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Assessing Productivity of Life Insurance Companies in Bangladesh: A Comparison of Ratios, Index Numbers and Frontier Methods

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Abstract

Given the financial services sector's importance to the economy, the necessity to maintain the productivity of the insurance sector mainly the life insurance sector is very crucial. The life insurance business in Bangladesh has undergone a number of reforms from time to time, as is widely known. The purpose of this study is to evaluate the productivity of all listed life insurance companies of the Dhaka Stock Exchange (DSE) for the time period of 2011-2020. In the past, financial services productivity was measured using ratio analysis or index numbers but in this study to measure the productivity of the life insurance sector ratio analysis, index numbers and frontier methods are used. A frontier efficiency strategy for dealing with many inputs and outputs is presented in this study. It shows the value of the financial ratios, index numbers and frontier approach five life insurance companies are inefficient and others doing well in terms of measuring productivity. This study can help to take the decision to the concerned authority on the overall productivity of the life insurance sector and also can provide good ideas to the further researcher to construct wide research on assessing the productivity of the life insurance sector.

Keywords: Life insurance, productivity, ratio, index numbers and frontier methods.

Introduction

Financial institutions' intermediation role is so important that their success has a significant impact on other sectors of the economy. When the financial sector does well, the economy benefits, but when the financial sector suffers, other sectors of the economy suffer as a result of the bandwagon effect. As a result, assessing the performance of financial service firms is crucial.

Miller (2008) stated that using productivity metrics, which entails using key performance indicators to enhance productivity, can make the process of evaluating productivity a lot easier.

Single factor productivity refers to a metric that uses only one input, such as labor or capital, to compute productivity. This is more precisely a partial measure of productivity because it only considers one element of production at a time. When more than one input is used in computing productivity, this measure is referred to as total productivity. This, according to Galarneau & Maynard (1995), may have resulted from the difficulty of obtaining and understanding capital data, which is necessary for estimating total factor productivity. Changes ascribed to a specific input may represent the influence of missing inputs, which is an evident drawback of partial productivity metrics.

Chesnick (2000), utilized financial measures to assess the variations in financial management and goals between investor-oriented and cooperative companies. Chesnick (2000), identified four different forms of ratio analysis these are liquidity, leverage, activity, and profitability

ratios. One of the primary advantages of financial ratio analysis, according to Athanassopoulos and Ballantine (1995), is the capacity to assess the connection between two figures in the financial statements, quoting Lawder (1989). Despite its apparent extensive usage for performance evaluation, the univariate nature of ratio analysis poses a significant restriction. Athanassopoulos and Ballantine (1995), when it comes to the implications of economies of scale, identifying benchmarking strategies, and estimating overall performance metrics of businesses, ratios aren't very useful. As a result, different techniques were sought.

Traditionally, productivity was evaluated by comparing the quantity of output to the quantity of inputs (OECD, 2001). The diverse character of products and services necessitates indexes, according to the OECD handbook, which prevents simply adding up units of different sorts of commodities. Paasche, Laspeyres, Fisher, and Tornqvist were the four indices most commonly used to achieve this. Fisher is often seen to be better than the others since it passes the time reversal and constant basket tests, as well as the constant amounts and proportionality tests (McLellan, 2004). To create output and input indices, a variety of index formulas can be employed. Some of the most commonly used index formulae include the Laspeyres, Paasche and Fisher indexes. The Laspeyres, Paasche and Fisher indexes are some of the more widely used index formulae. The formula for the Laspeyres Price Index is as follows:

$$Laspeyers\ Price\ Index = \frac{\sum(Pi,t)x(Qi,0)}{\sum(Pi,0)x(Qi,0)} \text{ x } 100$$

Where

- **Pi,0** is the price of the individual item at the base period and **Pi,t** is the price of the individual item at the observation period.
- **Qi,0** is the quantity of the individual item at the base period.

The Paasche price index is commonly confounded with the Laspeyres price index. The main differentiator between the Paasche Index and the Laspeyres Price Index is that the former uses current-period quantity weightings while the latter uses base-period quantity weightings. The formula for the Paasche Price index is as follows:

$$\text{Paasche } Price\ Index = \frac{\sum(Pi,t)x(Qi,t)}{\sum(Pi,0)x(Qi,t)} \text{ x } 100$$

Where

- **Pi,0** is the price of the individual item at the base period, and **Pi,t** is the price of the individual item at the observation period.
- **Qi,t** is the quantity of the individual item at the observation period.

Similar to other consumer price indices, the Fisher Price Index is used to measure the price level and cost of living in an economy and to calculate inflation. The index corrects for the upward bias of the Laspeyres Price Index and the downward bias of the Paasche Price Index by taking the geometric average of the two weighted indices.

$$\text{Fisher } Price\ Index = (Laspeyers\ Price\ Index\ x \text{Paasche } Price\ Index\ ) 0.5$$

The demand for a systematic and comprehensive framework for assessing company performance has grown as a result of the vast range of stakeholders that are interested in it (Athanassopoulos and Ballantine, 1995). As a result, a family of benchmarking methods known as frontier efficiency approaches, also known as Data Envelopment Analysis, has emerged (DEA). DEA is a scalar measure of relative efficiency for each Decision Making Unit (DMU) studied, created by Charnes, Cooper, and Rhodes (1978) from a notion of efficiency introduced by Farrell (1957). DEA is a mathematical programming approach that may be used to analyze the 'relative' efficiency of a range of organizations using a variety of input data, according to Yeh (1996). He emphasized the significance of the term "relative," saying that an institution designated by the DEA as an efficient unit in one data set may be judged inefficient in another. Data Envelopment Analysis (DEA) is a non-parametric method. It refers to linear programming that uses multiple input and output indicators to evaluate the relative effectiveness of comparable units (Wang and Wu, 2011). In practice, the input distance function can be defined as follows:

$$D1(x,y) = \max\{\rho:(x/\rho,y)\in S\},=(\min\{\rho:(\rho x,y)\in S\})-1$$

where: S is land trait technology, which describes the transformation of contract inputs into ideal biophysical traits, such as $S = \{(x, y)$: x can produce $y\}$, which is a joint-production technology assumed to be a closed, convex set with arbitrary inputs and outputs;

Vector x is the parcel input;

Vector y is the parcel output; and distance measure ρ is the factor by which all input quantities can be reduced while still remaining within the feasible input set for the given output level. The distance measure is 1) greater than or equal to one, 2) equal to one only if a parcel belongs to the frontier, or 3) non decreasing in x and increasing in y.

The distance function defined by the above formulas can be estimated using mathematical methods. For example, a linear faceted cone is established by observing the input and output of the parcel. Parcels are sorted according to a contract cost that can be reduced based on the trait

vector and target of the given parcel. The distance function in DEA usually needs to be calculated with DEA Frontier or auxiliary software.

Frontier Methods have been applied to a variety of organizations and settings, including advertising (Cheong and Leckenby, 2006), transportation (Barnum et al, 2007), hospitals and health care (Sherman, 1984; Banker, 1984; Banker, Conrad, and Strauss, 1986; Wang and Chou, 2003).

In this study mainly based on the input price and output price and evaluate the productivity through various ratios, index numbers and frontier methods. All the methods are widely used to determine the productivity of the financial sector. To achieve the actual result three objectives are set: (1) To determine the productivity of life insurance sector through ratio analysis (2) To evaluate the productivity of life insurance sector through index numbers approach and (3) To assess the productivity of life insurance sector through the frontier approach.

Methodology of the Study

Research Design

This is a causal study because the goal is to determine the productivity of the life insurance industry in Bangladesh. The measurement procedure is crucial to quantitative research because it establishes the link between empirical observation and mathematical articulation of quantitative relationships.

Sampling Frame

A sampling frame is a representation of the target population's elements. It is made up of a list or set of instructions for locating the target population. Though the population comprises all of Bangladesh's life insurance businesses, the sampling frame in this study focuses on life insurance companies that are all listed on the Dhaka Stock Exchange (DSE).

Sources and Method of Data Collection

The majority of the data was gathered from secondary sources. Secondary information was gathered from the company's annual report from (2011-2020).

Measurement and Analysis Plan

There were two types of data analysis in this study: descriptive and quantitative. The initial step in this investigation is descriptive analysis. It aided in the description of relevant features of the cash conversion cycle phenomenon as well as the provision of specific information on each relevant variable. The different factors in this study were analyzed using Data Envelopment Analysis (DEA) software. DEA for Windows is perhaps the most extensively utilized computer software for social productivity analysis of quantitative data.

Three approaches were used in this study. The first method is to use financial ratio analysis where Profit/Total capital, settled claims/Total claims, Investment Income/Profit, Total operation cost/Net premium are considered as financial ratios for life insurance companies. Second, Index numbers methods are to use for measuring productivity. Third, DEA analysis and these measures gave more information on the productivity of the listed life insurance companies by accounting for the influence of other constructs.

Results and Discussion

Analysis Productivity through Financial Ratios

From table 1, the study revealed that the highest employed Sunlife, Popular life, Prime life, Progressive life, Pragati life, and Fareast Life Company run above average in terms of profit to total capital. The ratio of settled claims to total claims demonstrates that the majority of the businesses investigated appear to settle a large percentage of their outstanding claims, with Sandhani life insurance companies settling the most outstanding claims, followed by National life, Megna life, Delta life, and others. The following column, which shows the investment income to profit ratio shows that Delta Life Company operates above average, followed by Megna Life, Sandhani Life, Popular Life, and Others. Delta life, Rupali life, and Fareast life appear to meet the management efficiency criterion based on the ratio of operating costs to net premium.

Analysis Productivity through Index Numbers Approach

This study used panel data collected over a ten-year period. These data are not in the typical form for calculating index numbers, that is, quantities and prices, because they are taken from the Company's Annual Reports. Regardless, the objective of this study is productivity, in which case output and input are critical. As a result, we utilize Investment income (an output) as a proxy for quantity and total investment as a proxy for price to demonstrate the application of index numbers to productivity assessment. Table 2 shows the final result.

Paasche Price index

The index is a ratio that compares the total purchase cost of a defined bundle of current-period commodities to their worth at based-period prices. According to the Paasche price index, progressive life insurance has a high value of 2.88. Then there's Pragati life insurance, Prime life insurance, which comes in at 1.69, 1.44. Because it already captures some of the changes in consumption patterns that occur when consumers respond to price

Table 1. Financial ratios of listed life insurance companies

Company Name	Profit/Total Capital	Settled claims/ Total claims	Investment income/Profit	Total operating Cost/Net Premium
Sondhani LIC*	0.83	0.27	0.75	0.59
Sunlife LIC	1.42	0.05	0.52	0.37
Padma LIC	0.94	0.17	0.43	0.35
Prime LIC	1.13	0.03	0.58	0.25
Megna LIC.	0.87	0.24	0.63	0.98
Rupali LIC	0.13	0.01	0.35	0.16
Progrssive LIC	1.05	0.13	0.39	0.35
Delta LIC	0.68	0.20	0.99	0.15
Fareast LIC	1.02	0.12	0.55	0.17
Pragati LIC	1.05	0.13	0.39	0.38
National LIC	0.94	0.24	0.56	0.93
Popular LIC	1.14	0.03	0.59	0.22

Sources: Annual Report for the time period of 2011-2020; *LIC= Life Insurance Company.

Table 2. Index numbers calculation for life insurance companies (Passche, Laspeyrs and Fisher Price Index)

Name	Paasche	Laspeyrs	Fisher
Sondhani LIC*	0.92	1.21	1.08
Sunlife LIC	0.47	1.89	0.90
Padma LIC	0.35	1.06	0.64
Prime LIC	1.47	1.08	2.09
Megna LIC.	1.32	1.93	1.59
Rupali LIC	0.49	1.08	0.73
Progrssive LIC	2.88	1.37	1.79
Delta LIC	0.61	1.66	1.28
Fareast LIC	0.92	1.42	1.15
Pragati LIC	1.69	1.37	1.94
National LIC	0.87	1.93	1.29
Popular LIC	0.78	1.08	0.92

*LIC= Life Insurance Company.

increases, the Paasche price index tends to understate price index rises.

Paasche Price index

The index is a ratio that compares the total purchase cost of a defined bundle of current-period commodities to their worth at based-period prices. According to the Paasche price index, progressive life insurance has a high value of 2.88. Then there's Pragati life insurance, Prime life insurance, which comes in at 1.69, 1.44. Because it already captures some of the changes in consumption patterns that occur when consumers respond to price increases, the Paasche price index tends to understate price index rises.

Laspeyrs Price index

The weighted aggregative price index is known as Laspeyers price index, and the quantities of the base time period is used as weights. After doing some research, it appears that the value of the national life insurance index is quite high. Then Sunlife, Megna life, and Delta life insurance companies are all in good shape, with values of 1.93, 1.89, respectively.

Fisher Price index

Fisher's price index is the geometric mean of Laspeyere's and Paasche's pricing indices. The current year and base year amounts are weighted in the Fisher price index. Prime life insurance, according to Fishers price index, is in a better position, with a score of 2.09. Then Pragati life insurance and Progressive life insurance, at 1.79 and 1.59 respectively, are in good shape.

It is obvious from the data that creating a single index that allows for inter-company comparisons is difficult. At most, we can claim that Sandhani life's investment

income, say, at the end of the ten-year term, is 0.92 percent higher than the base year 2011.

The frontier efficiency approach

The efficiency scores in Table 3, are averages for the period, but when we look at the life insurance businesses over multiple years, the conclusion is the same: all of the companies under consideration have pure technical efficiency, but some do not have scale efficiency. As a result, the general conclusion is that Bangladeshi life insurance companies are effectively managed in terms of pure technological efficiency, but size matters and five of the insurance companies have diminishing returns to scale. In terms of technological and scale efficiency, seven organizations were determined to be generally efficient in Table 3, whereas five were judged to be inefficient. In terms of their inputs and outputs, five companies are inefficient when measured by constant returns to scale (CCR) and scale efficiency.

Table 3. Technical Efficiency Scores of Life Insurance Companies (LIC), average values for the period of 2011-2020

No.	Company Name	Technical Efficiency, CRS-CCR Model	Technical Efficiency, VRS-BCC Model	Scale Efficiency	Position of Company on the frontier
1	Sondhani LIC**	0.93	1.00	0.93	DRS*
2	Sunlife LIC	1.00	1.00	1.00	_
3	Padma LIC	1.00	1.00	1.00	_
4	Prime LIC	.90	.95	.90	DRS*
5	Megna LIC.	.90	.96	.90	DRS*
6	Rupali LIC	.17	1.00	.17	DRS*
7	Progrssive LIC	1.00	1.00	1.00	_
8	Delta LIC	1.00	1.00	1.00	_
9	Fareast LIC	1.00	1.00	1.00	_
10	Pragati LIC	1.00	1.00	1.00	_
11	National LIC	1.00	1.00	1.00	_
12	Popular LIC	.95	1.00	.95	DRS*

Drs*=Decreasing Returns to Scale; **LIC= Life Insurance Company.

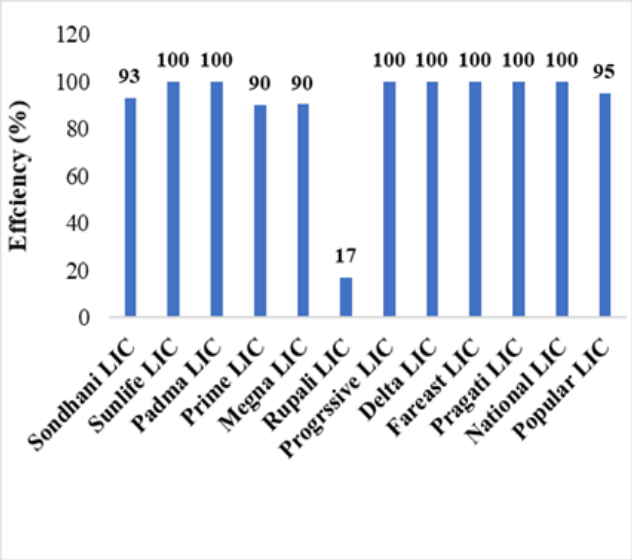

Figure 1. Efficiency Score (CRS). LIC= Life Insurance Company.

Constant Return to Scale (CRS)

In a graphical representation of the constant return to scale of the CCR model (Figure 1), it appears that all other companies are efficient except Sondhani Life Insurance Co., Prime Life Insurance Co., Megna Life Insurance Co., and Rupali Life Insurance Co. Although Pragati Life Insurance Company appears to be 100 percent efficient, it is in fact inefficient, with a total operating cost/net premium ratio that is not sufficient. Rupali Life Insurance Co. is also more inefficient than other companies, according to the graphical display. Using the CCR model, it appears that the inefficient firm should focus on the inputs that will improve its productivity.

Variable Return to Scale (VRS)

In a graphical representation of the variable return to scale of the CCR model (Figure 2), it appears that all other companies are efficient except Prime Life Insurance Co. and Megna Life Insurance Co. In the instance of Pragati Life Insurance Company, it appears to be 100 percent efficient, yet the total operating cost/net premium ratio is not adequate. Using the CCR model of variable return to scale, it appears that the inefficient firm should focus on the inputs that will improve its productivity. The most we could go with the Financial Ratios and Index Number techniques was to compare the ratios or indices one at a time.

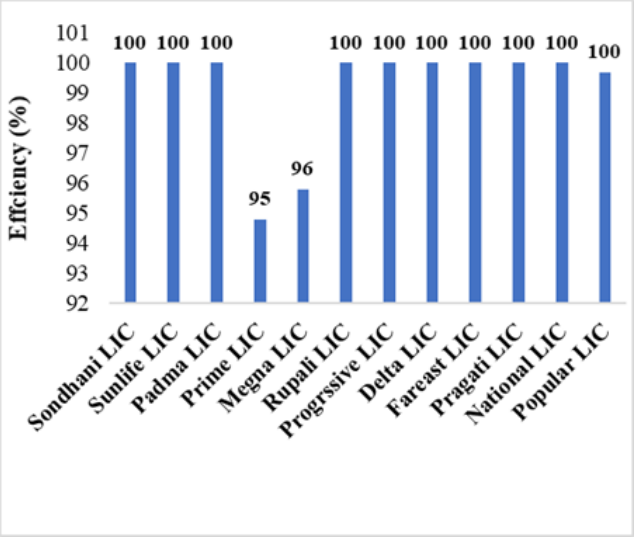

Figure 2. Efficiency Score (VRS). LIC= Life Insurance Company.

operating cost/net premium should all be improved. The resolved claims/total claims, investment income/profit, and total operating cost/net premium ratios of Prime Life Insurance Company should all be improved. The profit/total capital, investment income/profit, and total operating cost/net premium ratios of Megna Life Insurance Company should all be improved. The resolved claims/total claims, investment income/profit, and total operating cost/net premium ratios of Popular Life Insurance Company should be improved.

Conclusion

This study compared the performances of the selected life insurance companies through ratio analysis, index number approach and frontier approach. This study also identified the best course of action by using efficient operators by using the frontier technique. General Insurance, Banks, mortgage businesses, and the finance sector can employ this process. In the instance of the life insurance business, we can see that many of the companies examined in the study appear to be efficient. Differences in management styles could explain some of the observed behavior. Attempts to eliminate identified inefficiencies should begin with a scale study and the implementation of a competitive strategy.

Table 4. Chances of Improvement of Productivity Based on CCR Model

Company Name	Profit/Total capital	Settled claims/Total claims	Investment income/Profit	Total operating cost/ Net premium
Sondhani LIC*	0.834 to 1.495	0.268 to0.268	0.743 to 0.691	0.596 to 0.554
Sunlife LIC	1.419 to 1.419	0.044 to0.044	0.513 to 0.513	0.366 to 0.366
Padma LIC	0.938 to 0.938	0.167 to0.167	0.428 to 0.428	0.349 to 0.349
Prime LIC	1.122 to 1.122	0.027 to0.093	0.579 to 0.523	0.246 to 0.222
Megna LIC	0.866 to 0.962	0.232 to0.232	0.621 to 0.562	0.978 to0.885
Rupali LIC.	0.129 to 0.129	0.001 to 0.01	0.343 to 0.059	0.151 to0.026
Progrssive LIC	1.048 to 1.048	0.125 to0.125	0.396 to 0.396	0.349 to 0.349
Delta LIC	0.674 to 0.674	0.197 to0.197	0.994 to 0.994	0.149 to 0.149
Fareast LIC.	1.021 to 1.021	0.118 to0.118	0.543 to 0.543	0.163 to 0.163
Pragati LIC	1.048 to 1.048	0.125 to0.125	0.396 to 0.396	0.375 to 0.349
National LIC	0.932 to 0.932	0.232 to0.232	0.559 to 0.559	0.92 to 0.92
Popular LIC	1.122 to 1.122	0.027 to0.107	0.579 to 0.551	0.216 to 0.206

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*LIC= Life Insurance Company.

However, because the Frontier approach is output-oriented, it allows us to analyze all outputs and inputs at the same time, allowing us to assess if an insurance firm can produce the same level of output with less input or a higher level of output with the same input.

Improvement

From Table 4, Rupali life insurance co.'s position appears to be more inefficient in the improvement sector of the CCR model, and it should be improved in all types of input and output that have a direct impact on productivity. Sondhani Life Insurance Company's profit/total capital, investment income/profit, and total

Conflict of interest

There is no conflict of interest among the authors.

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