education has been encompassing both in-house programmes and supporting/sponsoring external programmes and encouraging all stakeholders to promote insurance awareness among the public by stepping up its efforts for insurance education.

REVIEW OF LITERATURE

Aleng (2013) measured the relative efficiency of 13 life insurance companies in Malaysia from 2007 to 2009. Study used SFA to panel data which includes variable like total profits of the company, net investment income, total liabilities and assets of the company, management expenses, annual premium, net claims paid by the company. The positive improvement show that the insurance industry has been in high demand among the people. According to the rank of efficiency included in the study will help people in selecting and evaluating life insurance companies that have good performance and also help management and administration of insurance firms involved in marketing and improves the weaknesses such as formulating business strategy to attract customers who can benefit the firm. **Barros & Obijaku** (2007) analyzed the technical efficiency of ten Nigerian insurance companies with aid of four DEA models DEA-CCR, DEA-BCC, Cross efficiency DEA model, super efficiency DEA model. The DEA-CCR and BCC model were strong in identifying efficient units but they could not discriminate between the inefficient units, so to overcome this deficiency cross efficiency DEA model was used. Insurance production was measured according to generalized Cobb-Douglas

production function. Outputs were net premium, settled claims, outstanding claims, investment income. Inputs were total capital, total operative costs, total number of employees, total investment. Results found that Nigerian companies were managed with pure technical efficiency and for technically inefficient insurance companies; there is room to upgrade their efficiency level by means of reference to the frontier of best practice. **Bikker and Leuvenstey** (2008) investigated efficiency and competitive behavior of the Dutch Life insurance market by using Translog Cost Function (TCF). To measure the competition, they have used four different empirical aggregate indicators i.e. average profit margins, scale economies, X-inefficiencies, and the boon indicator. The results proved that supplier power is limited due to large number of insurance firms and consumer power is limited due to opaque nature of many life insurance products. Secondly, competitive pressure in the insurance market has so far been insufficient to force insurance firms to exploit these existing scale economies. **Chen, Power and Qiu** (2009) evaluated the efficiency of life insurers operating in china and compared foreign firms with domestic firms. The basic idea of DEA is to construct a frontier that reflects optimal production. Output indicators used in the study were annuity; savings related life and health and invested assets. Inputs were equity capital, number of employees and agents, material and other related costs. Results concluded that foreign insurers tend to manifest greater efficiency than domestic insurers and therefore must increase their efficiency in Chinese market. Foreign insurers should focus on scale economy for future development. Controlling inputs, as opposed to outputs is more important for inefficient insurers. In short greater competition caused mainly by the entry of foreign insurers likely caused both increased and decreased in firm efficiency. **Nandi** (2014) evaluated relative efficiency of 13 life insurance companies with the help of DEA for the period of 2002-03 to 2011-12. Two basic DEA models namely CCR- for constant returns to scale and BCC for Variable returns to scale have been applied to estimate the relative efficiency. Results showed that life insurers carrying life business at an average technical efficiency of 82.6 %, pure technical efficiency 87.5 % and scale efficiency of 94.7%. Moreover they have found diverse trends of improvement direction and space over a period of time. **Rahman** (2013) analyzed the sources of efficiency and technical changes in both life and non-life Takaful companies in Bangladesh by using Non-Parametric approach of DEA together with Malmquist Index. Study isolate the contributions of technical change, efficiency change the pure and the scale changes to total factor productivity growth of different life and non life Takaful operators in Bangladesh. The data of 17 companies 3 Takaful life operators and 10 life insurers has been considered for efficiency analysis in this study. Inputs taken for the study was commission expenses and outputs were premium and net

investment income. The Total Factor Productivity of the takaful life insurance industry is mainly due to both efficiency and technical change where the main source of the efficiency change is pure efficiency rather than scale efficiency. So this work shows despite having potentiality, but due to inefficient operators life insurance companies cannot gain success in this country. **Saad and Idris** (2011) study focused on the performance of insurance industry in Malaysia and Brunei by making compassion on the efficiency of life insurance companies in the Malaysia and Brunei for the year 2000-2005 by using DEA. In DEA technical efficiency is measured by Malmquist index. The study utilized two inputs namely commission agents and management expenses and two outputs namely premium and net investment income. Findings indicated that the bigger the size of the company, the higher the profitability for the companies to be more efficient in utilizing their inputs to generate ore outputs. **Sabet and Fadavi** (2013) measured the performance of insurance firms which were active in Iran over the period of 2006-2010 with the help of two stage data envelopment analysis. The study measured the relative efficiencies over the period of 2006-2010. Firstly they have calculated the firm independently at two stages and then multiply this number together to get the overall efficiency. The average efficiency of insurance firms in all years was relatively low which means limited number of units dominated the market compared with other insurance firms. The results of the survey indicated that while there were four efficient firms most other firms were noticeably inefficient. This means that market was monopolized mostly by a limited number of insurance firms and competition was not fair enough to let other firms participated in economy more efficiently. **Sinha** (2007) author examined the performance of life insurance companies from the period of 2003 to 2006 by using radial data envelopment analysis. Also the study focused upon the sale of new life insurance policies, market share and market trend its growth. Efficiency has been checked by taking into account operating income and the net premium income of the observed life insurance companies as output factors and number of agents employed by the company and equity capital as inputs. Findings revealed that mean technical efficiency has improved in 2003-04 in relation to 2002-03. In 2004-05 it remained as the same level. In 2005 it started declining. The study proved an indication of the wide opportunities that the insurers have store for them. **Yang** (2006) assessed the impact of operating and business strategies on the Canadian life and health assurance industry. Two approaches have been used to obtain a different aspect of efficiency measures, this research proposed a new two stage DEA-model which integrate the production performance and investment performance and consider compromise between these two aspects for Canadian life and health insurance industry. Inputs were labour expenses, general operating expenses, capital, equity and

claims incurred and two outputs were premium underwritten and net income to evaluate the production performance. It can be concluded that BCC model identified technical efficiency of 76% and 52% on average for the production model and investment model respectively. **Borges et al** (2008) analyzed the technical efficiency of Greek life insurance companies from 1994 to 2003 with DEA models. Inputs include labor cost, non labor cost, equity capital and output factors were invested assets, and losses incurred, reinsurance reserves. The VRS methodology was preferred because author assumed that there was strong disposability of inputs and outputs was assumed, technical efficiency can be decomposed into two different components pure technical efficiency and scale efficiency. Thus, it was suggested that Greek life insurance companies reflect average management quality, when pure technical efficiency is concerned; therefore the life insurance sector was in great need of consolidation in order to increase the scale of operations. **Jeng and Lai** (2008) examined the impact of deregulation and Liberalization on the efficiency of the life insurance industry. Author compared the efficiency performance of old domestic firms to that of new firms in three stages pre D&L (before 1987) and foreign entry period (1988-1993) post D&L (1994-2004). Inputs used were home office labor, Agent labor, and business service and equity capital. Outputs include benefit payment. Both DEA and Malmquist index results show that the old domestic firms have been slightly impacted by the new competitors around 1992-1994. However existing firms cope with new challenges well. It became important to treat new firms as one group and also old domestic firms as another group when examining their efficiency differences. Results suggested that any new entrant into the market should acquire an old firm rather than establish a new one because it took longer for new firm to establish the distribution system and business connections in the new market.

DATABASE AND RESEARCH METHODOLOGY

Performance measurement is one of the most important issues among the insurance firms and there are many studies focusing on measuring the efficiencies of insurance firms in this sector (Barros et al., 2010ⁱⁱ; Cummins and Xie, 2008ⁱⁱⁱ). So in this study an attempt has been made to evaluate the efficiency of life insurance companies in India. The study covers the period of 5 years from 2008-09 to 2012-13. Data have been taken from annual reports of the respective life insurance companies, IRDA Annual Reports and Statistical year book of Insurance. The companies which are taken into consideration for the purpose of analysis are: Bajaj Allianz Life Insurance Company, Reliance Life Insurance Company, Aviva Life Insurance Company, Birla Sun Life

Insurance Company, HDFC Standard Life Insurance Company, ICICI Prudential Life Insurance Company, Max New York Life Insurance Company, Life Insurance Corporation of India, Met Life Insurance Company, ING Vysya Life Insurance Company, Om Kotak Life Insurance Company, SBI Life Insurance Company.

There are two kinds of methods to calculate productivity: a) Stochastic Frontier Analysis, which is parametric and b) DEA which is non-parametric. The two alternative approaches have different strength and weaknesses. The main advantage of DEA is that it does not require any information more than input-output quantities. The efficiency is measured relative to the highest observed performance rather than an average. However, a DEA based estimate is sensitive to measurement errors or otherwise in the data because DEA is deterministic and attributes all deviations from the frontier to inefficiencies. The strength of SFA is that it considers stochastic noise in data and also allows for the statistical testing of hypothesis concerning production structure and degree of inefficiency. Its main weaknesses are that it requires an explicit imposition of a particular parametric functional form representing the underlying technology and also an explicit distributional assumption for the inefficiency terms. The rationale for using two competing approaches is to countercheck whether results obtained by one can be confirmed by the other. Therefore, in this paper Data Envelopment Analysis technique has been used to evaluate the efficiency of life insurance companies in India.

Data Envelopment Analysis technique is a Linear Programming technique that measures the relationship of produced goods and services (outputs) to assign resources (inputs). DEA determines the efficiency scores as an optimization result. DEA models can be specified under the assumption of Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS) and can be decomposed cost efficiency into single components – Technical, Pure Technical, and Scale efficiency. Technical efficiency relates to the productivity of inputs. The TE of a firm is comparative measure of how well it actually processes inputs to achieve its outputs, as compared to its maximum potential for doing so, as represented by its production possibility frontier (Barros and Mascarenhas, 2005^{iv}). A measure of technical efficiency under the assumption of Constant Returns to scale is known as a measure overall technical efficiency (OTE). The OTE measure helps to determine inefficiency due to the input/output configuration as well as size of operations. In DEA, OTE measure has been decomposed into two mutually exclusive and non-additive components PTE and SE. This decomposition allows an insight into the sources of inefficiencies. The PTE measure is obtained by estimating the efficient frontier under the assumption of VRS. It is a measure of

Technical efficiency without scale efficiency and purely reflects the managerial performance to organize the inputs in the production process. Thus, PTE measure has been used as an index to capture managerial performance. The ratio of Overall Technical Efficiency over Pure Technical Efficiency proves Scale Efficiency measure. The measure of Scale Efficiency provides the ability of the management to choose the optimum size of resources i.e. to decide on the banks size or in other words, to choose the scale of production that will attain the expected production level. Inappropriate size of a firm (too large or too small) may sometimes be a cause of technical efficiency. This is referred as scale inefficiency and takes two forms: Decreasing returns to scale and increasing returns to scale. DRS imply that a firm is too large to take full advantage of scale size. In contrast, a firm experiencing IRS is too small for its scale of operations, thus, operates at sub optimum scale size. A firm is efficient if it operates at constant returns to scale.

Method of Selection of Input and Output Variables

There are three main insurance inputs labor, Material and Capital. Labor can be further divided into agent and home office labor. The category of business service and materials is usually not further sub divided, but includes items like travel, communication, and advertising. And, at least three categories of capital can be distinguished: Physical, Debt and Equity Capital. (Ram Pratap Sinha, 2007^v).

Measurement of Output

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

a) The Asset Approach, b) The user Cost Approach, c) The value Added Approach

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

The **User cost approach** was developed by Hancock (1985). It determines whether a financial product is an input or an output by analyzing if its net contribution to the revenues of an insurance company is positive or negative. According to that, a product is

considered an output, if its financial return exceeds the opportunity cost. Otherwise the financial product would be classified as an input. This method would require precise information on product revenues and opportunity costs which cannot be obtained for the Indian life insurance firms.

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. The remaining categories are treated as rather unimportant outputs, intermediation products, or inputs. An important advantage compared to the user cost approach consists in the fact that the value added approach uses operating costs data rather than determining the costs implicitly or using opportunity costs. The value added approach is considered to be the most appropriate method to measuring output of financial firms and is widely used in recent insurance studies.

On the basis of value added approach and considers two output proxies: Benefit paid to the customer and Net premium mobilized by the insurance companies. So Net Premium is taken as the output indicator for the study.

The variables of inputs which are considered under the present study are as:

Equity capital (x1): Cummins/Tennyson/Weiss, 1999^{vi}) have defined capital into three categories Physical, Debt and equity Capital. Physical capital is often included in the business service and material category, but debt and equity capital are important inputs for which adequate cost measures have to be found. The choice of inputs is mainly determined by the data that are publicly available in the countries. In this study equity share capital has taken as the first indicator of input.

Labor (x2): As the insurance companies, do not constitute the part of the manufacturing industries rather form a part of the financial service industry, so it does not uses raw material as primary input. In financial service industry the cost of labor is the most important input. The main difficulty regarding this input is to get salary data of insurers, which is not feasible. So, amount of commission as the second indicator of input.

The variables of outputs which are considered under the present study are as:

Premium (y1): The choice of output indicator has been controversial in the insurance

literature. Premium is to insurers what income to manufacturers, and therefore, that insurance premium should be regarded as the principal indicator of output. In general, insurance outputs can be measured by premium revenues, benefits and claims costs and investment income. The argument is that the objective in efficiency analysis is output maximization whereas normal practice for an insurance company is to minimize insurance claims. (Dutta and Sengupta(2011^{vii})).

Data Analysis and Interpretation

Table 1 Showing Company-Wise Analysis of Life Insurance Companies

Bajaj Allianz Insurance					
Indicator	2008-09	2009-10	2010-11	2011-12	2012-13
TE	0.63	0.743	0.936	1	1
PTE	1	1	1	1	1
SE	0.633	0.743	0.936	1	1
R to S	Increasing	Increasing	Increasing	-	-
Reliance Life Insurance					
Indicators	2008-09	2009-10	2010-11	2011-12	2012-13
TE	0.382	0.425	0.425	0.538	0.505
PTE	0.561	0.551	0.535	0.538	0.514
SE	0.68	0.771	0.795	0.999	0.982
R to S	Increasing	Increasing	Increasing	Increasing	Increasing
Aviva Life Insurance					
Indicators	2008-09	2009-10	2010-11	2011-12	2012-13
TE	0.598	0.548	0.728	0.985	0.827
PTE	0.088	0.913	0.908	1	1
SE	0.679	0.600	0.802	0.985	0.827
R to S	Increasing	Increasing	Increasing	Increasing	Increasing
Birla Sun Life Insurance					
Indicators	2008-09	2009-10	2010-11	2011-12	2012-13
TE	0.433	0.389	0.468	0.69	0.706
PTE	0.535	0.481	0.528	0.706	0.712
SE	0.808	0.809	0.886	0.979	0.992
R to S	Increasing	Increasing	Increasing	Decreasing	Increasing

HDFC					
Indicators	2008-09	2009-10	2010-11	2011-12	2012-13
TE	0.597	0.486	0.592	0.684	0.72
PTE	0.671	0.562	0.623	0.695	0.898
SE	0.89	0.865	0.95	0.985	0.802
R to S	Increasing	Increasing	Increasing	Decreasing	Decreasing
ICICI Prudential Life Insurance					
Indicators	2008-09	2009-10	2010-11	2011-12	2012-13
TE	1	1	1	0.909	0.720
PTE	1	1	1	0.961	0.958
SE	1	1	1	0.946	0.751
R to S	Constant	Constant	Constant	Decreasing	Decreasing
Ing Vysya Life Insurance					
Indicators	2008-09	2009-10	2010-11	2011-12	2012-13
TE	0.596	0.496	0.41	.484	0.603
PTE	1	1	0.836	0.786	0.939
SE	0.596	0.496	0.491	.616	0.642
R to S	Increasing	Increasing	Increasing	Increasing	Increasing
Life insurance Corporation of India					
Indicators	2008-09	2009-10	2010-11	2011-12	2012-13
TE	1	1	1	1	1
PTE	1	1	1	1	1
SE	1	1	1	1	1
R to S	Constant	Constant	Constant	Constant	Constant
Max New York Life Insurance					
Indicators	2008-09	2009-10	2010-11	2011-12	2012-13
TE	0.449	0.421	0.338	0.417	0.44
PTE	0.57	0.538	0.392	.042	0.44
SE	0.787	0.782	0.862	0.993	0.999
R to S	Increasing	Increasing	Increasing	Decreasing	Increasing
Met Life Insurance Company					
Indicators	2008-09	2009-10	2010-11	2011-12	2012-13
TE	0.26	0.316	0.901	0.863	0.81
PTE	0.49	0.518	1	0.869	0.908

SE	0.531	0.611	0.901	0.993	0.892
R to S	Increasing	Increasing	Increasing	Increasing	Increasing
Om Kotak Life Insurance Company					
Indicators	2008-09	2009-10	2010-11	2011-12	2012-13
TE	0.474	0.623	0.717	1	0.963
PTE	1	1	1	1	1
SE	0.474	0.623	0.717	1	0.963
R to S	Increasing	Increasing	Increasing	Increasing	Decreasing
SBI Life Insurance Company					
Indicators	2008-09	2009-10	2010-11	2011-12	2012-13
TE	0.703	0.662	0.773	1	0.831
PTE	0.859	0.768	0.804	1	1
SE	0.818	0.862	0.962	1	0.831
R to S	Increasing	Increasing	Increasing	Increasing	Increasing

Table 1 depicts company-wise efficiency analysis of life insurance companies in India. Technical, Pure Technical and Scale efficiency of all the twelve life insurance companies has been shown for the period of 2008-09 to 2012-13. Bajaj Allianz showed an increasing trend of efficiency in the first three years i.e. 2008-09 to 2010-11 and subsequently achieved the efficient frontier w.e.f 2011-12 (The companies that lie on efficient frontier mean that they are operational on optimal scale). In case of Reliance Life insurance, technical efficiency has shown a mixed trend but in case of scale efficiency an upward trend has been reported, which shows that company has sufficient resources or inputs to attain desirable outputs. Aviva is performing better than reliance life in terms of technical efficiency. However, its scale efficiency is quite low. Birla Sun Life reported very weak technical but high scale efficiency. ICICI Prudential life insurance is fully efficient during the three out of five year's period under study. Results also showed that LIC is the fully efficient company in all the five years. Also, it has been found that there are four inefficient companies which do not lie on the efficient frontier in any year i.e. Reliance, HDFC, Max New York and Birla Sun Life. This proves LIC being the only public sector company holding its position tightly and lying on the efficient frontier in all the years as against private sector companies. In short, it can be concluded that some private companies are doing extremely well in this sector, whereas, some companies have not even touched the efficient frontier.

Table II Showing Year Wise Analysis of TE, PTE, SE

Company	TE	PTE	SE	R to S	Company	TE	PTE	SE	R to S
2008-09					2009-10				
Bajaj	0.633	1	0.635	Increasing	Bajaj	0.743	1	0.743	Increasing
Reliance	0.382	0.561	0.68	Increasing	Reliance	0.425	0.556	0.771	Increasing
Aviva	0.598	0.88	0.679	Increasing	Aviva	0.548	0.913	0.6	Increasing
Birla	0.433	0.535	0.808	Increasing	Birla	0.389	0.481	0.809	Increasing
HDFC	0.597	0.671	0.89	Increasing	HDFC	0.486	0.562	0.865	Increasing
ICICI	1	1	1	Constant	ICICI	1	1	1	Constant
IngVysya	0.596	1	0.596	Increasing	Ing Vysya	0.496	1	0.496	Increasing
LIC	1	1	1	Constant	LIC	1	1	1	Constant
MNYL	0.449	0.57	0.787	Increasing	MNYL	0.421	0.538	0.782	Increasing
Met Life	0.26	0.49	0.531	Increasing	Met Life	0.316	0.578	0.611	Increasing
Kotak	0.474	1	0.474	Increasing	Kotak	0.623	1	0.623	Increasing
SBI	0.703	0.859	0.818	Increasing	SBI	0.662	0.768	0.862	Increasing
2010-11					2011-12				
Bajaj	0.936	1	0.936	Increasing	Bajaj	1	1	1	Constant
Reliance	0.425	0.535	0.795	Increasing	Reliance	0.538	0.538	0.999	Increasing
Aviva	0.728	0.908	0.802	Increasing	Aviva	0.985	1	0.985	Increasing
Birla	0.468	0.528	0.886	Increasing	Birla	0.69	0.706	0.977	Decreasing
HDFC	0.592	0.623	0.95	Increasing	HDFC	0.684	0.695	0.983	Decreasing
ICICI	1	1	1	Constant	ICICI	0.909	0.961	0.946	Decreasing
Ing Vysya	0.41	0.836	0.491	Increasing	Ing Vysya	0.484	0.786	0.616	Increasing
LIC	1	1	1	Constant	LIC	1	1	1	Constant
MNYL	0.338	0.392	0.662	Increasing	MNYL	0.417	0.42	0.993	Decreasing
Met Life	0.901	1	0.901	Increasing	Met Life	0.863	0.869	0.993	Increasing
Kotak	0.717	1	0.717	Increasing	Kotak	1	1	1	Constant
SBI	0.773	0.804	0.962	Increasing	SBI	1	1	1	Constant
2012-13									
Bajaj	1	1	1	Constant					
Reliance	0.505	0.514	0.982	Increasing					
Aviva	0.827	1	0.827	Increasing					
Birla	0.706	0.712	0.992	Increasing					
HDFC	0.72	0.898	0.802	Decreasing					
ICICI	0.72	0.958	0.751	Decreasing					
Ing Vysya	0.603	0.939	0.642	Increasing					
LIC	1	1	1	Constant					
MNYL	0.44	0.44	0.999	Increasing					
Met Life	0.81	0.908	0.892	Increasing					
Kotak	0.963	1	0.963	Decreasing					
SBI	0.831	1	0.831	Increasing					

Table II shows the year-wise efficiency of life insurance companies in India. In the year wise analysis, an effort has been made to find out the year in which maximum number of life insurers lied on the efficient frontier with a score equal to 1. It was found that LIC is efficiently performing in all the years with a score equal to 1. In the year 2008-09, companies like Reliance Life, Birla Sun Life, Max New York, Met Life and Kotak were having very low technical efficiency and only ICICI and LIC of India were on the efficient frontier. In year 2009-10 also, no private life insurer lied on the frontier except ICICI and also they have reported very weak technical efficiency. In contrast, the situation is better in the year 2010-11 where the performance efficiency has improved tremendously of insurers like Bajaj, Met Life, Kotak and SBI Life. LIC and ICICI are operating at constant returns to scale. In the year 2011-12, except ING Vysya, no other insurer's efficiency is below 0.50, whereas Bajaj, LIC, Kotak and SBI have score equals to 1. In the year 2012-13 only Bajaj Allianz was able to stay back in the competition with LIC and rest of the insurers have registered sound technical and scale efficiency.

Table III showing overall analysis of mean of TE, PTE and SE

Year	Mean of TE	Mean of PTE	Mean of SE
2009	0.594	0.797	0.818
2010	0.592	0.778	0.764
2011	0.691	0.802	0.858
2012	0.797	0.831	0.958
2013	0.76	0.864	0.89

In this table, mean efficiency of both the sectors is given. For the purpose of overall analysis, mean efficiency scores have been classified into 0-0.5, 0.5 to 0.7 and 0.7-9, and thereafter, the comparison of all insurers has been made with respect to their efficiency scores in order to find out the range within which they lie. It was derived that, no single insurer falls in the first category in year 2008-09. From the year 2009 to 2013, all the insurers fall in the second and third category. This might be because all the insurers are operating at increasing returns to scale or it can be contributed by Pure Technical efficiency and Scale efficiency. By comparing it was found that all the insurers are also better at Technical efficiency, as the mean of TE is more as compared to mean of PTE in all the years. This can also be justified through scale economies as most of the life insurance companies have strong increasing returns to scale and also taking advantages from the scale economies which have increased from 0.818 to 0.89.

CONCLUSION & IMPLICATIONS OF THE STUDY

The life insurance sector of any economy plays a very valuable role in the growth and development of that economy. From an investor's point of view, although a number of financial planning instruments are available in the market, but these options focus only on one side of the coin i.e. the growth of money invested. They totally ignore the other side, which is protection against major risk to human life e.g. early death, disability and critical illness etc. These emergencies can be secured with the help of insurance. Thus, efficient working of various insurance companies becomes imperative for benefit of not only the company itself but also for the investors and the economy as a whole.

This research endeavor has facilitated in understanding the comparative efficiency level of all the life insurance companies in India. Data envelopment technique (DEA) has been employed for the present study. The DEA allows managers to identify the most efficient Decision Making Units (DMUs) and compare them with the relatively inefficient units. With the help of this analysis, efficiency of 12 life insurance companies including one public insurance company has been checked by taking one output namely (Net Premium) and inputs (Equity Capital, Labor). It has been found that out of 12 life insurance companies; only ICICI was able to reach to full technical efficiency and that too in first three years of study period i.e. year 2006-07 to year 2009-2010. In the year 2011-12, only Om Kotak Life insurance Company and SBI Life Insurance Company were able to reach at the efficiency level. Life insurance Corporation of India was efficient in all the years. Based on this and the other results of the study, the insurers can get aware of their position and efficiency level as compared to their competitors and take required managerial steps to improve upon the resource utilization and accordingly enhance their operational efficiency.

Endnotes

- ⁱ IRDA Annual Reports 2012-13.
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