Premium Income
of Indian Life Insurance Industry
A Total Factor Productivity Approach

Ram Pratap Sinha*

Subsequent to the passage of the Insurance Regulatory and Development Authority (IRDA) Act, 1999, the life insurance market in India underwent major structural changes in recent years. Between end-March 2000 and end-March 2005, the number of life insurance companies operating in India has increased from 1 to 15. As on March 31, 2005, the private sector life insurers enjoyed nearly 10% of the premium income and nearly 25% of the new business. In view of the changing scenario of competition in the life insurance sector, the paper compares 13 life insurance companies for the financial years 2002-03, 2003-04 and 2004-05 in respect of technical efficiency and changes in total factor productivity. For the purpose of computation of technical efficiency and total factor productivity, the net premium income of the observed life insurance companies has been taken as the output, and equity capital and the number of agents of insurance industries have been taken as the inputs. The results suggest that all the life insurers exhibit positive total factor productivity growth during the period.

Introduction

Indian life insurance industry underwent major structural changes during the second phase of financial sector reform. Prior to this, the government had a monopoly control over the insurance industry. Obviously, this facilitated preemption of scare financial resources for meeting government budgetary needs. The absence of competition, however, resulted in low penetration of life insurance in the Indian households. The scenario changed in the current millennium following the introduction of competition in life insurance industry on the basis of the recommendation of the R N Malhotra Committee on Insurance Deregulation (1994). In the end of 1999, the IRDA bill was passed in the parliament, which allowed the entry of private sector companies in the insurance business and led to the formation of Insurance Regulatory and Development Authority (IRDA).

In view of the changed competition scenario in the life insurance industry, this paper attempts to assess total factor productivity growth in the industry for the period 2003-05 using Malmquist Total Factor Productivity Index. The paper provides an overview

* Assistant Professor and Head, Department of Economics, Acharjya Brajendra Nath Seal (Government) College, Coochbehar, Kolkata, West Bengal. E-Mail: rp1153@rediffmail.com bundle

of the growth of the life insurance industry during the reform period; presents the methodological issues relating to measurement of technical efficiency and change in total factor productivity; describes the results obtained from the study; and finally, analyzes the results.

Growth of Life Insurance Business in the Reform Phase

After the opening up of the insurance sector for the private sector in end-1999, four private life insurance companies—Birla Sunlife Insurance Company, ICICI Prudential Life Insurance Company, Max New York Life Insurance Company, and HDFC Standard Life Insurance Company Ltd.—commenced their operations in 2000-01. By 2004-05, the total number of life insurance companies increased to 14.

During 2002-03 to 2004-05, the life insurance companies sold a total of 80,208,788 policies. Out of these, LIC sold 75,491,722 policies (94% of the total). The remaining 6% went to the private life insurers. In 2004-05, the life insurance companies sold a total of 26,211,198 new policies. Of this, LIC sold 23,978,123 policies (market share 91.48%), while the private sector life insurers sold 2,233,075 new policies (market share of 8.52%). Table 1 provides the details.

During the same period (2002-03 to 2004-05), the total premium income of the life insurance sector grew from Rs. 55,768 Cr to Rs. 82,855 Cr i.e., a growth of 49% first premium income (including single premium) grew by 55%, while renewal premium income grew by 46%. As on March 31, 2005, LIC enjoyed 90.67% market share of the total premium income. Tables 2 and 3 contain the details.

Table 1: Number of New Policies Sold by Life Insurance Companies (2002-03 to 2004-05)

(Rs. in Cr)

Insurer	2002-03	2003-04	2004-05
LIC	24,545,580	26,968,069	23,978,123
Private Insurers	825,094	1,658,847	2,233,075
Total	25,370,674	28,626,916	26,211,198

Source: IRDA Annual Reports.

Table 2: First Premium Income (Including Single Premium) of the Life Insurance Companies (2002-03 to 2004-05)

(Rs. in Cr)

Insurer	2002-03	2003-04	2004-05
LIC	15,977	17,347	20,653
Private Insurers	986	2,441	5,565
Total	16,963	19,788	26,218

Source: IRDA Annual Reports.

Table 3: Renewal Premium Income of The Life Insurance Companies (2002-03 to 2004-05)

(Rs. in Cr)

Insurer	2002-03	2003-04	2004-05
LIC	38,652	46,186	54,474
Private Insurers	153	680	2163
Total	38,805	46,866	56,637

Source: IRDA Annual Reports.

Productivity and Technical Efficiency of Life Insurance Companies

Sinha (2004) made a survey of the life insurance sector deregulation in India and made an early survey of the changing competition scenario in the sector and the emerging regulatory and supervisory issues relating to the sector.

Sinha (2006) compared the operating efficiency of 13 life insurance companies for the financial year 2004-05 using Data Envelopment Analysis (DEA). For this, the operating income and the net premium income of the observed life insurance companies have been taken as the output, and number of agents employed by the companies and equity capital as the inputs. The comparison of efficiency scores of the life insurance companies with the same of LIC show that the private insurance companies are still way behind LIC. However, the difference is less sharp in terms of net premium generation—the mean efficiency score of the private life insurance companies is only 36%, if we take operating income as the output indicator, which increases to 54%, if we take net premium income as the output indicator. In terms of net premium income not only LIC but SBI Life also has a technical efficiency score of one i.e., these two companies are declared technically efficient (given the inputs utilized, they produce the maximum observable output). All other firms have technical efficiency score less than one. In terms of operating income, no life insurance company except LIC was found to be technically efficient.

Sinha (2006) constructed stochastic production frontier for the Indian life insurance industry for 2003-05 using a Cobb-Douglas Production Function. For the purpose of construction of production frontier, the paper follows the approach taken by Battese and Coelli (1992) and adopts the parameterization process of Battese and Corra (1977). The results obtained from the study shows that during the period, there has been a secular improvement in the efficiency score of the life insurance companies. Further, the private sector life insurance companies improved their performance. On an average, the mean technical efficiency score of the private sector companies has been 35% of that of LIC. Further, from the error components frontier, it is observed that the output (net premium of the life insurance companies) is negatively related to the equity holding of the relative companies. It may be due to the fact that the equity holding decision in the present circumstances is more a regulatory requirement than anything else.

The Methodological Issues

In the study, we are concerned about productivity and efficiency of life insurance companies. Productivity refers to the output produced per unit of input. Measurement of efficiency, on the other hand, involves a comparison of actual output/input to optimal output/input.

Technical and Scale Efficiency of Productive Organizations:
A Formal Presentation

The production possibility set of a productive organization can be represented by two alternatives, but equivalent ways in terms of the input and output set. For any output bundle q^0, the input requirement set is

$$V(q^0) = \{x : (x, q^0) \in Ps\},$$ where Ps is production possibility set.

Similarly for any input bundle x^0, the producible output set is

$$P(x^0) = \{y : (x^0, q) \in Ps\}$$

A firm can be an output maximizer or a cost minimizer. In the output maximization approach, the firm is believed to maximize output given the input bundle. The efficacy of the firm in doing so is measured in terms of technical efficiency.

Technical Efficiency

It refers to the ability of a productive unit to reduce all variable inputs to produce a given level of output or to expand all variable outputs for given levels of inputs.

In our case, Technical Efficiency $= q^0/Ps(x^0) =$ Actual Output/Best Practice Output

Following the Banker *et al.* (1984) orientation (under the assumption of variable returns to scale), the problem for the firm is:

$$Max\,\phi$$

$$S.t.\,\phi q^0 \leq \lambda Y$$

$$X^0 \geq \lambda X$$

$$\sum \lambda j = 1 \lambda j \geq 0$$

If, however, the firm is assumed to enjoy constant returns to scale, then the condition $\sum \lambda j = 1$ is excluded.

Scale Efficiency

Scale efficiency is the ratio of Constant Return to Scale (CRS) Technical Efficiency/Variable Returns to Scale (VRS) Technical Efficiency, which is the indicator of the local returns to scale enjoyed by the firm (at the point of the observation). If scale efficiency is less than one, the respective firm exhibits VRS (increasing/decreasing). If the ratio is equal to one, the firm exhibits CRS.

Concept of Productivity Change

This paper also tries to measure productivity change in the observed public and private sector commercial banks taking off balance sheet exposure as the output. For this, output based Malmquist Total Factor Productivity (TFP) Index has been used. The Malmquist productivity index was introduced by Caves *et al.,* (1982). It is a normative productivity measure, which constructs a production frontier representing the technology and makes use of the corresponding distance functions evaluated at different input output combinations for the purpose of comparison of productivity. Following Fare *et al.,* (1994), the Malmquist TFP Index is defined as:

$$M_0(Y_{t+1}, X_{t+1}, Y_t, X_t) = [d_0^t(Y_{t+1}, X_{t+1}) \times d_0^{t+1}(Y_{t+1}, X_{t+1})/d_0^t(Y_t, X_t) \times d_0^{t+1}(Y_t, X_t)]$$

This represents the productivity of the production point (Y_{t+1}, X_{t+1}) compared to the point (Y_t, X_t). If $M_0(Y_{t+1}, X_{t+1}, Y_t, X_t) > 1$, it implies a positive total factor productivity growth during the period.

Decomposition of Productivity Change

The productivity change is now decomposed into technical change and technical efficiency change. In case of VRS, the technical efficiency can be further decomposed into pure technical efficiency and scale efficiency. Thus, we have the following relationships:

- For CRS:

    Total Factor Productivity Change = Technical Change x Technical Efficiency Change

- For VRS:

    Total Factor Productivity Change = Technical Change x Pure Technical Efficiency Change (VRS) x Change in Scale Efficiency

For a detailed study of the concept of TFP Malmquist approach, one may also refer to Diewert (1992), Førsund (1997), Coelli *et al.,* (1998) and Ray (2004).

Results from the Study

This study estimates the change in TFP (with decomposition) of 13 life insurance companies for 2002-03, 2003-04 and 2004-05, using the Malmquist Total Factor Productivity Index. Sahara Life is not considered in the paper, as it did not have operation for all the three years under consideration. For measurement of TFP and technical efficiency, specification of output and inputs is essential. In this case, the net premium income (after making adjustment for reinsurance premium paid) of the observed life insurance companies is considered as the output. The number of agents employed by the companies and equity capital has been considered as the inputs for the study. The data has been obtained from the IRDA website. The company-wise technical (both CRS and VRS) and scale efficiency scores are presented in Tables 4, 5 and 6. Table 7 shows the change in total factor productivity. Tables 8 to 11 present the mean efficiency and productivity change scores across ownership categories.

Table 4 presents the insurer-wise technical (under both CRS and VRS) and scale efficiency scores for the year 2002-03. Under CRS, only LIC is found to be efficient, while under VRS, two more insurers (Met Life and SBI Life) are found to be efficient. Excepting LIC, all other insurers enjoyed increasing returns to scale.

Table 5 discusses the insurer-wise technical (under both CRS and VRS) and scale efficiency scores for 2003-04. Under CRS, only LIC is found to be efficient, while under VRS, three more insurers (Aviva, Met Life and OM Kotak) are found to be efficient. Excepting LIC, all other insurers enjoyed increasing returns to scale.

Table 6 analyzes the insurer-wise technical (under both CRS and VRS) and scale efficiency scores for 2004-05. Under CRS, LIC and SBI Life are found to be efficient, while under VRS, three more insurers (AMP Sanmar, Met Life and OM Kotak) are found to be efficient. Excepting LIC, all other insurers enjoyed increasing returns to scale.

Table 7 shows the insurer-wise mean productivity change scores for the observed years. The change in total factor productivity under CRS can be decomposed into change in technical efficiency and technical change. The change in technical efficiency under CRS is the product of the change in technical efficiency under VRS and scale efficiency.

Table 4: Insurer-wise Efficiency Score of 2002-03 (Output—Net Premium Income)				
Insurer	Total Efficiency (CRS)	Total Efficiency (VRS)	Scale Efficiency	Returns to Scale
LIC	1.000	1.000	1.000	Constant
Birla Sunlife	0.385	0.454	0.846	Increasing
ICICI Pru	0.302	0.315	0.960	Increasing
HDFC Standard Life	0.221	0.242	0.915	Increasing
ING Vysya	0.093	0.124	0.751	Increasing
Max New York Life	0.285	0.343	0.832	Increasing
AMP Sanmar	0.065	0.298	0.217	Increasing
Bajaj Allianz	0.084	0.090	0.932	Increasing
Aviva	0.121	0.308	0.392	Increasing
Met Life	0.095	1.000	0.095	Increasing
TATA AIG	0.089	0.095	0.938	Increasing
SBI Life	0.562	1.000	0.562	Increasing
OM Kotak	0.183	0.247	0.743	Increasing

Table 5: Insurer-wise Efficiency Score of 2003-04 (Output—Net Premium Income)				
Insurer	Total Efficiency (CRS)	Total Efficiency (VRS)	Scale Efficiency	Returns to Scale
LIC	1.000	1.000	1.000	Constant
Birla Sunlife	0.991	1.000	0.991	Increasing
ICICI Pru	0.521	0.522	0.998	Increasing
HDFC Standard Life	0.373	0.387	0.962	Increasing
ING Vysya	0.184	0.200	0.921	Increasing
Max New York Life	0.508	0.551	0.922	Increasing
AMP Sanmar	0.115	0.189	0.611	Increasing
Bajaj Allianz	0.149	1.000	0.149	Increasing
Aviva	0.397	0.671	0.591	Increasing
Met Life	0.216	1.000	0.216	Increasing
TATA AIG	0.186	0.193	0.965	Increasing
SBI Life	0.225	0.246	0.912	Increasing
OM Kotak	0.539	1.000	0.539	Increasing

Table 8 compares the mean technical and scale efficiency of LIC and the private insurers for 2002-03. Table 9 compares the mean technical and scale efficiency of LIC and the private insurers for 2003-04. Table 10 compares the mean technical and scale efficiency of LIC and the private insurers for 2004-05 and Table 11 compares the mean productivity change scores of LIC and the private insurers for the period 2002-03 to 2004-05.

Table 6: Insurer-wise Efficiency Score of 2004-05 (Output—Net Premium Income)				
Insurer	Total Efficiency (CRS)	Total Efficiency (VRS)	Scale Efficiency	Returns to Scale
LIC	1.000	1.000	1.000	Constant
Birla Sunlife	0.717	0.717	1.000	Constant
ICICI Pru	0.368	0.384	0.957	Constant
HDFC Standard Life	0.303	0.315	0.963	Increasing
ING Vysya	0.196	0.198	0.989	Decreasing
Max New York Life	0.252	0.262	0.964	Decreasing
AMP Sanmar	0.095	1.000	0.095	Increasing
Bajaj Allianz	0.150	0.154	0.971	Increasing
Aviva	0.274	0.304	0.901	Increasing
Met Life	0.101	1.000	0.101	Increasing
TATA AIG	0.132	0.134	0.983	Increasing
SBI Life	1.000	1.000	1.000	Constant
OM Kotak	0.639	1.000	0.639	Increasing

Table 7: Insurer-wise Productivity Change Scores (Mean of the Observed Years)					
Insurer	Total Efficiency (CRS)	Technical Change	Total Efficiency (VRS)	Scale Efficiency Change	Total Factor Productivity Change
LIC	1.000	1.416	1.000	1.000	1.416
Birla Sunlife	1.365	1.953	1.256	1.087	2.667
ICICI Pru	1.103	1.912	1.105	0.998	2.109
HDFC Standard Life	1.171	1.911	1.141	1.026	2.238
ING Vysya	1.450	1.939	1.264	1.147	2.811
Max New York Life	0.940	1.969	0.873	1.077	1.852
AMP Sanmar	1.212	1.936	1.831	0.662	2.346
Bajaj Allianz	1.333	1.877	1.306	1.021	2.501
Aviva	1.506	2.001	0.993	1.517	3.014
Met Life	1.030	1.989	1.000	1.03	2.049
TATA AIG	1.216	1.890	1.188	1.024	2.298
SBI Life	1.334	2.027	1.000	1.334	2.704
OM Kotak	1.867	1.978	2.013	0.928	3.693

Analysis of Results

Comparison of technical efficiency scores of the life insurance companies show that the private insurance companies are still way behind the Life Insurance Corporation (LIC). Since under the assumption of CRS, the inefficient firms are penalized more in terms of distance from the best practice frontier the mean technical efficiency score of the life insurers under

Table 8: Technical and Scale Efficiency Score by Ownership Category—2002-03 (Output—Net Premium Income)			
Particulars	Technical Efficiency (CRS)	Technical Efficiency (VRS)	Scale Efficiency
LIC	1.000	1.000	1.000
Private Life Insurance Companies (Mean)	0.207	0.376	0.682
Overall Mean	0.268	0.424	0.706

Table 9: Technical and Scale Efficiency Score by Ownership Category—2003-04 (Output—Net Premium Income)			
Particulars	Technical Efficiency (CRS)	Technical Efficiency (VRS)	Scale Efficiency
LIC	1.000	1.000	1.000
Private Life Insurance Companies (Mean)	0.367	0.580	0.731
Overall Mean	0.416	0.612	0.752

Table 10: Technical and Scale Efficiency Score by Ownership Category—2004-05 (Output-Net Premium Income)			
Particulars	Technical Efficiency (CRS)	Technical Efficiency (VRS)	Scale Efficiency
LIC	1.000	1.000	1.000
Private Life Insurance Companies (Mean)	0.352	0.539	0.797
Overall Mean	0.402	0.574	0.813

Table 11: Mean Productivity Change Scores of the Observed Life Insurers (By Ownership Category) (2002-03 to 2004-05)					
Insurer Category	Technical Efficiency Change–CRS	Technical Change	Technical Efficiency Change–VRS	Scale Efficiency Change	Total Factor Productivity Change
LIC	1	1.416	1	1	1.416
Private	1.294	1.949	1.248	1.071	2.524
Total	1.271	1.907	1.228	1.065	2.438

CRS is much lower than under VRS. For all the observed years, LIC and SBI Life have a technical efficiency score of one. All other life insurance firms are technically inefficient (technical efficiency score of less than one). For 2002-03 and 2003-04, excepting LIC, all other insures exhibited increasing returns to scale. For 2004-05, ING Vysya and Max New York Life exhibited decreasing returns to scale.

Tables 7 and 11 provide the insurer and ownership category-wise total factor productivity change scores. All the life insurers exhibited positive total factor productivity growth. Obviously, the total factor productivity growth rate of the private life insurers is much higher than LIC. Among the private life insurers, OM Kotak Life exhibited highest total factor productivity growth rate followed by Aviva Life insurance. ❖

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