

## Efficiency of Life insurance Companies Operating in Punjab

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### **Abstract**

: The issue of efficiency is the key concern in the insurance sector. Efficiency 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 efficiency of the life insurer. The present study is an attempt to determine the efficiency of life insurance companies and also to give the overview of life insurance business. Most of the studies have been done at India level and no study could be found that determines the efficiency at the state level. So, in this study an effort has been made to get an insight into the level of efficiency, at which the life insurance companies are operating, with special reference to the Punjab State. The sample for the study includes all the 13 life insurance companies registered till the year 2003. Data pertaining to seven financial years i.e. from 2006-07 to 2012-13 has been taken for the analysis. With the help of Data envelopment analysis, a non parametric technique, technical efficiency of life insurance companies has been determined. Results of the study found that LIC is found to be efficient in all the years, similarly in case of private life insurance companies Aviva and SBI were found to be efficient in the first four years of the study period. In Punjab, the life insurance business is operating at an average technical efficiency of 55.0 %, pure technical efficiency 67.9 %, scale efficiency of 80.5 %.

### **Keywords:**

Life Insurance, Data Envelopment Analysis, Punjab

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### **Introduction**

Insurance occupies an important place in the complex modern world since risk, which can be insured, has increased enormously in every walk of life. This has led to the growth in the insurance business and evolution of various types of insurance covers. The insurance sector acts as a mobiliser of savings and a financial intermediary and is also a promoter of investment activities. Insurance, particularly life insurance, is one of the ways of making provision for the future. A life insurance policy, which gives an annuity, is a combination of protection and investment. It increases the creditworthiness of the assured person because it can provide funds for repayment in the event

of death. A recent study by McKinsey and Company indicates that consumers have an unmet need for long term savings and they prefer insurance vis a vis other investment products. Consumers rank insurance higher than other investment options because of the ease and convenience in investing and in obtaining tax benefits and protection cover. Indian consumers perceive life insurance as a low risk and high return investment, this being a perception driven by the awareness of LIC's performance and its record of delivering stable returns over the years. However, the opening up of private life insurance sector in India since year 2001, has posed a threat for LIC. There were only ten life insurance companies in year 2001, 14 till year 2006 and the number has further increased to 24 by the year 2014. Due to the ever-increasing competition among the all the life insurers including LIC, the performance and efficiency of all the insurers has been affected.

In this study, an attempt has been made to check the level of efficiency at which these insurers have been operating over a period of past seven years i.e. year 2006-07 to year 2012-13. Since, analysis of Punjab state has been done, so years before 2006-07 could not be taken because of non-availability of state-wise data of the insurance companies.

In this study technical efficiency of 13 life insurance companies have been found by employing DEA. DEA is a new research area which synthesis operations research management science and econometrics. It was first proposed by Charnes et.al in 1978. DEA is a mathematical programming approach to provide relative efficiency assessment (called DEA efficient) for a group of Decision Making units (DMU) with multiple numbers of inputs and outputs. Koopmans (1951) defined technical efficiency as a DMU is technically efficient if and only if it is not possible to increase any of the outputs or to reduce any of the inputs without reducing some other output or increasing some other input. In addition, the input and output vectors of the DMUs expand the production possibility set. Determining whether a DMU is efficient from the observed data is equivalent to testing whether the DMU is on the frontier of the production possibility set. The concept of the production frontier is extended from the production function to the case of multiple outputs. The methods and models of DEA can be used to comprehensively describe the structure of the production frontier. Therefore, DEA is also recognized as a non-parametric statistical estimation method. To evaluate the relative efficiency of a set of DMUs by DEA methods, some insightful management information can be obtained with some economic background. Therefore, the research and application of DEA attract a great amount of interest from both academic field and industrial practice. The standard approach undertaken in the empirical literature on efficiency measurement implies fulfilling four steps: 1) Collect data on inputs and outputs from a set of assumed

homogeneous Decision Making Units (DMUs), 2) Choose estimation technique-i.e. econometrics or linear programming-that best suits the nature of availability of data, 3) estimate the efficiency indexes 4) searching for variables capable of distinguishing between efficient and inefficient DMUs.

#### **Various studies related directly or indirectly to the objectives of the present study have been reviewed:**

**Aleng** (2013) measured the relative efficiency of 13 life insurance companies in Malaysia from 2007 to 2009. Study also identified most efficient company based on relative efficiency scores and analyzed the comparative efficiency of insurance companies. 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 were the variables used for analyzing the data through SFA to panel data. The maximum likelihood method is applied for the estimation of the parameters of the model and the production of the technical efficiency of the firms over time. 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. Technical and Scale efficiency was checked at first stage and at second stage Mann-Whitney U test was used. 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 was 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. Author has used Translog Cost Function (TCF) to reveal the existence of scale economies and a stochastic cost frontier model to measure the X efficiency. 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 first indicator proved that supplier power was limited due to large number of insurance firms and on the demand side;

consumer power was limited due to opaque nature of many life insurance products. Second indicator of scale efficiency proved that, competitive pressure in the insurance market has so far been insufficient to force insurance firms to exploit these existing scale economies. Third indicator of X-efficiency revealed that X efficiency estimates of around 25 % on an average a magnitude which would not be expected in a market with increased competition. Fourth indicator of profit margin proved that current profit margins in the domestic market were small, whereas given the current low interest rates; the outlook for future was also not very favorable. **Chen, Power and Qiu** (2009) evaluated the efficiency of life insurers operating in China and compared foreign firms with domestic firms. In this paper DEA has been used to study the firm efficiency. The basic idea of DEA is to construct a frontier that reflects optimal production. Study used DEA BCC model because it distinguishes pure, technical and scale efficiency. It enabled to identify the directions and potential for improvement for each efficient DMU. 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 were more important for inefficient insurers. **Huang** (2011) evaluated the profit and cost efficiency of insurance firms representing over 90% of commercial insurance firms assets in China for the period from 1999-2004. And, also investigate the relationship between efficiency scores and specific features of china's life and non-life insurance companies respectively by using SFA. For measuring the efficiency inputs and outputs have been segregated. Outputs were premium earned, incurred benefits, Additions to reserves, total invested assets and Inputs were labor, capital and Material. Results reported that china's insurance industry was low in cost and profit efficiency reason being very limited level of cost management and profitability and variations in the efficiency score of insurance companies were very high. **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. Empirical results have shown year wise, company wise, sector wise and overall analysis of the 13 life insurance companies. 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%. LIC was operating on increasing returns to scale taking the more advantages of pure technical efficiency and scale

efficiency than others. **Rahman** (2013) analyzed the sources of efficiency and technical changes in both life and non-life Takaful companies in Bangladesh for the period of 2009-11. The data of 17 companies 3 Takaful life operators and 10 life insurers has been considered for efficiency analysis by using DEA together with Malmquist Index. Inputs taken for the study was commission expenses and outputs were premium and net investment income. It was found that geometric mean, the TFP 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 showed that despite having enough potential 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 comparison on the efficiency of life insurance companies in the Malaysia and Brunei for the year 2000-2005 by using DEA. 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 more outputs. Due to the positive impact of both efficiency and technical changes the overall total factor productivity for these firms was maintained at a value higher than one. **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. At the first stage inputs were operating costs, insurance costs, number of employees, number of branches and central offices and number of agents. Outputs were direct insurance, number of insurance certificates and complementary insurance and outputs of first stage were inputs of second stage and outputs of second stage were income from sale of insurances, short term and long term investment returns and market share. 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 data envelopment analysis. Also the study focused upon the sale of new life insurance policies, market share, market trend and 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 and in 2005 it started declining. The study proved as 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 labor 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 outputs 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, 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). They have studied the three efficiency measures technical, cost and revenue efficiency of life insurance industry in Taiwan. They further utilized the cross frontier approach to test whether new firms could have produced their outputs using old firm technology more efficiently than they use their own technology. Inputs used were home office labor, Agent labor, and business service and equity capital. Outputs include benefit payment. Both DEA and Malmquist index results showed that the old domestic firms have been slightly impacted by the new competitors around 1992-1994.. 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.

**Objectives of the study:** The following are the two objectives of the study which includes the life insurance business of Punjab in terms of Life Insurance Penetration, Density, Premium and Number of Policies. Growth rates have been calculated for seven years in first objective. And second objective has achieved with the help of DEA.

1. To study the overall status of life insurance business in Punjab.
2. To assess the efficiency of Life insurance companies operating in Punjab.

### Research Methodology

#### Data Base

The study covers the period of 7 years from 2006-07 to 2012-13. Secondary sources of data have been used for the study which is 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, TATA life insurance company ltd. For, first objective growth rate has been calculated with the help of log linear regression model. To achieve the second objective of the study Data Envelopment Analysis technique has been used. This 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, Allocative and Scale efficiency. Technical Efficiency reflects the ability of a firm to obtain maximal output from a given set of inputs, and allocative efficiency, which reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices.

#### 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. So for this study Number of agents and Number of Branches have been taken as inputs.

**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 and Number of policies are taken as the output indicators for the study.

**Table 1 showing inputs and outputs taken for the study:**

Inputs	Outputs
Number of Agents	Net Premium
Number of Offices	Number of Policies

**Overall status of Life insurance in Punjab**

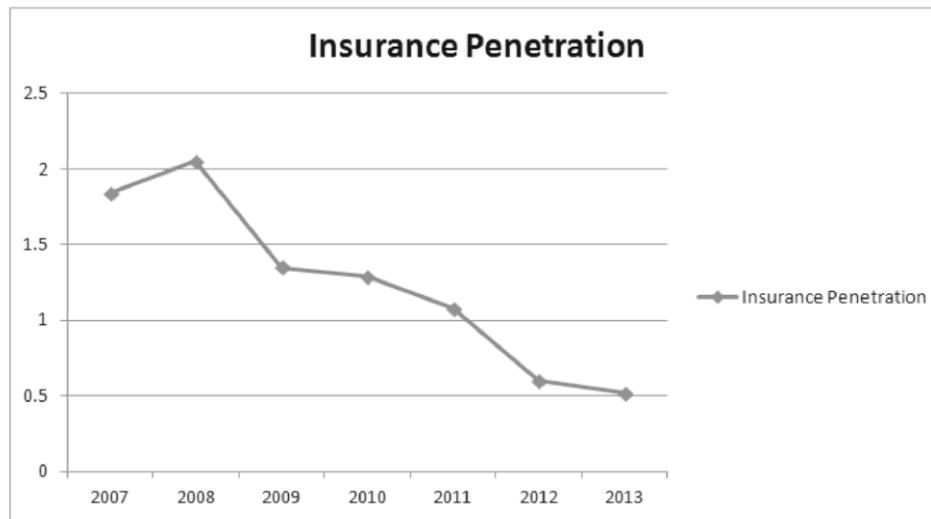
To achieve the first objective, trend of penetration and

density has been checked. The growth rates of premium and number of policies have been calculated with the help of log linear regression model.

**Table II Showing Insurance Penetration in Punjab**

Years	Insurance Penetration
2007	1.84
2008	2.05
2009	1.35
2010	1.29
2011	1.08
2012	0.6
2013	0.52

Source: IRDA Annual Reports.



Indian states are more prone to physical savings than to financial savings which contributed to the lower level of insurance penetration in Punjab. Although, the level of penetration has increased after the entry of private players, but it is still very low as compared to other countries. Insurance Penetration is the ratio of Premium underwritten in a given year to Gross Domestic Product. In Table 1, Insurance Penetration is given; Insurance penetration indicates the level of development of insurance sector in a country. As it can be seen from the table and chart given

below that Insurance penetration in Punjab was 1.84 in the year 2007 and increased in 2008 that is 2.05. After the year 2008, penetration in Punjab has been showing the decreasing trend which shows very little development of life insurance business in Punjab. According to consumer feedback, the problem has been exacerbated due to the agents' inability to clearly explain the features of the products, Lengthy documents that are not user friendly and the perception that agents are only concerned with their commissions.

**Table III showing Insurance Density in Punjab**

Years	Insurance Density
2007	900.3
2008	1184.4
2009	881.4
2010	940.9
2011	893.6
2012	554.7
2013	546

Source: IRDA Annual Reports.

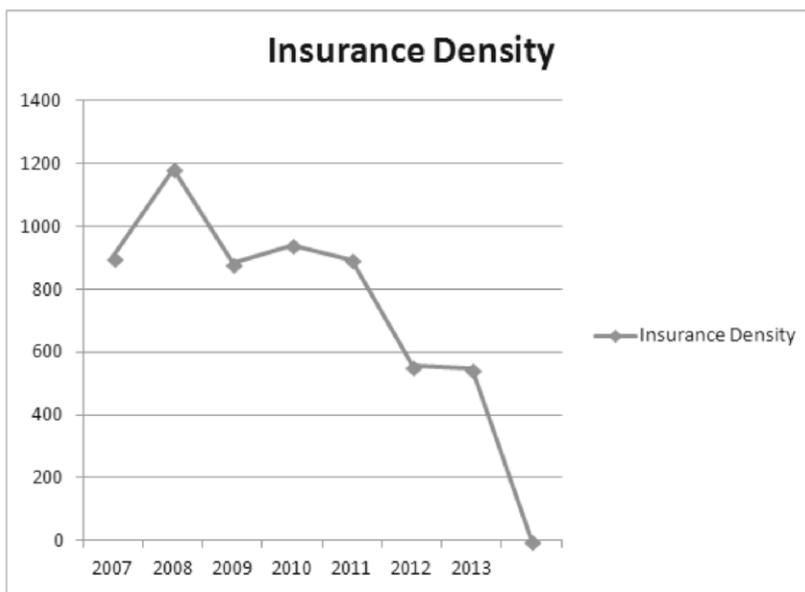


Table II shows the insurance density in Punjab, which is measured by premium over per capita. It was 900.3 in the year 2007 and started increasing in the next year that is in

2008. In the next three years insurance density have not shown big fluctuations but subsequently in the year 2012 and 2013 it started declining.

**Table IV Showing Life Insurance Growth in terms of Policies and Premium of LIC in Punjab**

Year	Premium (in cr)	Growth (in %)	Policies (in numbers)	Growth(in %)
2006-07	1464.17	-	589717	-
2007-08	1509.72	3.11	642214	8.90
2008-09	1086.79	28.01	766721	19.39
2009-10	1275.47	17.36	1000324	30.47
2010-11	1283.26	0.61	812330	-18.79
2011-12	693.69	-45.94	813352	0.13
2012-13	711.42	11.21	807675	-0.70
CAGR	-	-11.130	-	5.442

Source: IRDA Annual Reports.

Table I shows growth of Premium and number of policies in Punjab for the period of 2006-07 to 2012-13. The growth of premium in Punjab was initially very low and suddenly rose from 3.11 to 28.01 in the year 2007-08, followed by a steep downfall in the subsequent two years by 10.65 percent and 16.75 percent respectively. Further, year 2011-12 showed a very high negative premium growth rate of -45.94 percent. Year 2012-13 has shown positive signs of recovery in the

premium underwritten of Life Insurance Corporation of India. Similarly, in case of number of policies if life insurance Corporation of India, growth rate is increasing from the year 2007-08 to 2009-10 and after that it became negative in the following years. But the compound annual growth rate of premium is showing negative value with -11.130 percent and CAGR of number of policies is 5.442 percent.

**Table VI Showing Life Insurance Growth in terms of Policies and Premium of Private Life Insurance Companies in Punjab**

Year	Premium	Growth	Policies	Growth
2006-07	876.31	-	350467	-
2007-08	1609.46	83.66	551379	57.33
2008-09	1264.93	-21.41	538152	-2.40
2009-10	1267.75	0.22	403867	-24.95
2010-11	1163.92	-8.19	325897	-19.31
2011-12	845.09	-27.39	241678	-25.84
2012-13	743.46	-12.03	212283	-12.16
CAGR	-	-6.484	-	-12.2782

Source: IRDA Annual Reports.

Table II shows growth rate of Premium and Number of Policies of Private life insurance companies in Punjab. In the year 2007-08 growth rate of both premium and number of policies is positive and very high i.e. 83.66 and 57.33

percent respectively. After that, it became negative and continued to decline till the year 2012-13. The CAGR of both premium and number of policies has reported negative figures i.e. -6.484 and -12.2782 respectively.

### Data Analysis and Interpretation

**Table VII Showing the analysis of efficiency of life Insurance Companies in Punjab**

2006-07					2010-11				
Company Name	TE	PTE	SE	Scale	Company	TE	PTE	SE	Scale
Aviva	1	1	1	-	Aviva	1	1	1	-
Bajaj Allianz	0.134	0.165	0.813	irs	Bajaj Allianz	0.216	0.236	0.914	Irs
Birla Sun Life	0.312	0.66	0.472	Irs	Birla Sun Life	0.184	0.195	0.944	Irs
HDFC	0.164	0.214	0.765	Irs	HDFC	0.669	0.701	0.954	Irs
ICICI	0.524	0.558	0.938	Irs	ICICI	0.414	0.588	0.704	Drs
Ing Vysya	0.201	0.307	0.656	Irs	Ing Vysya	0.274	0.6	0.457	Irs
Kotak Life	0.238	0.583	0.409	Irs	Kotak Life	0.322	0.656	0.491	Irs
Met Life	0.321	0.338	0.949	Drs	Met Life	0.58	0.586	0.991	Drs
Max New York	0.113	1	0.113	Irs	Max New York	0.239	0.424	0.563	Irs
Reliance	0.398	0.743	0.535	Irs	Reliance	0.217	0.217	0.998	Irs
SBI	1	1	1	-	SBI	1	1	1	Irs
TATA	1	1	1	-	TATA	0.17	0.692	0.245	Irs
LIC	1	1	1	-	LIC	1	1	1	Irs
2007-08					2011-12				
Company Name	TE	PTE	SE	Scale	Company	TE	PTE	SE	Scale
Aviva	1	1	1	-	Aviva	1	1	1	-
Bajaj Allianz	0.362	0.373	0.97	Drs	Bajaj Allianz	0.281	308	912	Irs
Birla Sun Life	0.149	0.176	0.845	Irs	Birla Sun Life	0.222	226	984	Irs
HDFC	1	1	1	-	HDFC	1	1	1	Irs
ICICI	0.809	0.987	0.82	Drs	ICICI	0.39	0.494	0.789	-

Ing Vysya	0.134	0.172	0.777	Irs	Ing Vysya	0.358	0.818	0.437	Irs
Kotak Life	0.225	0.608	0.37	Irs	Kotak Life	0.369	0.643	0.574	Irs
Met Life	0.404	0.426	0.946	Irs	Met Life	0.929	0.946	0.982	drs
Max New York	0.257	1	0.257	Irs	Max New York	0.715	0.821	0.871	Irs
Reliance	0.113	0.14	0.807	Irs	Reliance	0.193	0.197	0.983	Irs
SBI	1	1	1	-	SBI	1	1	1	
TATA	0.76	1	0.76	Irs	TATA	0.196	1	0.196	Irs
LIC	1	1	1	-	LIC	0.955	1	0.955	Drs
2008-09					2012-13				
Company Name	TE	PTE	SE	Scale	Company	TE	PTE	SE	Scale
Aviva	1	1	1	-	Aviva	0.6	0.86	0.698	Irs
Bajaj Allianz	0.462	0.524	0.881	Drs	Bajaj Allianz	0.309	0.333	0.929	Irs
Birla Sun Life	0.207	0.266	0.778	Irs	Birla Sun Life	0.117	0.221	0.801	Irs
HDFC	0.371	0.477	0.779	Irs	HDFC	1	1	1	-
ICICI	0.402	0.549	0.731	Drs	ICICI	0.395	0.425	0.93	Irs
Ing Vysya	0.166	0.8	0.207	Irs	Ing Vysya	0.355	0.544	0.653	Irs
Kotak Life	0.566	0.923	0.613	Irs	Kotak Life	0.218	0.36	0.607	Irs
Met Life	0.47	0.472	0.995	Irs	Met Life	1	1	1	-
Max New York	0.183	0.706	0.26	Irs	Max New York	0.913	1	0.913	Irs
Reliance	0.508	0.51	0.996	Irs	Reliance	0.195	0.248	0.789	Irs
SBI	0.631	0.706	0.894	Irs	SBI	0.837	0.841	0.995	Drs
TATA	0.111	0.6	0.185	Irs	TATA	0.148	1	0.148	Irs
LIC	1	1	1	-	LIC	1	1	1	-
2009-10									

Company Name	TE	PTE	SE	Scale
Aviva	0.751	1	0.751	Irs
Bajaj Allianz	0.324	0.339	0.956	Irs
Birla Sun Life	0.124	0.225	0.551	Irs
HDFC	0.398	0.583	0.683	Irs
ICICI	0.319	0.518	0.617	drs
Ing Vysya	0.152	0.733	0.208	Irs
Kotak Life	0.448	0.688	0.64	Irs
Met Life	0.31	0.334	0.928	Irs
Max New York	0.294	0.505	0.583	Irs
Reliance	0.44	0.529	0.832	Irs
SBI	1	1	1	-
TATA	0.081	0.688	0.118	Irs
LIC	1	1	1	-

In the year wise analysis the performance of companies are measured on three economies of scale that is CRS, VRS and DRS. 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. The companies which are operating at CRS are Aviva, SBI, Tata and LIC (2007), Aviva, SBI, Tata, HDFC and LIC (2009), SBI and LIC (2010), Aviva, SBI, LIC (2011), Aviva, HDFC, SBI (2012), and HDFC, Met Life and LIC (2013). This signifies that insurance companies are able to scale the inputs and outputs linearly with increasing or decreasing

efficiency. On the other hand, companies like Bajaj and ICICI (2007-2009), ICICI (2010), ICICI and Met Life (2011), LIC and Met Life (2012) and SBI in (2013) are operating at decreasing returns to scale which means that changing all inputs by the same proportion changes in output by less proportional values. So it shows that scale efficiency of these companies is satisfactory or optimal but they are not utilizing their resources properly. Rest of the companies are operating at IRS, which holds the assumption that changing all inputs by same proportion changes the output by a greater extent than the proportional value.

Table VIII showing Mean Efficiency of Life Insurance Company

Year	Insurers	TE	PTE	SE
2006-07	All	0.493	0.659	0.742
2007-08	All	0.555	0.683	0.812
2008-09	All	0.467	0.656	0.717
2009-10	All	0.434	0.627	0.682
2010-11	All	0.484	0.607	0.789
2011-12	All	0.589	0.727	0.825
2012-13	All	0.550	0.679	0.805

In this table, mean efficiency of both public and private life insurance companies is given. For the purpose of overall analysis mean efficiency scores have been classified into 0-0.4, 0.4-0.8 and 0.8-1 and after that 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. No single insurer falls in the first category in the year 2006-07. Thereafter in all the years it was found in the higher range of 0.4 to 0.8. This might be because all the insurers are operating on increasing returns to scale or it can be contributed by PTE and SE. By comparing it was found that all the insurers are also better at PTE, as the mean of PTE is more as compared to mean of TE 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 0.742 to 0.805.

### Conclusion

In this study, DEA model has been applied for the evaluation of efficiencies of life insurance companies in India and to study the overall life insurance business in Punjab. Penetration and density determines the level of development of insurance. In this study, it was found that there is very low insurance penetration and density in Punjab. The private players from India and are well aware of the fact that very less portion of population has been covered by the insurance companies which states that the Indian insurance market has enough potential to exploit. Growth of premium and number of policies has shown initially positive growth but negative CAGR. Results of the study found that LIC is found to be efficient in all the years at Constant Returns to scales, similarly in case of private life insurance companies Aviva and SBI were found to be efficient in the first four years of the study period. It was observed that out of the overall insurance business in Punjab, the life insurance business is operating at an average technical efficiency of 55.0 %, pure technical efficiency 67.9 %, scale efficiency of 80.5 %.

### References

Ahmed, W. Navi, A.A.M & Aleng A.N. (2013) Relative Efficiency Analysis Industry of Life and General Insurance in Malaysia. Using Stochastic Frontier Analysis. Applied Mathematical Sciences, Vol 7,

No 23, 1107-1118.

- Barros, P.C. & Obijaku, L.E. (2007) Technical Efficiency of Nigerian Insurance Companies. School of Economics and Management, Technical University of Lisbon, Department of Economics. WP018/2007/DE/UECE, ISSN 0874-4548.
- Bikker, J.A and Leuvenstey, Y.A (2008) Competition and Efficiency in the Dutch Life Insurance Industry. Applied Economics, 40, 2063-2084.
- Chen, B., Powers, R.M. & Qiu, J. (2009) Life Insurance Efficiency in China: A Comparison of Foreign and Domestic Firms. China and World Economy, 43-63. No.6
- Jeng, V. & Lai, C.G. (2008) the impact of Deregulation on Efficiency: An Analysis of Life Insurance Industry in Taiwan from 1981 to 2004. Risk Management and Insurance Review, 2008, 11(2), 349-375.
- Nandi, K.J. (2014) Relative Efficiency Analysis of Selected Life Insurance in India Using DEA. Pacific Business Review International, 6(8).
- Rahman, A. (2013) Comparative Study on the Efficiency of Bangladesh Conventional and Islamic Life Insurance Industry, a Non Parametric Approach. Asian Business Review, Vol II, Issue 5, 2304-2613.
- Saad, M.N. and Idris, H.E.N (2011) Efficiency of Life Insurance Companies in Malaysia and Brunei: A Comparative Analysis. International Journal of Humanities and Social Science, Vol 1, No 3,
- Sabet, J.R and Fadavi, A (2013) Performance Measurement of Insurance firms using a two Stage DEA method. Management Science Letters, 3 (2013) 303-308.
- Sinha, P.R.(2007) Operating Efficiency of Life Insurance Companies: An Assurance Region Model. Arth Vijana, Vol XLIX, No3-4 pp 305-320.
- Yang, Z. (2006) A Two Stage DEA Model to Evaluate the Overall Performance Of Canadian Life And Health Insurance Companies. Elsevier Mathematical and Computer Modelling. 43, 910-919.