

## UNDERWRITING EFFICIENCY OF NON-LIFE INSURANCE INDUSTRY IN INDIA

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**Abstract:** *Purpose:* Insurance companies earn their profits through underwriting of premium from various policies and investing in various securities. If, premiums collected will not be adequate to cover the cost of coverage, insurance companies will confront underwriting loss. The purpose of this paper is to assess underwriting efficiency of non-life insurance industry in India. *Design/methodology/approach:* DEA models have been applied on two inputs (Share Capital and Total Investment) and three outputs (Profit, Net Premium and Investment Income). This study focuses upon nineteen non-life insurance companies operating in India over a period of five years from 2011-12 to 2015-16. *Findings:* Underwriting efficiency of non-life insurance industry has declined on both BCC model and CCR model from 2011-12 to 2014-15. However, it slightly improved in the year 2015-16. The study further highlights that during all years under study, four (21 per cent) to eight (42 per cent) non-life insurers have been found on the CRS frontier and seven (37 per cent) to twelve (63 per cent) non-life insurers have been found on the VRS frontier. With regard to scale efficiency issues, four (21 per cent) to eight (42 per cent) companies have been operated at their most productive scale over the study period. *Research limitations/implications:* Paper has successfully developed underwriting model for insurance companies. Taking clue from findings, insurance companies could deal with various underwriting related challenges in their respective companies. *Originality/value:* The paper uses DEA models to assess underwriting efficiency of insurance companies not discusses so far in previous studies

**Keywords:** Data Envelopment Analysis, Technical Efficiency, Pure Technical Efficiency, Scale Efficiency, Underwriting efficiency.

### INTRODUCTION

The basic function of insurance companies is underwriting of insurance policies (including estimating the acceptability of risks, the coverage terms, and the premium), billing and collecting premiums, and evaluating and settling claims made under policies. Insurance industry plays crucial role in development of India by transfer of contingent losses to insurers, who agree to compensate policyholders for such losses, to provide other monetary benefits on their happening, or to render services related with risks. As insurers seek opportunities to streamline underwriting with greater efficiencies and enhanced capabilities, many are focusing both high-level strategic decisions and discrete points within the risk selection process, such as procedural tasks and

underwriting parameters. Insurance companies earn their profits through underwriting of premium from various policies and investing in various securities as prescribed by the regulatory body. If, premiums collected will not be adequate to cover the cost of coverage, insurance companies will confront underwriting loss. Thus, prices of insurance policies are based on assessment of expected claim costs and the costs to issue and administer the policy. In India, The underwriting losses of the non-life insurers increased to 149620 million in 2015-16, from 105760 million in the 2014-15. The underwriting losses increased by 41.47 per cent over previous year. The public sector insurance companies losses increased by 54.42 per cent to 108390 million in 2015-16 from 70190 million in 2014-15. The private sector insurance companies losses

increased to 36620 million in 2015-16 from 24950 million in 2014-15. The underwriting losses of standalone health insurer decreased to 2730 million in 2015-16 from 6110 million in 2014-15. Specialized insurers reported significant decrease in underwriting losses in 2015-16 which is 1880 million as compared to underwriting loss of 4500 million in 2014-15.

Over the last decade Indian insurance industry has experienced exceptional changes and confronted more difficulties. As an aftermath of deregulation and globalization foreign companies entered in Indian market place. The competitive pressures force many insurance companies to change corporate strategies in order to reduce operating costs while keeping up or improving the quality of their services. As the marketplace continues to evolve at a rapid pace, it is imperative to find a tool to help managers in identifying the companies that are best positioned to thrive in a changing environment. Along these lines, assessing performance in the insurance industry remains an important objective and has always been the subject of considerable interest. This research proposed a DEA model which estimate underwriting performance of Indian non-life insurance industry. The paper successfully provides a comprehensive evaluation for insurance companies.

### **INSURANCE INDUSTRY PERFORMANCE EVALUATION**

Some work has been done on performance evaluation of insurance industry. The most widely acknowledged technique used by insurance companies to benchmark their performance has been the ratio analysis. The well-known ratio used to evaluate underwriting performance of insurance companies are underwriting expense ratio and combine ratio. Underwriting expense ratio measures operational efficiency in underwriting. Specifically, this ratio represents the percentage of a company's net premiums earned that went toward underwriting expenses such as commissions to agents and brokers, state and municipal taxes, salaries, employee benefits, and other operating costs. The combined ratio reflects both the cost of protection and the cost of generating and maintaining the business. Ratio analysis provides relatively insignificant amount of information when considering the effects of

economies of scale, identification of benchmarking policies and estimation of underwriting performance measures of firms. As a result, there is an incentive to use more successful strategies in evaluating the underwriting performance of insurers. Bhawa and Kaur (2011) determined technical efficiency, pure technical efficiency and scale efficiency of general companies using DEA over the years from 2002-2003 to 2009-10. For this purpose claim incurred was taken as output and investment income as well as net income were taken as input. Their study declared some improvement in overall efficiency of general insurance companies over the period of study. Hsiao (n.d) determined capital investment efficiency and efficiency changes using DEA and malmquist productivity index over the years from 1998 to 2008. The researcher had also made some hypotheses to test if there is a statistically significant difference among the DEA model and TFI of CAMEL-S model for life insurers. The result of study suggested that insurers should revise their investment strategies to improve company's overall financial performance. Hsiao & Su (2006) employed DEA and malmquist productivity index to measure relative efficiency and investment performance of 24 life insurers in Taiwan from 1998 to 2002. The main findings disclosed that efficiency and investment performance are the main determinants of business performance. Wu *et al.* (2007) developed a new problem-oriented DEA model to simultaneously assess the production and investment performance of insurers, differing from classical DEA models appropriate for independent performance evaluation. The results showed that Canadian L & H insurance companies operated very efficiently for the examined three year period (1996–1998). Yang (2006) constructed a two-stage DEA model to provide valuable managerial insights while assessing the dual impacts of operating and business strategies for the Canadian life and health (L&H) insurance industry. The results of study showed that the Canadian L & H insurance industry operated efficiently during the period examined (the year 1998). Adam (1996) examined the relationship between investment earning of life insurance firms in New Zealand and their organizational characteristics using a pooled weighted least squares regression model over the period 1988-1993. The empirical result of study indicated that investment

earnings are positively associated with size, leverage, underwriting risk and stock companies. Adams and Buckle (2003) examined the determinants of corporate (i.e. underwriting and investment related) financial performance in the Bermuda insurance market using panel data for 1993–1997. The study found that highly leveraged, lowly liquid companies, reinsurers and companies with higher underwriting risk have better operational performance. Binay (2005) measured the risk-adjusted equity investment performance of all institutional investors in the United States during 1981–2002. The results indicated that institutional investors have been successful in managing client assets and displayed significant stock selection skills during the period. Joo (2013) analyzed the impact of various factors on solvency position of non life insurers by applying multiple regression analysis over the period of 2004–05 to 2008–09. The factors taken for analysis were firm size, investment performance and liquidity ratio. The study found that claim ratio and firm size have greater impact on solvency position of non life insurance companies. Kamau (2013) evaluated the relationship between underwriting profit and investment income. The result of study presented low correlation between underwriting profit and investment income. Underwriting profit has low correlation with all other selected variables notably admitted assets, admitted liabilities, capital employed, non-life net premium unlike investment income that have high correlation. Kumar (2010) revealed that public sector general insurance companies have higher underwriting loss than private sector general insurance companies, but higher investment income of public sector compensated their high underwriting loss, leading to higher profitability than private sector general insurance companies. Kumari (2013) evaluated the financial performance of life

insurance industry in India through various financial ratios. These ratios are based on Gart et al. (1994) NAIC guidelines and Insurance Regulatory and Development Authority of India (IRDA) norms. Some of these ratios are Total Assets to Earned Premium Ratio, Investment Income to Earned Premium Ratio, Investment Income to Total Investments Ratio, Current Ratio. Overall result of these ratios gives the positive indication of financial soundness. Other important literatures are shown in table 1:

### MODELS AND METHODOLOGY

This paper develops a comprehensive DEA model to measure underwriting efficiency for the Indian non-life insurance industry. In the underwriting approach, insurers are treated as institutions whose functions are to provide various products and services to their policyholders by engaging in risk reduction through pooling. Insurance companies collect premiums from their policyholders and redistribute most of the funds to those clients who sustain losses. In the process, firms incur various actuarial, underwriting, and related expenses in operating the risk pool and providing loss settlement services. This approach is appropriate for assessing insurers' ability to satisfy claims brought by policyholders. The study has two inputs which are Share capital and Total investment, and three outputs which are Profit, Net premium and Investment income. The diagram for the investment model is provided in Fig. 1.

#### Mathematical solution

The study adopts both types of envelopment surfaces, BCC and CCR in order to examine scale efficiency issues as given in equation 1 and equation 2. This method



Figure 1: Underwriting Model

**Table 1**  
**Table from Past Literature**

<i>Authors</i>	<i>Countries</i>	<i>No. of DMUs</i>	<i>Sample period</i>	<i>Input</i>	<i>Output</i>
Ahmad (2010)	India	10	2001-2009	Share capital including the reserves and surpluses	Shareholders' investment
Barros and Obijiaku (2007)	Nigeria	10	2001-2005	Capital, operative costs, number of employees, total investments	Profits, net premiums, settled claims, outstanding claims, investment income
Cummins <i>et al.</i> (1996)	Italy	94	1985-1993	Labor (acquisition, admin.), fixed capital expense, equity capital	<i>Life</i> : sum of life insurance benefits, changes in reserves, invested assets. <i>Non-life</i> : Losses incurred, invested assets
Fukuyama and Weber (2001)	Japan	17	1983-1994	Labor (office, sales), capital	Reserves, loans, investment
Cummins and Nini (2002)	US	770-970	1993-1998	Labor (office, sales), materials and business service, financial equity capital	Present value of losses incurred, total invested asset
Cummins and Xie (2008)	US	1550	1994-2003	Labor (admin., agent), materials and business services, financial equity capital	Present value of losses incurred, real invested assets
Hao and Chou (2005)	Taiwan	26	1977-1999	labor, physical capital, claim	Premiums, investment
Hwang and Gao (2005)	Ireland	11	1991-2000	Labor (admin, agent), financial capital	Insurance benefits, investible funds
Klumpes (2004)	UK	40	1994-1999	Labor (home office, agent), business services, financial capital	Claims, real invested assets
Mahlberg and Url (2003)	Austria	70	1992-1999	Expenditures on labor, material, energy, depreciation, marketing, commissions (1 input); capital management cost (1 input)	Claims, net change in provisions, allocated investment returns, bonuses and returned premia
Noulas <i>et al.</i> (2001)	Greece	16	1991-1996	Salaries and expenses (1 input) and payment to insurers and expenses incurred in the production of services (1 input)	Premium income, revenue from investment activities
Diacon <i>et al.</i> (2002)	15 European Countries	454	1996-1999	Total operating expenses, total capital, total technical reserves, total borrowings from creditors	Net earned premiums (general, long-term), total investment income
Qiu and Chen (2006)	China	14-32	2000-2003	Labor, equity capital,	Benefit payments, additions to reserve, yield of investment
Wu <i>et al.</i> (2007)	Canada	71-78	1996-1998	<i>Prod</i> : Labor expenses, general operating expenses, capital equity, claims incurred <i>Inv</i> :	<i>Prod</i> : Net premiums written, net income <i>Inv</i> : Investment gains in bonds and

*contd. table 1*

*Underwriting Efficiency of Non-life Insurance Industry in India*

<i>Authors</i>	<i>Countries</i>	<i>No. of DMUs</i>	<i>Sample period</i>	<i>Input</i>	<i>Output</i>
Yang (2006)	Canada	72	1998	Net actuarial reserves, investment expenses, total investments, total segregated funds <i>Prod</i> : Labor expenses, general operating expenses, capital equity, claims incurred <i>Inv</i> : Net actuarial reserves, investment expenses, total investments, total segregated funds	mortgages, investment gains in equities and real estate <i>Prod</i> : Net premiums written, net income <i>Inv</i> : Investment gains in bonds and mortgages, investment gains in equities and real estate
Yao <i>et al.</i> (2007)	China	22	1999-2004	Labor, capital, payment and benefits	Premiums, investment income

provides a convenient way to categorize efficiency as technical efficiency, pure technical efficiency and scale efficiency. *Pure technical efficiency (PTE)*: In PTE, efficiency is measure relative to variable return to scale (VRS) frontier. It takes into account the variation of efficiency with respect to the scale of operation. *Scale efficiency (SE)*: Scale efficiency perceives that economy of scale cannot be achieved at all scales of production and there is one most productive scale size, where the scale efficiency is at 100 per cent. The scale efficiency is measured by dividing technical efficiency with the PTE. *Technical efficiency (TE)*: TE can be viewed as the product of PTE and SE. It mirrors the ability of a firm to obtain the maximum output from a given set of input or the efficiency with which inputs are transformed into output or just the output/input ratio. Output orientation (the LP is oriented to maximize outputs) was selected for the underwriting model, since the management wants to maximize the underwriting gains.

The mathematical solution to implement the conceptual model is given in equation 1 and equation 2. Assume there are data on K inputs and M outputs on each of N firms or DMUs. For i-th DMU these are represent by vector of  $x_i$  and  $y_i$  respectively. The  $K \times N$  input matrix, X, and the  $M \times N$  output matrix, Y, represent data of all N DMUs.  $\lambda$  is a vector of constant.

Equation 1 represents output oriented CCR DEA model and Equation 2 represents output oriented BCC DEA model.

$$\begin{aligned} & \max_{\Phi, \lambda} \Phi, \\ & \lambda Y \geq \Phi y_i \\ & \lambda X \leq x_i \\ & \lambda \geq 0 \end{aligned} \tag{equation 1}$$

Performing a DEA analysis requires the solution of n linear programming problems of the above form, one for each DMU. In the study, there are data on nineteen non-life insurance companies for five years; hence there are nineteen linear programming problems for CRS DEA to be solved in a particular year. The CRS linear programming can be easily modified to account for VRS by adding the convexity constraint:  $\sum \lambda = 1$  to equation 1 to provide:

$$\begin{aligned} & \max_{\Phi, \lambda} \Phi, \\ & \lambda Y \geq \Phi y_i \\ & \lambda X \leq x_i \\ & \sum \lambda = 1 \\ & \lambda \geq 0 \end{aligned} \tag{equation 2}$$

$\sum \lambda = 1$  is N\* 1 vector of ones. The approach forms a convex hull of intersecting plans which envelope the data point more tightly than CRS hull and thus provide technical efficiency score which is greater than or equal to those obtained using the CRS model.

Note that the linear programming problem given in equation 2 must be solved N times, once for each DMU in the sample for a particular year. In the study, there are data on nineteen non-life insurance companies for five

years; hence there are nineteen linear programming problems for VRS DEA to be solved in a particular year.

### Data

The empirical results of the study are primarily based on financial data of non-life insurance companies. Audited and accounting data for 2011-12 to 2015-16 (denominated in Rs.) were obtained for nineteen major non-life insurers from IRDA annual reports and annual reports of respective companies. Some firms eliminated from the sample because of data problems such as companies come into existence after study period or non availability of data. The firms remaining in the sample account for about 90 per cent of premium volume in the non-life insurance market in each year of the sample period. The data is from annual balance sheets, policyholders account and shareholders account of following companies:

1. Bajaj Allianz General Insurance Company Ltd.
2. Bharti AXA General Insurance Company Ltd.
3. Cholamandalam MS General Insurance Company Ltd.
4. Future Generali India Insurance Company Ltd.
5. HDFC ERGO General Insurance Company Ltd.
6. ICICI Lombard General Insurance Company Ltd.
7. IFFCO Tokio General Insurance Company Ltd.
8. L & T General Insurance Company Ltd.
9. Raheja QBE General Insurance Company Ltd.
10. Reliance General Insurance Company Ltd.
11. Royal Sundaram Alliance Insurance Company Ltd.
12. SBI General Insurance Company Ltd.
13. Shriram General Insurance Company Ltd.
14. TATA AIG General Insurance Company Ltd.
15. Universal Sampo General Insurance Company Ltd.
16. National Insurance Company Ltd.
17. The New India Assurance Company Ltd.

18. The Oriental Insurance Company Ltd.

19. United India Insurance Company Ltd.

To evaluate the underwriting efficiency of private non-life insurance companies in India, the essential element is the selection of input and output variables. Variables were selected on the basis of research aim and availability of data. Variables of the study are as follows:

- Profit
- Net Premium
- Investment Income
- Share Capital
- Total Investment

### RESULTS AND DISCUSSIONS

Table 2 shows the gross efficiency (overall technical efficiency) of non-life insurers calculated at constant return to scale. The insurance companies which achieve values of the OTE scores equal to one form the CRS frontier; and those having the values less than one are below the frontier and termed as inefficient. Table reveals that during all years under study, four (21 per cent) to eight (42 per cent) non-life insurance companies have been found on the frontier. Bajaj Allianz General Insurance Company Ltd., IFFCO Tokio General Insurance Company Ltd., Raheja QBE General Insurance Company Ltd., and National Insurance Company Ltd., have efficient during all year under study from 2011-12 to 2015-16. Underwriting efficiency of non-life insurance industry has shown declining trend from 2011-12 to 2014-15 as average efficiency has decreased from 0.888 in 2011-12 to 0.791 in 2014-15. However, average efficiency score has improved to 0.845 in 2015-16. Notably, in the year 2011-12 insurance industry found to be highly efficient as mean efficiency stood at 0.888. The study further highlighted that maximum number of companies found to be efficient on constant return to scale during 2011-12. Average efficiency score of public non-life insurers are 0.924 and private non-life insurers are 0.802 which revealed public non-life insurers more efficient than private non-life insurers.

Table 3 evinces technical efficiency (pure technical efficiency) of private life insurers calculated at variable

*Underwriting Efficiency of Non-life Insurance Industry in India*

**Table 2**  
**Efficiency Score at Constant Return to Scale i.e. Overall Technical Efficiency**

<i>DMUs</i>	<i>2011-12</i>	<i>2012-13</i>	<i>2013-14</i>	<i>2014-15</i>	<i>2015-16</i>	<i>Mean</i>	
Bajaj Allianz General Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	0.802
Bharti AXA General Insurance Company Ltd.	0.716	0.712	0.651	0.659	0.611	0.6698	
Cholamandalam MS General Insurance Company Ltd.	0.900	0.827	0.723	0.702	0.809	0.7922	
Future Generali India Insurance Company Ltd.	0.804	0.716	0.707	0.700	0.827	0.7508	
HDFC ERGO General Insurance Company Ltd.	0.650	0.612	0.622	0.628	0.728	0.648	
ICICI Lombard General Insurance Company Ltd.	0.881	0.738	0.756	0.802	0.815	0.7984	
IFFCO Tokio General Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	
L & T General Insurance Company Ltd.	1.000	0.810	0.749	0.596	0.951	0.8212	
Raheja QBE General Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	
Reliance General Insurance Company Ltd.	0.721	0.664	0.988	0.888	0.770	0.8062	
Royal Sundaram Alliance Insurance Company Ltd.	0.784	0.641	0.618	0.679	0.792	0.7028	
SBI General Insurance Company Ltd.	0.930	0.657	0.650	0.606	0.697	0.708	
Shriram General Insurance Company Ltd.	1.000	1.000	0.727	0.686	0.714	0.8254	
TATA AIG General Insurance Company Ltd.	0.726	0.677	0.668	0.726	0.826	0.7246	
Universal Sompo General Insurance Company Ltd.	0.963	0.694	0.616	0.783	0.897	0.7906	
National Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	0.924
The New India Assurance Company Ltd.	0.804	0.827	0.878	0.787	1.000	0.8592	
The Oriental Insurance Company Ltd.	1.000	0.988	0.993	0.927	0.727	0.927	
United India Insurance Company Ltd.	1.000	0.919	0.901	0.857	0.888	0.913	
Mean	0.888	0.815	0.802	0.791	0.845		

*Source:* Computed through DEAP version 2.1

**Table 3**  
**Efficiency Score at Variable Return to Scale i.e. Pure Technical Efficiency**

<i>DMUs</i>	<i>2011-12</i>	<i>2012-13</i>	<i>2013-14</i>	<i>2014-15</i>	<i>2015-16</i>	<i>Mean</i>	
Bajaj Allianz General Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	0.877
Bharti AXA General Insurance Company Ltd.	0.724	0.724	0.655	0.661	0.626	0.678	
Cholamandalam MS General Insurance Company Ltd.	1.000	0.831	0.744	0.730	0.867	0.8344	
Future Generali India Insurance Company Ltd.	0.880	0.737	0.721	0.701	0.834	0.7746	
HDFC ERGO General Insurance Company Ltd.	0.824	0.929	0.812	0.666	0.831	0.8124	
ICICI Lombard General Insurance Company Ltd.	1.000	1.000	1.000	0.900	0.954	0.9708	
IFFCO Tokio General Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	
L & T General Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	
Raheja QBE General Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	
Reliance General Insurance Company Ltd.	0.851	1.000	1.000	1.000	1.000	0.9702	
Royal Sundaram Alliance Insurance Company Ltd.	0.909	0.701	0.623	0.682	0.794	0.7418	
SBI General Insurance Company Ltd.	1.000	1.000	1.000	0.704	0.834	0.9076	
Shriram General Insurance Company Ltd.	1.000	1.000	0.758	0.704	0.781	0.8486	
TATA AIG General Insurance Company Ltd.	0.878	0.817	0.756	0.786	0.830	0.8134	
Universal Sompo General Insurance Company Ltd.	0.987	0.719	0.623	0.792	0.968	0.8178	
National Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	0.974
The New India Assurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	
The Oriental Insurance Company Ltd.	1.000	0.992	0.997	0.935	0.823	0.9494	
United India Insurance Company Ltd.	1.000	0.969	0.914	0.910	0.953	0.9492	
Mean	0.950	0.917	0.874	0.851	0.900		

*Source:* Computed through DEAP version 2.1

return to scale. Table reveals that during all years under study, seven (37 per cent) to Twelve (63 per cent) non-life insurance companies have been found on the frontier. Bajaj Allianz General Insurance Company Ltd., IFFCO Tokio General Insurance Company Ltd., L & T General Insurance Company Ltd., Raheja QBE General Insurance Company Ltd., National Insurance Company Ltd., and The New India Assurance Company Ltd. have efficient maximum number of times in five years; while Bharti AXA General Insurance Company Ltd., Future Generali India Insurance Company Ltd., HDFC ERGO General Insurance Company Ltd., Royal Sundaram Alliance Insurance Company Ltd., TATA AIG General Insurance Company Ltd., and Universal Sompo General Insurance Company Ltd. have not shown efficiency score of one in any years from 2012 to 2016. Underwriting efficiency of non-life insurance industry has shown declining trend from 2011-12 to 2014-15. Average efficiency has decreased from 0.950 in 2011-12 to 0.851 in 2015-16. However, average efficiency score has improved to 0.900 in 2015-16. Notably, in the year 2011-12 insurance industry found to be highly efficient as mean efficiency stood at 0.950. It can further be analyzed from table that

public non-life insurers are more efficient than private non-life insurers as average efficiency score of public non-life insurers are 0.974 and private non-life insurers are 0.877.

Table 4 depicts the scale efficiency of life insurers which is the ratio of CRS efficiency score to VRS efficiency score. This table represents that during all the years under study four (21 per cent) to eight (42 per cent) companies have been operated at their most productive scale. Bajaj Allianz General Insurance Company Ltd., IFFCO Tokio General Insurance Company Ltd., Raheja QBE General Insurance Company Ltd., and National Insurance Company Ltd. have efficient maximum number of times in five years from 2012 to 2016. Underwriting efficiency of non-life insurance industry has shown increasing trend from 2011-12 to 2015-16 except for the 2012-13. Average efficiency has decreased from 0.933 in 2011-12 to 0.923 in 2013-14. However, it has increased thereafter. It can further be analyzed from table that public non-life insurers are more scale efficient than private non-life insurers as average efficiency score of public non-life insurers are 0.948 and private non-life insurers are 0.917.

**Table 4**  
**Scale Efficiency Scores**

<i>DMUs</i>	<i>2011-12</i>	<i>2012-13</i>	<i>2013-14</i>	<i>2014-15</i>	<i>2015-16</i>	<i>Mean</i>	
Bajaj Allianz General Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	0.917
Bharti AXA General Insurance Company Ltd.	0.989	0.983	0.995	0.996	0.975	0.9876	
Cholamandalam MS General Insurance Company Ltd.	0.900	0.996	0.971	0.963	0.933	0.9526	
Future Generali India Insurance Company Ltd.	0.914	0.972	0.980	0.997	0.992	0.971	
HDFC ERGO General Insurance Company Ltd.	0.789	0.659	0.766	0.944	0.876	0.8068	
ICICI Lombard General Insurance Company Ltd.	0.881	0.738	0.756	0.891	0.855	0.8242	
IFFCO Tokio General Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	
L & T General Insurance Company Ltd.	1.000	0.810	0.749	0.596	0.951	0.8212	
Raheja QBE General Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	
Reliance General Insurance Company Ltd.	0.848	0.664	0.988	0.888	0.770	0.8316	
Royal Sundaram Alliance Insurance Company Ltd.	0.863	0.914	0.993	0.996	0.997	0.9526	
SBI General Insurance Company Ltd.	0.930	0.657	0.650	0.862	0.836	0.787	
Shriram General Insurance Company Ltd.	1.000	1.000	0.959	0.974	0.914	0.9694	
TATA AIG General Insurance Company Ltd.	0.827	0.829	0.883	0.923	0.996	0.8916	
Universal Sompo General Insurance Company Ltd.	0.976	0.966	0.989	0.988	0.927	0.9692	
National Insurance Company Ltd.	1.000	1.000	1.000	1.000	1.000	1	0.948
The New India Assurance Company Ltd.	0.804	0.827	0.878	0.787	1.000	0.8592	
The Oriental Insurance Company Ltd.	1.000	0.997	0.996	0.991	0.883	0.9734	
United India Insurance Company Ltd.	1.000	0.949	0.986	0.942	0.932	0.9618	
Mean	0.933	0.893	0.923	0.934	0.939		

*Source:* Computed through DEAP version 2.1



**Table 5**  
**Economies of Scale of the Insurance Companies**

Years	IRS	CRS	DRS	Total
2011-12	2	8	9	19
2012-13	6	5	8	19
2013-14	5	4	10	19
2014-15	7	4	8	19
2015-16	7	7	5	19

Source: Computed through DEAP version 2.1

The table 5 shows that in all years under study most of insurers have marked decreasing return to scale except the year 2015-16. Decreasing return to scale reveals that increase in output has been less than proportionate increase in input.

### CONCLUSION

Insurance companies earn their profits through underwriting of premium from various policies and investing in various securities as prescribed by the regulatory body. If, premiums collected will not be sufficient to cover the cost of coverage, insurance companies will face underwriting loss. Thus, Insurance prices are established based on estimates of expected claim costs and the costs to issue and administer the policy. In this study, an attempt has been made to estimate underwriting efficiency of nineteen non-life insurers over the period from 2012-16 by using DEA. The study finds that during all years under study, four (21 per cent) to eight (42 per cent) non-life insurance companies have been found on the CRS frontier and seven (37 per cent) to twelve (63 per cent) non-life insurance companies have been found on the VRS frontier. With regard to scale efficiency issues, four (21 per cent) to eight (42 per cent) companies have been operated at their most productive scale over the study period. The study also reveals that underwriting efficiency of non-life insurance industry has declined on both BCC and CCR model from 2011-12 to 2014-15. However, it slightly improved in the year 2015-16. Insurance companies should attempt to improve their underwriting results.

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