

Performance Appraisal of Life Insurance Companies in India: An All-Inclusive Analysis Using DEA

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Abstract

The article attempts to compute the efficiency of Life Insurance Companies operating in India in terms of technical, cost, revenue and profit efficiency for the period 2013-14 to 2021-22 by employing Data Envelopment Analysis (DEA). The article also scrutinises the sector-wise efficiency scores of Life Insurers by comparing Public and Private Insurance Sector. The efficiency values demonstrate that Indian life insurers are not fully efficient. Canara HSBC, LIC, MaxLife and Shriram exhibit high efficiency with a score of 1 during all years in terms of all measures of efficiency. Maximum inefficiency subsists on the pure technical side leading to technical inefficiency and the cost side, which in turn leads to profit inefficiency. Inferior efficiency in Private Sector appears to have marred the overall efficiency values of Insurance industry in India. The study strongly recommends the private sector to follow suit with LIC, the most efficient company representing the whole public sector.

Keywords: Life Insurance Companies, Cost Efficiency, Revenue Efficiency, Technical Efficiency, Pure Technical Efficiency, Profit Efficiency, Data Envelopment Analysis

JEL Classification: G2, C24

Introduction

Prior to liberalisation and privatisation, the Indian life insurance industry revolved around only one player, viz., Life Insurance Corporation of India (LIC), operating in

the public sector under the government's control. But eventually the Insurance Regulatory and Development Authority of India Act (IRDA) made several amendments in the Insurance Act 1938 and LIC Act 1956. This revoked the ascendancy of Life Insurance Corporation of India, as the entry of domestic and foreign private firms into the Indian life insurance market was allowed by IRDA. Thus, India today has its life insurance sector spread across the Public sector and the private sector. With this revolutionisation, India today is one of the fifth largest life insurance markets in the world, growing at a rate of 32-34% each year (Indian Brand Equity Foundation, 2022). Indian life insurance coverage has increased from 2.15% in 2002 to 3.2% till 2022. India's life insurance companies have witnessed evident growth since the last decade when measured in terms of their collective premium income, which accelerated from US\$ 39.7 billion in 2012 to US\$ 89.3 billion in 2022 (Indian Brand Equity Foundation, 2022). It is further anticipated that the premium collection from India's life insurance industry is expected to reach US\$ 317.98 billion by FY31 (Indian Brand Equity Foundation, 2022). But ironically the statistics of life insurance penetration in India are gloomy and exhibit a low figure of just 3.2% even till the year 2022, depicting a huge underserved market. This raises a question on the efficiency of life insurance companies and motivates gauging the efficiency performance of players in the life insurance sector in recent years.

'Efficiency' refers to how well a company uses its resources in comparison to the current best performing company in terms of performance at a specific time (Bhatia & Mahendru 2019). It describes how much of

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a gap exists between the quantity of inputs and outputs used by the concerned company and the quantity of inputs and outputs used by the efficient company. Efficiency is supposed to be attained when a company is not in a position to lessen the quantity of inputs to generate the level of outputs they are generating at present or when a company is unable to generate more outputs from the available level of resources. To analyse the performance of a company, different types of efficiency measures are used, such as, technical, cost, revenue and profit.

Technical efficiency is defined as the choice of alternatives which produce the largest outputs with the application of given resources or which use minimum inputs to produce given outputs (McKeivitt & Lawton, 1994). In order to survive in a competitive environment, companies need to be technically efficient and must increase their output or reduce the input usage to the extent possible. To know the causes of inefficiencies, technical efficiency is further segregated into two components of efficiency, i.e., pure technical and scale. Analysis of technical efficiency and its components assists in knowing whether companies are utilising their inputs to the fullest extent to produce desired output, thus balancing their input-output mix, without considering their prices. Pure Technical efficiency (PTE) illustrates the capability of a firm in using its most advantageous level of inputs to produce maximum outputs or, otherwise, its competence to produce utmost outputs with the minimum level of resources. On the other hand, scale efficiency (SE) indicates the ability of the company to operate at an optimum scale. Thus, the technical inefficiencies can be either owing to the ineffective application of the production plans (pure technical inefficiency) or the divergence of the company from the most productive scale size (scale inefficiency).

Cost efficiency is the effective choice of inputs along with their prices which aims to minimise the production cost of an insurance company (Bhatia & Mahendru, 2018; 2018a; 2018b). It suggests the possibility for an insurance company to further trim down its cost so that it can become even cost efficient by operating efficiently at the minimum cost. Evaluating cost efficiency is worthwhile, as this measure helps to investigate efficiency value at the existing output capacity by minimising the cost at that point of production. But measurement of cost efficiency alone is not adequate because the goal of revenue and profit maximisation supersedes the cost aspect (Bhatia

& Mahendru, 2018; 2018a; 2018b). Revenue efficiency evaluates the performance of a company in relation to the most revenue-efficient insurance company, which is generating the highest outputs from the inputs accessible to it. Profit efficiency is believed to be attained when an insurance company is not in a position to reduce the quantity of inputs and increase the level of outputs. Thus, a company is fully profit efficient, when it is able to generate maximum revenue with the minimum cost given the input-output prices. If a company wishes to be entirely efficient it requires concentrating on cost and revenue efficiency together in order to attain profit efficiency. A company is said to be fully efficient when it is able to minimise its inputs/cost and maximise its outputs/revenue concurrently at its existing production capacity and hence achieve greater profits. If companies perform efficiently in the market, only then can they derive benefit in this cutthroat environment. A fully efficient company can make higher profitability, which will assist them to survive and sustain the market.

Therefore, the present article assesses various efficiency measures, i.e., technical, cost, revenue and profit of life insurance companies working in India. It conducts company-wise and sector-wise assessments of the efficiency of life insurance organisations. The present article uses a non-parametric, approach namely, Data Envelopment Analysis (DEA), for the calculation of various measures of efficiency.

The study with its prominent objectives contributes significantly to the available literature. The simultaneous examination of technical, pure technical, scale, cost, revenue and profit efficiency shall enrich the extant literature, which suffers from a dearth of such an encyclopaedic evaluation. The measurement and analysis of all the inter-dependent parameters of efficiency would lead to a comprehensive assessment of the Indian insurance industry. Also, the study shall identify the lagging sector vis-a-vis public and private insurance sectors and help the government as well as the investors in rational decision-making with respect to policy formulations and investment in these sectors, respectively.

In order to develop an inclusive structure, the current article is distributed in different sections. The introductory section introduces the life insurance sector in India.

The section also outlines the concept of efficiency and brings out significant contributions of the current work to the literature. The section second presents the literature available on efficiency evaluation of insurance corporations and confirms the research gap. The third section outlines the econometric framework and inputs-outputs employed to compute the efficiency values. The fourth section explains the sample, data source, time period and research methodology applied in the present article. The section fifth represents the efficiency values of insurance companies and findings of the study. Section six examines the outcomes and gives discussion. The seventh section highlights the outcomes and the following section eighth presents theoretical implications. The penultimate section ninth gives practical implications. The final section 10 gives limitations and prospects of future research.

Literature Review and Research Gap

Review of literature suggests that considerable work has been undertaken in India to analyse the efficiency of the insurance sector. Some studies analysed insurance companies on the basis of technical efficiency and reported varied results. Sinha (2006) revealed that out of 13 life insurance companies, LIC and SBI Life had a technical efficiency score of one, whereas all other firms had scored less than one in the financial year 2004-05. Sinha (2007) further extended the study on 13 life insurance companies covering 4 years with respect to technical efficiency. The study stated that the average technical efficiency score had enhanced in 2003-04 in comparison to 2002-03; further, the scores remained the same in 2004-05, followed by a decline in 2005-06. Dutta and Sengupta (2011) also revealed that out of 14 life insurance companies, LIC, ICICI Prudential, SBI Life and Sahara were 100 % technically efficient from 2004-05 to 2008-09. The results of Nandi (2014) also depicted that LIC performed better as compared to other private companies and it operate on increasing return to scale. Sinha (2015) again studied technical efficiency of 15 Indian life insurance companies for the period 2005-06 to 2011-12. The results showed that the average technical efficiency scores declined in 2011-12 as compared to 2008-09. Throughout the study time period, both LIC and SBI were technically efficient.

The measure of technical efficiency alone does not provide a holistic picture of life insurance companies,

as it does not consider input-output prices in calculating technical efficiency. On account of the same, researchers used more contemporary measures of efficiency evaluation. Tone & Sahoo (2005) assessed the cost efficiency of Life Insurance Corporation of India (LIC) over a long period from 1982 to 2001. The results highlighted a decline in efficiency in the initial years till 1994-95 and an increase in the latter years till 2000-01. Sinha and Chatterjee (2009) evaluated the cost efficiency of Indian life insurance firms for the public and private sectors. A sample of 14 companies was assessed from 2002-03 to 2006-07. LIC was reported as 100 percent cost efficient for all the years of study. For private insurers, a rising pattern in cost efficiency was noticed in initial years but a fall was witnessed in the efficiency scores in 2005-06 and 2006-07. Sinha (2012) focussed on the efficiency from cost point of view of private life insurance concerns functioning in India. 15 corporations were assessed over the years 2005-06 to 2009-10. The results revealed variations and inconsistency in the cost efficiency values of private players. Noronh and Shinde (2012) also found LIC to be fully efficient with a cost efficiency score of 1. Variation in scores was reported for the remaining 22 life insurance corporations in the private segment over the whole decade of 2000-10. Dash and Muthyala (2018) too found Life Insurance Corporation to be the most efficient company out of a sample of 15 firms over the period 2010-17, chased by SBI Life and then by ICICI Prudential Life. Sen (2020) too assessed all life insurance corporations in India. The sample varied from 14 to 24 companies over the period of 10 years from 2005-06 to 2015-16. Companies performed better in the initial years, while stagnation was observed in the cost efficiency values towards the last years under analysis. Even LIC was revealed as cost inefficient in the later years.

Measurement of cost efficiency alone is also inadequate (Bhatia & Mahendru, 2018c). It is possible that a cost inefficient company which is spending high costs may make greater revenues due to high spends on marketing and advertising of its policies than the cost efficient one. Thus, ignoring the revenue side of an insurance company depicts an incomplete or probably an ambiguous opinion of the holistic performance of insurance companies. Hence, researchers evaluated different efficiency measurements simultaneously. Cummins (1999), Ward (2002), Choi and Weiss (2005) and Cummins and Xie

(2008) evaluated cost and revenue efficiency together. Berger et al. (1997), Klumpes (2004), Zanghieri (2009) and Trigo-Gamarra and Growitsch (2010) checked the cost and profit efficiency simultaneously. Berger et al. (2000) assessed cost, technical, revenue and profit efficiency of US insurance companies for the years 1988-1992. Bhatia and Mahendru (2023) also computed economic efficiency scores of Indian life insurance companies for the years 2013-14 to 2020-21. But, anxiously, no work is available in the prevailing literature which assesses the performance of life insurance companies in terms of all efficiency measurements together with respect to India. Since India has a massive population of 1.42 billion units where not much support is provided by the government, people need to be self-sustained. For this reason, the Indian population is highly dependent on the life insurance sector. Apprehensions with respect to the untimely death of the breadwinner scare the dependants of the family. Hence, people save for a rainy day and prefer to invest in life insurance policies. In the interest of mass investors, evaluation of all efficiency of life insurance companies is required. Since different measures of efficiency have their individual significance, hence, assessment of all the efficiencies shall establish an insightful vision of the efficiency of the insurance business in India. Thus, the current article endeavours to undertake the same and fill the prevalent research gap.

Econometric Framework

Data Envelopment Analysis (DEA)

Data Envelopment Analysis (DEA) is a linear programming-based benchmarking technique which calculates a firm's efficiency by converting inputs into outputs relative to its cluster firms (Deb, 2025; Simon & Prakash, 2025). It has the capability to scrutinise numerous inputs and outputs so that performance can be best modelled. DEA was initially established for computing technical, pure technical and scale efficiency in which input and output prices are not necessary. Subsequently, DEA was improved to calculate cost efficiency, revenue efficiency and profit efficiency which requires diverse input-output groupings with their prices (Fried, Lovell & Schmidt, 2008). The objective

of this measure is to assess whether a firm has achieved the specified objective of minimised cost and maximised revenue and profit. Cost efficiency is an input-orientated model, revenue efficiency is an output-orientated model and profit efficiency model is maximising profit model which considers costs and revenues simultaneously.

Input-Output Selection

The choice of inputs and outputs for computing the efficiency of financial institutions is a subjective process (Berger & Humphrey, 1997). Several approaches, namely, user cost approach, value added approach and intermediate approach are used for selecting inputs and outputs. The user cost approach was elaborated by Hancock (1985), who developed production theory for financial institutions in which a financial product is whether an input or output is determined depending on its net contribution to the revenues. Under the value added approach; high value adding items are regarded as outputs while labour and capital are regarded as inputs. The intermediate approach supposes that insurance companies act as a financial intermediary, where it transfers the potential losses of one party to another in exchange for a premium. Intermediate approach is most popularly used for studying the efficiency of insurance companies and is considered most appropriate in the case of the insurance sector (Noronh & Shinde, 2012; Nandi 2014; Sinha, 2015). Moreover, insurance companies act as a monetary intermediary that raises money from shareholders (capital) and policyholders (annuities and insurance policies). It then invests this money in the capital market and buffers it as investment for paying insurance claims. Thus, this article follows the intermediation approach by treating 'agents' and 'shareholder funds' as inputs and 'investments' and 'net premium received' as outputs. Agents play the main role in earning a premium by selling products of insurance companies to consumers. The funds collected from shareholder funds are used for investment purposes. Similarly, in order to calculate revenue efficiency, cost efficiency and profit efficiency, input-output prices are required. Input and output prices are calculated by considering the cost incurred or revenue generated by these inputs and outputs. The inputs, outputs and their prices are represented in Table 1.

Table 1: Explanation of Input and Output Variables

<i>Variables</i>	<i>Description</i>
Input Variables	
1. Total Agents	Total number of Agents that is, persons and Corporations employed by the Insurance Company
2. Capital Fund	Share Capital + Share Application Money that is pending Allotment + Surpluses + Fair Value Change Account
3. Policyholder Fund	Credit/(Debit) Fair Value Change Account+ Policy Liabilities+ Insurance reserves+ Provisions for Linked Liabilities
Input Prices	
1. Price of Number of Agents	Payment and Commission paid to agents/ Total Agents
2. Price of Capital Fund	(Operating Expenses of Insurance + Other Expenses than those indirectly related to insurance)/ Capital Fund
3. Price of Policyholder Fund	(Benefits Paid (Net) +Interim Bonuses paid)/ Policyholder Fund
Output Variables	
1. Investments	Shares + debentures+ Investments in Approved Securities + Government Securities + other approved securities
2. Net Premium Received	Premium -Reinsurance ceded+ Reinsurance accepted
Output Prices	
1. Prices of Investments	(Interest, Dividends & Rent + Profit on sale/redemption of investments + (Loss on sale/ redemption of investments) + Transfer/gain on revaluation/Change in Fair value + Amortization of Premium/Discount on Investments)/ Total Investments
2. Prices of Received Premium	Price of Premium Received as unity throughout the years for all companies.

Source: Authors' calculations.

Database and Research Methodology

The Indian insurance sector comprises 24 life insurance companies till date; 23 in the private sector while just a

single company i.e. LIC, in the public sector. The current study reviews the efficiency of all these 24 Life insurers. The list of Indian Life Insurers is shown in Table 2 as below:

Table 2: Indian Life Insurance Companies

<i>Sr. No.</i>	<i>Insurer</i>	<i>Foreign Partners</i>	<i>Year of Operation</i>
1	Aditya Birla Sunlife Insurance Company Ltd.	Sun Life Financial (India) Insurance Investment Inc, Canada	2000-01
2	Aegon Life Insurance Company Ltd.	Aegon India Holdings BV, Netherlands	2008-09
3	Ageas Federal Life Insurance Company Ltd.	Aegis Insurance International NV Netherlands	2007-08
4	Aviva Life Insurance Company India Ltd.	Aviva International Holdings Ltd. UK	2002-03
5	Bajaj Allianz Life Insurance Company Ltd.	Allianz, SE Germany	2001-02
6	Bharti AXA Life Insurance Company Ltd.	AXA India Holdings, France	2006-07
7	Canara HSBC Life Insurance Company Ltd.	HSBC Insurance (Asia Pacific) Holdings Ltd. UK	2008-09
8	Edelweiss Tokio Life Insurance Company Ltd.	Tokio Marine & Nichido Fire Insurance Company Ltd. Japan	2011-12
9	Exide Life Insurance Company Ltd.	---	2001-02
10	Future Generali India Life Insurance Company Ltd.	Participatie Maatschapij Graafschap Holland NV, Netherlands	2007-08
11	HDFC Life Insurance Company Ltd.	Standard Life (Mauritius Holdings) 2006, Ltd. UK	2000-01
12	ICICI Prudential Life Insurance Company Ltd.	Prudential Corporation Holdings Ltd. UK	2000-01
13	IndiaFirst Life Insurance Company Ltd.	Carmel point investments India pvt. Ltd.	2009-10
14	Kotak Mahindra Life Insurance Ltd.	---	2001-02

Sr. No.	Insurer	Foreign Partners	Year of Operation
15	Life Insurance Corporation of India	---	1956-57
16	Max Life Insurance Company Ltd.	Mitsui Sumitomo Insurance Company Ltd. Japan	2000-01
17	PNB Metlife India Insurance Company Ltd.	Metlife International Holdings Inc, USA	2001-02
18	Pramerica Life Insurance Company Ltd.	Prudential International Insurance Holdings Ltd. USA	2008-09
19	Reliance Nippon Life Insurance Company Ltd.	Nippon Life Insurance Company Ltd. Japan	2001-02
20	Sahara India Life Insurance Company Ltd.	---	2004-05
21	SBI Life Insurance Company Ltd.	BNP Paribas Cardif, France	2001-02
22	Shriram Life Insurance Company Ltd.	Sanlam Emerging Markets (Mauritius) Limited	2005-06
23	Star Union Dai-ichi Life Insurance Company Ltd.	Dai-ichi Life Insurance Company Ltd. Japan	2008-09
24	TATA AIA Life Insurance Company Ltd.	American International Assurance Company (Bermuda) Ltd.	2001-02

Source: IRDA Website, 2022.

The latest 9 years, from 2013-14 to 2021-22, are taken for the efficiency evaluation of the life insurance industry. The information of insurance companies is gathered from the Insurance Regulatory Development Authority (IRDA) website, which provides company-wise policyholder account, shareholder account and balance sheets. Annual reports of insurance companies, website of Life Insurance Council and handbook on Indian insurance statistics have also been used.

Results and Empirical Findings

Efficiency of Indian Life Insurance Companies

In this section, technical, pure technical, scale, cost, revenue and profit efficiency are calculated for the time period of the study. First, the efficiency scores are calculated individually for all life insurance companies operating from 2013-14 to 2021-22 by employing Data Envelopment Analysis (DEA). Then the efficiency scores are aggregated to know the overall efficiency. The results are presented in Table 3:

Table 3: Efficiency Scores of Indian Life Insurers

Year	TE	PTE	SE	CE	RE	PE
2013-14	0.934	0.958	0.974	0.882	0.877	0.733
2014-15	0.933	0.952	0.980	0.882	0.878	0.776
2015-16	0.940	0.959	0.980	0.866	0.858	0.625
2016-17	0.950	0.970	0.979	0.860	0.907	0.809
2017-18	0.957	0.971	0.986	0.862	0.894	0.798
2018-19	0.966	0.980	0.986	0.845	0.912	0.833
2019-20	0.974	0.981	0.992	0.854	0.893	0.563
2020-21	0.977	0.981	0.995	0.875	0.912	0.865
2021-22	0.977	0.981	0.996	0.882	0.897	0.822
Average	0.956	0.971	0.985	0.868	0.892	0.758

TE: Technical Efficiency, PTE: Pure Technical efficiency, SE: Scale Efficiency, CE: Cost Efficiency, RE: Revenue Efficiency, PE: Profit Efficiency.

Source: Authors' calculations.

As seen in Table 3, the overall average technical, pure technical, scale, cost, revenue and profit efficiency (inefficiency) of the Indian life insurers is 95.6% (4.4%), 97.1% (2.9%), 98.5% (1.5%), 86.8% (13.2%), 89.2% (10.8%) and 75.8% (24.2%), respectively, for the duration of the study. The results emphasise that the overall life insurance sector is inefficient in consuming its inputs and generating the outputs, as the efficiency value is lower than the full efficiency score of 1 for all efficiencies. To elaborate, the results of technical efficiency indicate that, on average, Indian life insurers have exploited only 95.6% of the inputs to generate their present level of outputs. The pure technical efficiency score (97.1%) also specifies that insurance companies can still reduce input resources and generate the same output levels or generate more outputs by utilising the same amount of inputs. The scale efficiency score (98.5%) shows that life insurers are not operating on the optimum scale. Additionally, the results of cost efficiency indicate that, on average, Indian life insurers have exploited only 86.8% of the inputs to generate the particular level of outputs and have unused inputs of 13.2%. Life insurers could produce only 89.2% of the revenues, which is to an extent lesser to have the full efficiency value of 1. Similarly, Indian life insurers merely earn 75.8% of accessible profits but lose the chance to make 24.2% further profits. Year-wise evaluation of technical, pure technical, scale, cost,

revenue and profit efficiency of Indian life insurers highlights that all efficiencies follow quite an erratic pattern, grossly remaining at 90% in each year when checked without prices and above 70% when prices are considered. A noticeable observation from Table 3 suggest that the main cause of technical inefficiency is attributed to pure technical inefficiency (2.9%) as it is higher than scale inefficiency (1.5%). No doubt both cost and revenue sides show a modest amount of inefficiency; however, the maximum inefficiency exists on the cost side, which is in succession reflected in profit inefficiency. In a nutshell, the overall performance of insurance companies expressed with the help of technical and economic efficiency scores seems to be slightly undesirable.

Company-Wise Technical, Pure Technical, Scale, Cost, Revenue and Profit Efficiency of Indian Life Insurers

The efficiency scores of the insurance sector in India reveal inefficiency among life insurers in India. In order to identify the grey areas, there is a need to evaluate company wise efficiency performance and examine the efficiency scores of Indian life insurance companies separately. This would assist to segregate relatively the bad performers from the good ones. The results are calculated in Table 4 below:

Table 4: Company-Wise Efficiency Scores of Life Insurers

<i>Insurers</i>	<i>TE</i>	<i>Rank</i>	<i>PTE</i>	<i>Rank</i>	<i>SE</i>	<i>Rank</i>	<i>CE</i>	<i>Rank</i>	<i>RE</i>	<i>Rank</i>	<i>PE</i>	<i>Rank</i>
Aditya Birla	0.950	18	0.950	18	1.000	1	0.887	15	0.753	21	0.489	20
Aegon	0.857	22	0.916	21	0.936	23	0.700	21	0.876	16	0.712	15
Ageas Federal	0.928	19	0.932	19	0.996	15	0.856	17	0.753	20	0.619	17
Aviva	0.913	20	0.928	20	0.984	18	0.858	16	0.601	24	0.125	24
Bajaj Allianz	0.996	8	1.000	1	0.996	13	0.938	11	0.800	18	1.000	1
Bharti AXA	0.799	24	0.902	23	0.886	24	0.528	23	0.871	17	0.408	21
Canara HSBC	1.000	1	1.000	1	1.000	1	1.000	1	1.000	1	1.000	1
Edelweiss Tokio	0.989	11	0.990	13	0.999	7	0.473	24	0.986	9	0.915	12
Exide.	0.912	21	0.915	22	0.996	14	0.760	20	0.752	22	0.495	19
Future Generali India	0.838	23	0.855	24	0.980	20	0.623	22	0.712	23	0.322	23
HDFC	0.997	7	1.000	1	0.997	12	0.998	5	1.000	1	1.000	1
ICICI Prudential	0.981	12	1.000	1	0.981	19	0.957	10	0.933	12	1.000	1
IndiaFirst	0.992	9	0.995	11	0.997	11	0.987	7	0.991	8	0.353	22
Kotak Mahindra	0.991	10	0.992	12	0.998	9	0.894	13	0.939	11	0.863	13
LIC	1.000	1	1.000	1	1.000	1	1.000	1	1.000	1	1.000	1
MaxLife	1.000	1	1.000	1	1.000	1	1.000	1	1.000	1	1.000	1
PNB Metlife	0.960	15	0.974	17	0.985	16	0.853	18	0.887	14	0.699	16

<i>Insurers</i>	<i>TE</i>	<i>Rank</i>	<i>PTE</i>	<i>Rank</i>	<i>SE</i>	<i>Rank</i>	<i>CE</i>	<i>Rank</i>	<i>RE</i>	<i>Rank</i>	<i>PE</i>	<i>Rank</i>
Pramerica	0.998	5	0.998	10	1.000	1	0.765	19	0.915	13	0.970	10
Reliance Nippon	0.964	14	0.978	16	0.985	17	0.892	14	0.881	15	0.718	14
Sahara India	0.998	5	1.000	1	0.998	9	0.985	8	1.000	1	1.000	1
SBI	0.955	16	0.986	14	0.969	21	0.972	9	0.968	10	0.926	11
Shriram	1.000	1	1.000	1	1.000	1	1.000	1	1.000	1	1.000	1
Star Union Dai-ichi	0.955	17	1.000	1	0.955	22	0.996	6	1.000	1	1.000	1
TATA AIA	0.980	13	0.981	15	0.999	7	0.901	12	0.785	19	0.582	18

TE: Technical Efficiency, PTE: Pure Technical efficiency, SE: Scale Efficiency, CE: Cost Efficiency, RE: Revenue Efficiency, PE: Profit Efficiency.

Source: Authors' calculations.

As seen from Table 4, the majority of life insurance companies are efficient, as their efficiency scores are higher than 0.800. Canara HSBC, LIC, MaxLife and Shriram Life insurers positioned at rank 1 with an efficiency score of 1. These are followed by Pramerica Life Insurance and Sahara India with an efficiency score of 0.998, succeeded by HDFC (0.997), Bajaj Allianz (0.996) and IndiaFirst Life Insurance Company (0.992). On the pessimistic side, Bharti AXA has the lowest technical efficiency score of 0.799, standing at 24th rank. It is preceded by Future Generali India (0.838), Aegon (0.857) and Exide (0.912). Moreover, one of the components of technical efficiency, i.e., pure technical efficiency reveals that 9 (37.5%) life insurance companies are fully efficient, as their efficiency score is 1. Canara HSBC, LIC, MaxLife, Sahara India, HDFC, Bajaj Allianz, ICICI Prudential, Star Union Dai-ichi and Shriram Life insurers positions at number 1. On the gloomy side, Future Generali India has the lowest pure technical efficiency score of 0.855, standing at 24 ranking positions, preceded by Bharti AXA with a score of 0.902. Scale efficiency, another component of technical efficiency, demonstrates that Aditiya Birla, Canara HSBC, LIC, MaxLife, Pramerica and Shriram Life insurers positioned at number 1 and have an efficiency score of 1. Bharti AXA has the lowest scale efficiency score of 0.886.

From Table 4, it is seen that 4 (17%) life insurance companies are efficient from a cost point of view, as they have an efficiency score of 1. An optimistic visualisation depicts that 18 (75%) Indian life insurers have efficiency scores higher than 0.800. Canara HSBC, LIC, MaxLife and Shriram Life insurers in the number 1 position and have the highest cost efficiency score of 1. It is followed

by HDFC Life Insurance Company (0.998), Star Union Dai-ichi (0.996) and Indiafirst (0.987). On the pessimistic side, the remaining 6 (25%) companies have wasted more than 25% of their inputs and are cost incompetent. Edelweiss Tokio has the lowest cost efficiency score of 0.473, standing at 24th rank, preceded by Bharti AXA (0.528), Future Generali India (0.623), Aegon (0.700) and Exide (0.760). The overall combined average cost efficiency scores no doubt drop to a low of 0.868 only (refer Table 3).

Table 4, also highlights that 7 (29%) out of 24 companies, namely, Canara HSBC, LIC, MaxLife, HDFC, Star Union Dai-ichi, Sahara India and Shriram Life insurers are fully revenue efficient with an efficiency score of 1, thus ranking in the first position. These are followed by Indiafirst (0.991), Edelweiss Tokio (0.986) and SBI (0.968). Aviva has the lowest score of 0.601 in the case of revenue, efficiency which suggests that the company has produced only 60% of the revenues that it is anticipated to produce. It is preceded by Future Generali India (0.712), Exide (0.752), Aditiya Birla (0.753) and Ageas Federal (0.753).

As seen from Table 4 again, 9 (37.5%) companies have a score of 1 in profit efficiency. Canara HSBC, LIC, MaxLife, HDFC, Star Union Dai-ichi, Sahara India, ICICI, Bajaj Allianz and Shriram Life Insurers are completely efficient from the viewpoint of profit efficiency with a score of 1. This depicts that all these companies take into consideration both the cost and the revenue side of the company's business concurrently. It is followed by Pramerica (0.970), SBI (0.926) and Edelweiss Tokio (0.915) as subsequent rankers. On the other hand, Aviva has the lowest profit efficiency of 0.125, preceded by

Future Generali India (0.322), IndiaFirst (0.353), Bharti Axa (0.408) and Aditiya Birla (0.489), which stands as the last 5 rankers.

On the whole, Canara HSBC, LIC, MaxLife and Shriram exhibit high efficiency scores of 1 during all years in terms of all the efficiency scores. These companies are considered as entirely efficient, as the input-output mix of these companies lies on the efficient frontier for all these years.

Ownership-Wise Efficiency Evaluation of Indian Life Insurers

This section assesses the efficiency of insurance businesses across ownership structures classified as the public and private insurance sectors. Consequently, the company-wise scores are aggregated to calculate ownership-wise average scores. Table 5 shows the ownership-wise efficiency scores of life insurance companies below:

Table 5: Ownership-Wise Efficiency Score of Life Insurers

Year	INSURERS	TE	PTE	SE	CE	RE	PE
2013-14	Public Insurers	1.000	1.000	1.000	1.000	1.000	1.000
	Private Insurers	0.931	0.957	0.973	0.877	0.871	0.721
2014-15	Public Insurers	1.000	1.000	1.000	1.000	1.000	1.000
	Private Insurers	0.930	0.950	0.979	0.877	0.873	0.767
2015-16	Public Insurers	1.000	1.000	1.000	1.000	1.000	1.000
	Private Insurers	0.937	0.957	0.979	0.860	0.852	0.609
2016-17	Public Insurers	1.000	1.000	1.000	1.000	1.000	1.000
	Private Insurers	0.948	0.969	0.978	0.854	0.903	0.801
2017-18	Public Insurers	1.000	1.000	1.000	1.000	1.000	1.000
	Private Insurers	0.955	0.970	0.985	0.856	0.889	0.789
2018-19	Public Insurers	1.000	1.000	1.000	1.000	1.000	1.000
	Private Insurers	0.965	0.979	0.985	0.838	0.908	0.825
2019-20	Public Insurers	1.000	1.000	1.000	1.000	1.000	1.000
	Private Insurers	0.973	0.980	0.992	0.848	0.888	0.544
2020-21	Public Insurers	1.000	1.000	1.000	1.000	1.000	1.000
	Private Insurers	0.976	0.981	0.995	0.870	0.908	0.859
2021-22	Public Insurers	1.000	1.000	1.000	1.000	1.000	1.000
	Private Insurers	0.976	0.981	0.995	0.876	0.893	0.814
Average	Public Insurers	1.000	1.000	1.000	1.000	1.000	1.000
	Private Insurers	0.954	0.969	0.985	0.862	0.887	0.748
TE: Technical Efficiency, PTE: Pure Technical efficiency, SE: Scale Efficiency, CE: Cost Efficiency, RE: Revenue Efficiency, PE: Profit Efficiency							

Source: Authors' calculations.

The results presented lead to much contemplation when LIC, being the only company representing the public sector has higher average efficiency scores, i.e., 1 in all the measures of efficiency in all years against 23 other companies representing the private sector with relatively low average efficiency scores of technical efficiency (0.954), pure technical efficiency (0.969), scale efficiency (0.985), cost efficiency (0.862), revenue efficiency (0.887) and profit efficiency (0.748).

Analysis and Discussion

The company-wise analysis highlights Canara HSBC, LIC, MaxLife and Shriram exhibit high efficiency scores of 1 during all years in terms of all the efficiency scores. Canara HSBC Life Insurance Company uses the faith and market information gathered by Punjab National Bank and Canara Bank jointly with the global insurance knowledge and proficiency of HSBC. It provides services

to more than 115 million bank customers with the help of a well-diversified network of over 11000 branches of bank partners in India (Canara, HSBC Life Insurance Company, 2022). This vast paraphernalia definitely helps it to generate more revenues.

LIC is one of the most trustworthy establishments benefitting from the confidence, belief and credence of the clients for more than 6 decades. After all, the insurance industry is based on 'reliance' and 'confidence'. The faith and trust of the public in LIC assist it to sell more policies and attract more customers without incurring much expenditure on marketing of its products. Moreover, LIC has a strong network of agents for distribution of their policies who are paid only when they sell insurance policies. This assists LIC to manage its cost while maintaining an equilibrium with generating outputs, i.e., selling of policies. Also, being a pioneer company, LIC has been in existence for a long time and has a huge branch network set up all over the nation (LIC, 2022). It has vast reach among the common people, which helps it to exploit economies of scale and reduce its working cost.

Max life Insurance Company serves customers with new-age innovative insurance products with multiple benefits like return on premium option, flexible policy terms and comfortable tenure, which helps them to generate more outputs by selling more and more policies. Besides, Max Life Company serves customers with long-term savings, protection and retirement solutions which are delivered by their highly professional agents and thus leading them to manage their operational costs efficiently. Moreover, Max Life Insurance Company is known for its best claim settlement ratio, i.e., 99.34% (FY 2021-22), which helps them to achieve higher profits by managing revenues and cost simultaneously (Forbes, 2022).

Shriram Life Insurance Company, with its efficient use of capital, offers a wide range of cost-effective individual and group insurance policies and has a strong network of 4050 branches across India, which targets mainly the underbanked and unbanked segments of the population of the country. Moreover, Economic Times (2021) reported that Shriram Life Insurance Company extends financial protection to customers residing even in the deepest rural locations, i.e., approximately 47% of its new business is generated from the rural segment. This all assists it

to reach every section of society and cater to a wider population at low operational costs.

It is seen that across ownership, the public sector (LIC) has overall revealed a full efficiency value of 1, which is different from the private sector life insurers. It appears that LIC dominates all the other private sector companies. LIC has a way back existence of more than 60 years. It endeavours to make insurance products available to every person in any corner of the country with a network of 2048 branches, 113 divisional offices, 8 zone-specific offices and 1381 satellite offices (LIC, 2022). LIC is the leading insurance participant and has massive client coverage of more than 29 crore policyholders (IRDA, 2019). Moreover, the premium charges on different products offered by LIC are less costly than those of private players. These all favourable points help LIC to considerably make higher revenues and profits as distinguished from their competitors in the private sector.

The private sector focuses just on the 'creamy layer' of society represented by rich and wealthy people. It ignores more than 3/4th of the population that belong to rural and semi-urban areas. Consequently, the major proportion of market share is captured by the Public sector leading to higher revenue efficiency. Also, private sector adds frills to its business in its endeavour to bring innovation and uniqueness. The premium added to the cost makes its products quite expensive for the larger population. The private sector also undertakes extensive marketing and advertising for the launching and sale of its products. It makes infrastructural investments in order to adopt tech-savvy channels of distribution. All these discretionary expenses reduce its cost efficiency as against the public-sector insurance companies, consequently significantly affecting its revenue and profit efficiency scores.

Our results corroborate with Sinha and Chatterjee (2009), Noronh and Shinde (2012) and Shinde (2012) who found LIC to be fully efficient. The results of these studies correspond with our sector-wise analysis, as well as endorse that public-sector insurance companies outperform those in the private sector. With respect to cost efficiency, Sinha and Chatterjee (2009) and Noronh and Shinde (2012), commensurate with our findings and suggest LIC to be 100% cost efficient. Findings of Sinha and Chatterjee (2009) and Noronh and Shinde (2012)

correspond with our findings with respect to private life Insurers endorsing variations in scores of cost efficiency of these companies over different years under review. However, our results do not support the latest study undertaken by Sen (2020) that suggests LIC to be cost inefficient. Anxiously, none of the studies are available in literature that can equate and support our findings with regard to revenue and profit efficiency in the insurance business.

Conclusion

The presented article bridges a very prominent research gap prevailing in the extant studies by concurrently evaluating all the measures of efficiency simultaneously in the Indian life insurance industry and undertaking an across ownership analysis by comparing companies in the public and private sector. The results lead to anxious outcomes where 23 private players seem incapable of competing with a single gigantic participant in the public sector, i.e., LIC. Overall, Indian life insurers are not fully efficient as their overall average technical, pure technical, scale, cost, revenue and profit efficiency of the Indian life insurers is less than the yardstick of 1. The company-wise results of the study suggest that Canara HSBC, LIC, MaxLife and Shriram exhibit high efficiency scores of 1 during all years in terms of all the efficiency scores. These companies are considered as entirely efficient, as the input-output mix of these companies lies on the efficient frontier for all these years. The ownership-wise results provide that the public sector (LIC) has more efficiency scores than life insurers in the private segment.

Theoretical Implications

There are some theoretical implications that the current study advocates with respect to insurance business. First, life insurance shields the masses in case of casualties like the early death of a bread earner, medical emergencies, etc. It is also a major source of savings in case of survival of the policyholders. In fact, life insurance gives an assurance of paying benefits both in case of death and survival. These savings help people to meet their lagging responsibilities, such as their children's education and marriage, medical expenses of ageing people at home, or any other kind of emergency situations. In the end, it is obligatory for insurance companies to pay back to the policyholders.

With such a demanding responsibility in its profile and the involvement of hard earned money of people, maintenance of efficiency in the insurance industry is very vital. Secondly, competition brings the spirit to perform better. So perhaps the inclusion of private players in the insurance industry has been a healthy step undertaken by the authorities of the country. But simultaneously new participants need to justify their existence by proving their efficiency. Inefficient businesses cannot be sustained in the long run. Insurance business thrives on the money collected from the public. Thus, it must prove its worth and efficiency. Thirdly, in India, insurance spread is quite low, as the life insurance penetration ratio is merely 3.2%. Hence, it is desirable that more insurance companies are opened in the country for the coverage of a vast population of 1.42 billion. But low performers need to be gauged and eliminated; otherwise, the average efficiency of the whole sector becomes low and disappointing. Last but not least, public sector insurance companies are deriving benefits of economies of scale by penetrating into even the backward areas, while the private players seem to take advantage of innovation and modernisation with focus on the creamy layer. A novel revenue business model that caters distinctly to different layers of the society for both sectors should be framed by the authorities so that benefits can be derived by all the companies across their varied ownerships.

Practical Implications

The results help in deriving some practical implications as well. First, since insurance companies are not fully efficient in all the years under assessment and inefficiency lies in the private sector, the study strongly implies that private sector insurance companies need to improve their performance and efficiency. The total average efficiency scores of insurance businesses are marred more due to the inefficiency of the private sector. They should adopt a new business model, the 'Profit Pyramid Business Model', which emphasises covering people from different income segments of the society. This would help the private sector to widen their coverage and include even the low and middle-income population of the country as investors in their business. Also, discretionary expenditure, especially on premium advertising, needs to be restricted by the private sector. Every drop fills the ocean and hence, the expenses saved shall provide for cost coverage and gradually lead to profit generation.

Secondly, the main cause of technical inefficiency is attributed to pure technical inefficiency as it is higher than the scale inefficiency. Thus, life insurers reconsider their input-output mix in order to improve technical efficiency. Thirdly, it is worth implicating that cost inefficiency plays a vital role in increasing the profit inefficiency. In order to improve cost efficiency, insurance companies need to focus more on controlling expenditure incurred, as there is less than proportionate contribution of this expenditure to productivity and revenue generation. Fourthly, company-wise analysis reports that Bharti AXA and Edelweiss Tokio have lower technical and cost efficiency scores. Aviva has the lowest revenue and profit efficiency score. These companies need to work upon improving their performance with respect to controlling costs and generating revenues. For instance, costs on excessive sales force must be curtailed and virtual modes of business may be adopted. A balanced combination of personal and automated structure perhaps solves the problem of lagging companies.

Limitations and Future Scope

The article gives deep insights into efficiency evaluation of Indian insurance business. But no work is perfect. Hence, the current article too suffers from some limitations. The choice of inputs and outputs leads to variation in efficiency scores of insurance companies. Researchers' biases creep in while selecting the inputs and outputs. This might have restricted the generalisation of results. Similarly, selecting an appropriate measure for the price of inputs and outputs is a subjective process and might have affected the standardisation of findings. Still, the current work is an elaborative study of all efficiency measures across both the sectors not found in the existing literature. For future contributions to research, the work can definitely be replicated by changing the input-output mix in the efficiency calculation using the DEA technique. Likewise, the investigation can further be extended to recognise several company, industry and economy related factors which affect the efficiency of the insurance industry.

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