

Performance Measure of Indian General Insurance Companies Using DEA and Super Efficiency Model

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Abstract

This paper investigates the efficiency of the general insurance companies operating in India during the period 2011 to 2017. Data Envelope Analysis has been applied to estimate the efficiency of these insurance companies using publicly available financial data of different parameters related to their financial health. The value-added approach has been used which is the most appropriate method for studying insurance efficiency (Cummins et al., 1999). The value-added approach is closely related to the traditional measure of financial performance. The efficiency of each company in comparison with other companies of the insurance sector is estimated. The Super Efficiency Model has been applied to measure the most efficient company over a certain time horizon among all the companies. Efficiency score derived using the DEA contributes significant information towards identifying the scope for improvement.

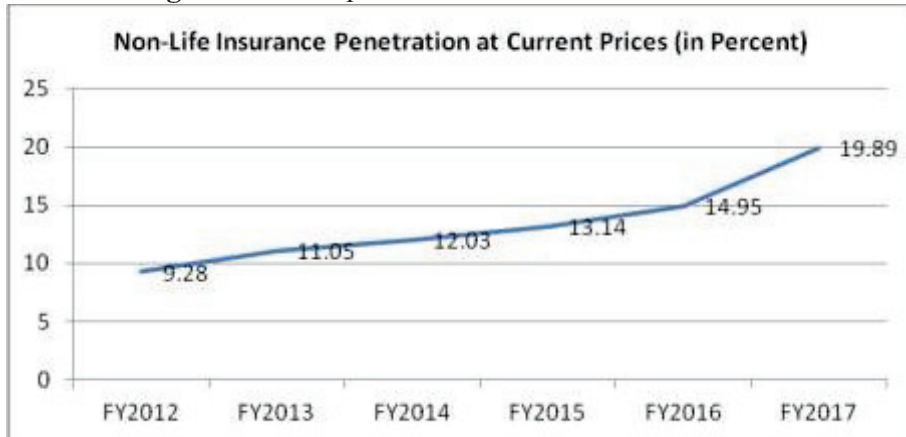
Keywords: DEA; Insurance Efficiency; Technical Efficiency; Super Efficiency Model; Value-Added Approach.

Introduction

Prior to liberalization, there were only four public sector companies in the general insurance sector. In 1994 the Government accepted the recommendations of RN Malhotra committee and opened up the sector for private sector. As at March 2017, there are 63 licensed insurers, with equal numbers of life and non-life, domestic reinsurers and foreign reinsurance company branches. While private insurers are more in number, public insurers account for about 55% in non-life, and about 60% in reinsurance, including business placed outside India. In recent years, most of the new entrants have been to the non-life sector, stand-alone health and reinsurance (since 2016), including the foreign reinsurer branches (IMF Report, 2018).

In December 2014, Government approved the ordinance increasing FDI limit in insurance sector from 26% to 49%. This was likely to attract investment of US\$ 7-8 billion. In 2015, Government introduced Pradhan Mantri Suraksha Bima Yojna and Pradhan Mantri Jeevan Jyoti Bima Yojana. The Government also introduced Atal Pension Yojana and Health insurance in 2015. National Health Protection Scheme will be launched under Ayushman Bharat, as per Union Budget 2018-2019. Insurance companies raised more than US\$ 6 billion from public issues in 2017(www.ibef.org).

Insurance has been strongly associated in India with savings and investments and less with protection (life or non-life). Most domestic property remains uninsured. For example, it is estimated that 40% of drivers have no motor insurance. Currently, crop and health insurance hardly exists. Moreover, most public non-life insurers rely on individual agents for product sales and level of digital penetration is also low.

Fig. no. 1. Low penetration of Non-Life insurance

Source: India Brand Equity Foundation (available: www.ibef.org)

However, recent regulatory changes and new delivery channels have required insurers to raise standards of customer treatment and improve persistency. There is particular focus on making available simple products that can be sold at low cost through the online channel. Government initiatives in cooperation with insurers have also contributed significantly to increased penetration. As per IRDA, in order to increase market penetration in health insurance people are needed to be educated about the benefits of health insurance along with providing incentives and free check-ups.

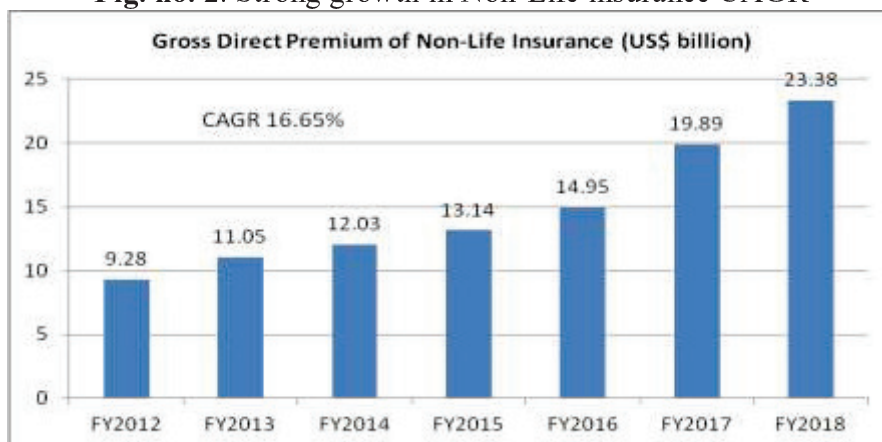
Statement of Problem

Insurance companies as financial institutions have two fold contribution for the growth and efficient functioning of the economy. Insurance companies not only facilitate risky businesses through transferring risk from insured to insurer, but also act as financial intermediaries to mitigate the transaction costs by bringing savers and borrowers together. The need for insurance as a risk transfer mechanism is even more imperative in the developing countries like India which are characterized as having low income levels, and lacking access to social security systems, healthcare, education, sanitation and employment opportunities.

As documented above, the non-life insurance segment has registered a consistent growth in terms of business size and premium over the decades. Gross Direct Premiums of non-life insurer in India

reached Rs.1.51 Trillion (US\$ 23.38 billion) in the 2017-2018 period. In the period 2011-2012 to 2017-2018, non-life insurance premium increased at a Cumulative Annual Growth Rate (CAGR) of 16.65%.

Fig. no. 2. Strong growth in Non-Life insurance CAGR



Source: India Brand Equity Foundation (available: www.ibef.org)

Many companies have roped into this industry which has germinated intense competition in the sector. Due to the high risky nature of this industry, need to analyze the performance of the non-life insurer is immensely critical. Thus, efficiency measurement is viewed as a coherent aspect of the business performance analysis in both the life insurance and non-life insurance sector.

In analyzing performance of a company, apart from window analysis it is important to measure their performance relative to other companies in that sector. So, measurement of insurers' efficiency in comparison to its peer companies is very relevant. In the non-parametric regime data envelopment analysis (DEA) gained momentum due to a number of factors like efficiency and simplicity. This encouraged its usage over several domains.

The primary objective of the study is to measure the efficiency score of the top ten non-life insurance companies operating in India. The study will also compare the efficiency score of the public and private sector non-life insurance companies.

Literature Review

A number of empirical studies have focused on efficiency of insurance companies and have examined many issues related to this problem. For instance, some studies have investigated the impact of risk management on the efficiency of insurers (Cummins et al., 2006; Cummins and Nini, 2002) whereas, some others have analyzed the impact of organizational form and corporate governance issues on the efficiency of insurers (Erhemjamts and Leverty, 2007). The general level of efficiency in both developed and developing countries has been examined by many researchers, but the results are mixed in both types of insurance markets. For instance; Kessner and Polborn (1999) applied Data Envelopment Analysis (DEA) to measure the efficiency of 110 life insurers of Germany over the period 1990 to 1993 and found that most of the insurers in the insurance market of Germany were inefficient. Another study by Weiss (1991) applied Stochastic Frontier Approach (SFA) to compute the efficiency of 100 US property and liability insurance companies over the period 1980 to 1984. The estimated results indicated cost inefficiency of around 12 to 33% amongst the US insurers. Moreover, Cummins (1999) applied DEA to compute the efficiency of 750 life insurers of U.S. for the period 1988 to 1995 and found lower efficiency scores amongst the insurance firms as compared to other financial institutions. Cummins et al. (1996) investigated the general level of technical efficiency over time in the 94 life and non-life insurers of Italy over the period 1985-1993. This study used the DEA technique to compute the efficiency scores and found that the efficiency amongst the insurers remain around 70% to 78% over the study period.

Another study by Hussels and Ward (2006) investigated the efficiency level of 78 German and U.K. life insurers over the period 1991-2002. The study used DEA and DFA to compute the efficiency scores and found that the insurers of German insurance market were more efficient as compared to U.K. insurance market.

Empirical researchers have also investigated the general level of efficiency in the insurance markets of developing economies. For instance, Tone and Sahoo (2005) investigated the general level of efficiency over time in the Indian life insurers using DEA over the period 1982-2001. The estimated results indicated that the allocative inefficiencies amongst the life insurers of India increased after 1994, whereas the cost efficiency also increased after 2000. In another study Qiu and Chen (2006) measured the efficiency of 32 life insurers of

China over the period 2000 to 2003 and reported a decline in the efficiency of insurance companies. Moreover, another study by Mansoor and Radam (2000) examined the general level of technical efficiency and productivity for 12 Malaysian life insurers using DEA approach over the period 1987-1997. Afza and Ali Asghar (2008) followed the value added approach to determine the output variables and input variables. They estimated the technical efficiency, allocative efficiency and cost efficiency of the insurance companies to determine the real contributors of efficiency in the insurance industry of Pakistan.

Methodology

This study applies the Data Envelopment Analysis (DEA) approach for the computation of efficiency scores in the insurance companies of India. DEA is a “data-oriented” approach for evaluating the performance of a set of peer entities called Decision Making Units (DMUs). By means of DEA relative efficiency of each DMU’s can be calculated in order to make a comparison. As a result, this method also provides reference units for inefficient ones. As a general rule of thumb, in competitive markets, DMUs are output-oriented, since we assume that inputs are under the control of the DMU, which aims to maximize its output subject to market demand (something that is outside the control of the DMU).

Charnes, Cooper and Rhodes (1978) first introduced the term DEA to describe a mathematical programming approach to the construction of production frontiers and efficiency measurements corresponding to the constructed frontiers. The latter authors proposed a model that had an input orientation and assumed constant returns-to-scale (CRS). This model is known in the literature as the CCR model. Later studies have considered alternative sets of assumptions. Banker, Charnes and Cooper (1984) were the first to introduce the assumption of variable returns-to-scale (VRS). This model is known in the literature as the BCC model.

The VRS model takes into account the variation of efficiency with respect to the scale of operation, and hence measures pure technical efficiency. The output-oriented measure of technical efficiency of any firm under VRS requires the solution of the following LP problem due to Banker, Charnes and Cooper, 1978:

Max θ

$$\text{Subject to } \sum_{j=1}^n w_j x_i^j \leq x_i^t; i = 1, 2, 3 \dots m$$

$$\sum_{j=1}^n w_j y_r^j \geq \theta y_r^t; r = 1, 2, 3 \dots s$$

$$\sum_{j=1}^n w_j = 1;$$

$$w_j \geq 0 (j = 1, 2, 3, \dots, n);$$

where:

w_j = the weight of the j th DMU,

x_i^j = value of the i th input variables for j th DMU,

y_r^j = value of the r th output variables for j th DMU and

x_i^t = the value of i th input variable for t th DMU.

m = number of inputs

s = number of outputs

n = number of DMU

θ = the efficiency of t th DMU.

Selection of inputs and outputs and number of DMUs is one of the core difficulties in developing a model and in preparation of the data. The choice of inputs and outputs is guided by choices made in previous studies as well as the availability of data. Insurer inputs can be classified into three principal groups: labor, business services & materials and capital. Insurance is a labor intensive industry, with agents' commission accounting for a major proportion of such labor costs. Operating expenses and other personnel costs related to insurance business are summarized under the head business services and materials. The rationale for the use of equity capital is that insurers must maintain equity capital to back the promise to pay claims even if losses are higher than expected and to satisfy regulatory requirements. Hence, equity to total asset ratio has been incorporated as the third input.

The present study has adopted premiums as output variable because it represents the risk pooling and risk bearing function of insurance companies. The income from investment is the second output as insurance companies can be considered as financial institutions seeking to maximize income from investments.

Data

The present study concentrates on non life insurance companies in India. The top ten non-life insurance companies operating in India have been identified based on their market share. The information has been collected from the insurance sector reports for the financial year 2017-2018. The study measures performance of all the companies over the last seven years ending 31.3.2011 to 31.3.2017. All relevant data have been collected from the annual reports of the respective insurance companies as publicized by them in their websites.

The top ten general insurance companies included in the study are as follows:

New India Assurance Company Limited
United India Insurance Company Limited
National Insurance Company Limited
Oriental Insurance Company Limited
ICICI Lombard General Insurance Company Limited
Bajaj Allianz General Insurance Company Limited
HDFC ERGO General Insurance Company Limited
GIC of India
Reliance General Insurance Company Limited
Tata AIG General Insurance Company Limited

The Data Envelopment Analysis (DEA) approach for the computation of efficiency scores in the general insurance companies of India has been applied as DEA is a linear programming technique for building an efficient frontier. The linear programmes have been solved using the LINGO statistical software and the results derived have been analyzed accordingly.

Results and Discussion

The efficiency score of a DMU states the efficiency of the DMU in utilizing the inputs to generate the outputs in comparison with other DMUs. Since we are using an output oriented model, the major aim is to increase outputs as much as possible, keeping the inputs either constant or decreasing it, if possible. The companies with an efficiency score of 1 indicate that the outputs cannot be further increased in their case and if it is increased, it will only be possible by increasing the inputs. The companies with an efficiency score of more than 1 indicate that even if all current inputs were used efficiently, output is less than potential output.

Table no. 1. Efficiency Score

YEAR	New India	United India	National	Oriental	ICICI	Bajaj	HDFC	GIC of India	Reliance	Tata
2017	1	1	1	1.43641	1	1	6.01949	1	1	4.80921
2016	1	1	1	1.42326	5.20408	1	5.99717	1	1	2.77671
2015	1	1	1	1	1	1	5.49716	1	1	3.25287
2014	1	1	1	1	1	1.07582	5.71013	1	1	3.11712
2013	1	1	1	1	1	1	5.85927	1	1	2.43397
2012	1	1	1	1	1	1	11.4243	1	1	2.57085
2011	1	1	1	1.18137	1	1.70081	13.4139	1	1	1

Source: Computed by the Authors using LINGO software

The output oriented technical efficiency of the different non-life insurance companies is depicted in Table no. 1. An efficiency score of more than 1 indicates that there is still scope for improvement and keeping the inputs constant; the outputs can be further increased thus the efficiency of the firm can be increased.

The analysis of a 7 year time-horizon that we considered shows that New India Insurance, United India Insurance, National Insurance, GIC of India and Reliance Insurance have proved to be efficient over all the years as compared to the other companies included in the study. ICICI Lombard has been efficient in all years under the study except one year that is 2015-2016. The performance of Bajaj Allianz has also been praiseworthy except for 2010-2011 and 2013-2014. All of them have been able to make the optimal utilization of the input consistently throughout the period. They have set examples for others to replicate. They have been able to generate substantial premium and ensure investment in marketable securities of the idle funds not used for claim settlements. They have also achieved an optimal output without change in the commission to premium ratio or investment in fixed assets or operating expenses.

HDFC ERGO and Tata AIG have not been able to match their competitors in any of the years included in the study. They have not been able to maximize the outputs to their fullest. These companies need to replicate the strategies adopted by the other efficient companies so as to increase their efficiency. Fortunately, both the companies have been trying to improve efficiency through different measures. Post merger with L&T General Insurance, HDFC ERGO has become the third largest private non-life company with a market share of 4.3%. To

fund expansion post acquisition, HDFC ERGO has raised Rs.350 crores through Non-Convertible Debentures in January 2017. In July 2016, Tata AIG General Insurance Company Limited has entered into corporate agency (non-life insurance) agreement with Bank of Baroda. The bank has one of the largest distribution networks in India which will be used by Tata AIG to build customized general insurance solutions for Bank of Baroda customers.

Interestingly, all the 5 public sector general insurance companies included in the study have been efficient in all the years of study. No wonder that the government proposes to merge National Insurance, United India Insurance and Oriental India Insurance into one company. Currently, these three major players contribute around 30% to the market of non-life-insurance. The synergies will bring in further efficiency in operations, claims management and technology platforms. The merger will reduce competition among the public sector general insurers and will shift their focus to reaching maximum number of uninsured people and assets. But subsequently, this will also create a monopolistic situation and private insurers must be cautious of it. Among the private players only Reliance General Insurance and to some extent ICICI Lombard and Bajaj Allianz have been able to match the performance of the public sector general insurers.

The years 2015-2016 seemed to be the worst of the lot wherein 4 general insurance companies have failed to attain an efficiency score of 1. The 2011-2012, 2012-2013 and 2014-2015 periods were the best years out of the 7 included in the study wherein a total of 8 companies out of the 10 companies attend an efficiency score of 1 respectively.

Table no. 2. Super Efficiency Score

Year	New India	United India	National	Oriental	ICICI	Bajaj	HDFC	GIC of India	Reliance	Tata
2017	0.45732	0.88980	1.92864	1.66725	0.62771	2.13210	6.73498	4.33E-02	2.55829	6.22627
2016	0.48162	0.86980	0.92453	1.57294	5.20408	1.80911	6.56587	4.45E-03	1.52005	3.84336
2015	0.53783	1.03798	0.86646	1.51714	1.22917	1.70704	6.15334	5.23E-02	2.23976	4.35967
2014	0.45367	1.01798	0.84767	1.34265	1.39881	1.91204	6.61414	5.69E-02	1.78368	4.76511
2013	0.37068	0.85840	1.06457	1.27503	2.41897	1.90738	6.99405	3.29E-02	2.47360	4.72193
2012	0.60956	0.95255	1.12028	1.12023	4.02632	1.91274	11.5131	3.46E-02	4.10132	5.45874
2011	0.61149	0.80263	0.80241	1.18455	4.19422	1.76674	13.4139	0.252976	1.34727	7.44497

Source: Computed by the Authors using LINGO software

Out of the multiple companies, which have been proved to be efficient each year, we had tried to identify the most efficient one by the super-efficiency analysis. These super efficiency scores among all efficient companies have been represented in Table no. 2. The analysis highlights GIC to be the most efficient for all 7 years included in the study. The public sector giant, General Insurance Corporation of India (GIC) has retained its leadership position in the general insurance market.

Limitation

In this study we have restricted the number of insurance companies to top ten. The period of study is also restricted to the last seven years. The study also includes only three inputs and two outputs. The study has concentrated on Indian general insurance companies only.

Further Research

In this study, DEA will be applied to Indian insurance companies only. Further research could be done on the insurance companies of different countries. Keeping in mind the constraints of DEA choice of input and output variables, further research and analysis have to be carried out to assess the impact of variables on efficiency. Year wise comparative analysis of each company considering each year as a separate DMU can be carried out in future.

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