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ARE NON-LIFE INSURANCE COMPANIES TECHNICALLY EFFICIENT AND PRODUCTIVE: A CASE STUDY OF PAKISTAN

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ABSTRACT
Insurance sector plays a vital role in the economic development of an economy. Presence of big insurance firms ensure the risk coverage to corporations and promotes escalated economic activities. This study attempts to analyze the technical efficiency and productivity of insurance companies of Pakistan. The data of 27 non-life insurance companies for the period 2007 to 2017 is collected. Total assets and number of employees are taken as input, while investment income, net premium earned and other income are used as output variables. The study has applied Data Envelopment Analysis and Malmquist- Productivity indices to calculate the results. The author has found mixed results regarding technical efficiency and productivity. Some firms are efficient while others are not. Similarly, some firms are productive while others are not. But overall results are pleasing and insurance industry is growing in Pakistan. The study has found that ACE Insurance Limited, Adamjee Insurance Company Limited are found the most technically efficient firms in Pakistan. Both firms get technical efficiency score '1' nine times during the study period. In 2010, the non-life insurance companies in Pakistan obtained highest technical efficiency score 0.79. Considering the productivity analysis by exercising Malmquist Productivity Index, it is found that that 16 out of 27 companies are productive in nature. Out of 16 firms, 8 are productive owing to efficiency change and technical change, while 7 companies are productive only due technical change.

Keywords: *Efficiency, Productivity, Insurance, Pakistan, Malmquist Productivity Index*
JEL Code: G14, G22

INTRODUCTION

Money markets play important role in resource mobilization in an economy. Since its independence, Pakistan is facing multiple challenges in financial markets along with lot of opportunities as well. Committed efforts were made for creating an enabling environment for an integrated economic market regarding insurance industry. Pakistan established the institution of Insurance under Ministry of Commerce in April 1948 for promoting and strengthening insurance industry. In insurance sector, markets may be classified as life insurance, general insurance and health insurance. As compared

to other regional countries insurance industry in Pakistan has smaller volume and low in expansion. In past insurance sector was underdeveloped despite having potential. After Insurance Ordinance 2000, a remarkable advancement has been observed in the insurance sector. Insurance sector is of paramount importance for boosting economic activities and to improve volume of domestic and foreign trade. Development in insurance sector acts as a catalyst for economic growth. The economic efficiency of the firm consists on technical efficiency and allocative efficiency. Technical efficiency refers to the minimum usage of resources such as capital and labour to produce maximum output. Allocative efficiency means the capacity of the firm at certain level of output to mix optimal combinations of inputs. A firm is said to be more efficient if it achieves economic efficiency which implies that the firm is earning more profit subject to resources constraints. In the age of globalization insurance companies operate in much competitive scenario. For survival of the fittest, these companies have to be efficient and productive. For optimal efficiency, they compare their results with other contemporary insurance companies and strive for further excellence. Insurance companies consider not only efficiency but also other indicators. Among these indicators profitability of the firm is the principal concern as profitability reflects the ability of a firm to convert its inputs into output. The firm's performance is measured by frontier methodologies in comparison with leading firm of the industry. Data Envelopment Analysis (DEA) is the commonly used modus operandi in insurance sector to measure efficiency. Data Envelopment Analysis estimates the company's efficiency by comparing multiple input, output variables through formulating benchmark concerned to the sectors. While discussing the insurance sector efficiency means the capability of insurance firm to provide a certain limit of output by using a prescribed amount of input like capital and labor. Furthermore, the insurer's main concerns of its business are insurance activity and investment. In insurance side, services and output rendered by insurer based on the activities potential because insurer utilizes his struggles for risk minimization as premium shows the insurers capability for market a product client selection, risk acceptance. While at investment part the profit investment is gained by the insurer with activities of investment. . Inputs such as capital and labor and material etc. show the resources that are employed by insurer to continue the operations. The increasing importance and continuously growing volume of insurance industry has inspired research in this field. One can find enough research on efficiency of insurance companies but few studies are available on this important sector in developing countries especially in Pakistan. The importance of study comes from importance of efficiency in the field of insurance companies and the relationship between performance and results. In the presence of the challenges confronted by insurance industry of Pakistan it is essential to measure how many firms are efficient and productive in order to evaluate their performance. This study aims at providing economic efficiency and productivity analysis so that insurance companies may seek guidance for better efficiency and management.

The objectives of study are as under:

1. To determine technical efficiency and productivity analysis of insurance sector in Pakistan
2. To portray concepts and measures of technical efficiency and productivity efficiency
3. To present literature on the technical and productivity analysis at national and international level
4. To suggest some recommendations to improve technical efficiency and enhance productivity of insurance companies

1. Literature Review

In economics the optimum utilization of resources refers to produce maximum output with minimum inputs or the resource constraints. The economic efficiency of the firm consists on technical efficiency and allocative efficiency. Technical efficiency refers to the minimum usage of resources such as capital and labour to produce output. Allocative efficiency means at certain level of output to mix optimal combinations of inputs. The economic efficiency thus cannot be achieved without achieving technical and allocative efficiency (Jaloudi et. Al. 2019). Theory the efficiency is a relative indicator which shows results of specific variables by means of comparing them with results of other related

variables. Furqan et al. (2023) assesses the technical efficiency of takaful and conventional firms in Pakistan from 2012-2018. The study highlighted that the takaful firms were also efficient but the conventional firms were more efficient in terms of technical, allocative and cost efficiency.

Achieving goals of efficiency and productivity is an important assignment for every organization. Nourani et al. (2017) analyzed the technical efficiency of insurance companies and productivity in Malaysia. This research measured the efficiency of insurance companies of Malaysia through technical way. It was observed that domestic firms were less efficient in the investment capabilities as compared to foreign insurers. Hefty amount of input quantities used and low investment were found to be major reasons of low efficiency.

Table 1: Bird's eye view of previous studies

Variables	Authors	Results
Total Assets, Number of Employees = f (Net Investment Income, Net Premium Earned, Other Income)	Furqan (2023)	Technically Efficient and Productive
	Nourani et al. (2017)	Technically Efficient and Productive
	Eling & Schaper (2017)	Technically Efficient and Productive
	Noreen & Ahmad (2016)	Technically Inefficient and Less Productive
	Iqbal and Awan (2015)	Technically Inefficient and Less Productive
	Bhishma Rao & Venkateswarlu (2015)	Technically Efficient and Productive
	Del Giudice et. al., (2014)	Technically Efficient and Productive
	Mandal & Dastidar (2014)	Technically Efficient and Productive

Shareholders set different sets of goals for the management and it is easy to accomplish these goals by understanding the relationship between input and output factors. Eling & Schaper (2017) analyzed impact of stress in business circumstances on productive capacity and efficiency of European insurance firms for life. The researchers analyzed the managerial structure by distinguishing environment changes. They concluded that the specific impact of business condition on life insurance efficiency. The study recommended to control the business environment in different countries. It was proved that inefficient firms would leave the market. Noreen & Ahmad (2016) conducted a study to investigate the total factor productivity and cost efficiency of insurance sector of Pakistan by employing data from 2000 to 2009. The researchers concluded that insurance market is cost inefficient. The researchers concluded that inefficiency was caused by inappropriate use of inputs depicting irrational behavior of the industry. They suggested that this unwise attitude of industry regarding cost expenditure should be get rid of meanwhile reducing expenditure of unprofitable branches and rescale their operations by utilizing the existing labor.

Iqbal and Awan (2015) analyzed technical efficiency of scale of insurance sector in Pakistan and examined relationship between productivity and technical efficiency of life insurance companies taking sample of 25 general life insurance firms. The data covered time period from 2002 to 2007. The outcomes revealed that many of insurance firms were technically mix and scale wise inefficient and the dominant cause of inefficiency was due to huge amount of labor and issues in settlement of claims. Bhishma Rao & Venkateswarlu (2015) conducted a study to assess the level of efficiency and productivity of non-life insurers in India. They adopted 12 private insurance firms and four public sector nonlife insurance firms for the period of 2008-

13. The researchers used CRS and VRS methods to measure technical efficiency. The findings showed that public sector non-life insurers were technically more efficient than the private nonlife insurers. They also concluded that the public insurers, private insurers were more scale efficient by showing increasing return to scale.

Del Giudice et. al., (2014) analyzed efficiency of nonlife insurance firms of China. Its objective was to inquire the inputs of capital intellectual for the operational efficiency of Chinese Nonlife firms of insurance. The researcher used DSBM model to check the running efficiency of thirty-two Chinese nonlife insurance firms. They used panel data for the period from 2006 to 2010. The results showed that insurers have approximate diminishing efficiency for the period from six to ten, and said that capital had positive relation to operating efficiency.

2. Data and Methodology

In present study data has been collected through annual reports of insurance association of Pakistan. In this analysis, the data of twenty-seven insurance companies from period of 2007 to 2017 has been used.

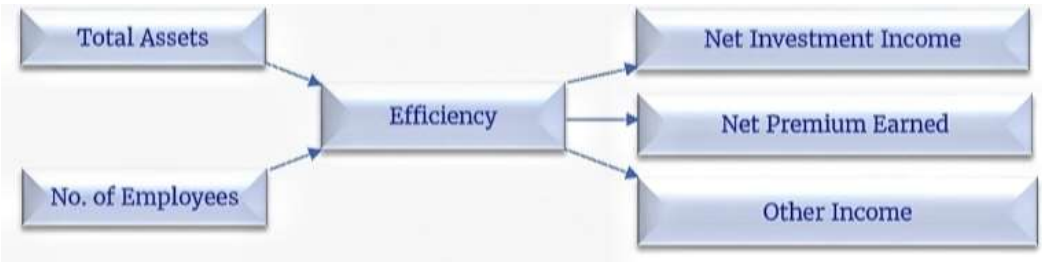
Table 2: List of Insurance Companies Used in Study

Sr. No.	Company Name	Sr. No.	Company Name
1	ACE Insurance Limited	15	IGI Insurance Limited
2	Adamjee- Insurance Company Limited	16	Jubilee General Insurance Co Limited
3	Alfalah- Insurance Company Limited	17	The Pakistan General Insurance
4	Alpha- Insurance Company Limited	18	PICIC- Insurance Limited
5	Asia- Insurance Company Limited	19	Premier- Insurance Limited
6	Askari general Insurance- co Limited	20	Reliance Insurance co Limited
7	Atlas Insurance- Limited	21	Saudi Pak Insurance Company Limited
8	Century Insurance co Limited	22	Security General Insurance Company ltd
9	The Cooperative Insurance	23	Shaheen Insurance Company Limited
10	The Crescent Star Insurance Co Limited	24	TPL- Direct Insurance Limited
11	East West Insurance Company Limited	25	UBL Insurers Limited
12	EFU General- Insurance Limited	26	The United Insurance Company
13	Excel- Insurance Company Limited	27	Universal Insurance Company Limited
14	Habib- Insurance Company Limited		

3.1 Inputs and Outputs Variables Selection

The work force, material and capital are three primary insurance sources. Labour can be further divided into office staff and agents. The company service and content group are not typically further divided, but contains items such as transport, communication and advertisement. And it is possible to differentiate between three types of capital: physical, debt, and equity capital. Therefore, the number of workers and all assets were taken as inputs for this analysis.

Figure 1: Theoretical Framework



3.2 Definition of Variables

i. Total Assets

Total assets mean total assets held by an organization or a person. Assets are items of economic interest that are spent on helping the owner over time. The net assets of companies include the value of all objects held by an individual company.

ii. Number of Employees

Total number of workers who are associated to their place of business on a normal working day in the previous calendar year is the number of employees. A cumulative number of workers in or out of work within one hour is the number of employees.

iii. Investment Income

Money earned from investment is investment income. Investment revenues are revenues arising from the payment of interest, dividends and capital gains from the sale of any property and any other income generated in every investment vehicle.

vi. Net Premium Earned

Average amount of insurance premiums charged is the total amount received by an insurance provider, relative to how long the policy has been transferred to its successful existence.

v. Other Income

Other earnings are profits not generated from a major company business, such as interest. For example, income from interest, rent and earnings from selling fixed assets are other incomes. Before operating revenues, companies present other revenues in a separate section. The variables for input and output, proxies, unit of measurement and data sources are prescribed in Table 3.

Table 3: List of Variables and Data Sources

	Output and input Variables	Measurement units	Sources of data
Variables used as input	Total Assets	Million Rupees (Pakistani)	The Insurance-Association of Pakistan
	Number- of employees	Number	The Insurance-Association of Pakistan
Variables used as output	Investment Income	Million Rupee (Pakistani)	The Insurance-Association of Pakistan
	Net Premium Earned	Millions Rupee	The Insurance-Association of Pakistan
	Other income	Millions Rupee	The Insurance-Association of Pakistan

3.3 Data Envelopment Analysis

Data Envelopment Analysis has following advantages.

1. Data Envelopment Analysis to set a benchmark may be used to evaluate the performance of several units with multiple services such as banks, universities, hospitals etc.
2. The evaluation is made to estimate efficiency-based operations.
3. Data Envelopment Analysis has superiority over other techniques of analysis as it can deal with complicated relation between a variety of inputs and variety of outputs when the units are not commeasurable.
4. Data Envelopment Analysis technique is concerned to linear programming though based on Linear-Algebra. The technique is like mathematical duality relation in linear programming.

3.4 Malmquist Productivity Index (MPI)

This approach was first proposed in Caves, Christensen and Diewert (1982). Malmquist Productivity Index is a tool of measurement of change in productivity over time. It keeps information about the Source of Productivity- Change evidence via decomposing into Frontier Shift and components of efficiency change.

The Malmquist Productivity Index (MPI) is only included in our outputs.
Usage of S-technology period

$$m_o^{\,s}\left(\mathbf{q}_s,\mathbf{q}_t,\mathbf{x}_s,\mathbf{x}_t\right)=\frac{d_o^{\,s}\left(\mathbf{q}_t,\mathbf{x}_t\right)}{d_o^{\,s}\left(\mathbf{q}_s,\mathbf{x}_s\right)}$$

Utilizing period t-technology

$$m_o^{\,t}\left(\mathbf{q}_s,\mathbf{q}_t,\mathbf{x}_s,\mathbf{x}_t\right)=\frac{d_o^{\,t}\left(\mathbf{q}_t,\mathbf{x}_t\right)}{d_o^{\,t}\left(\mathbf{q}_s,\mathbf{x}_s\right)}$$

Based on the period s and time t technology, the MFP can be defined as the Geometric -Average of the two, since the two possible MFP measures are:

$$m_o\left(\mathbf{q}_s,\mathbf{q}_t,\mathbf{x}_s,\mathbf{x}_t\right)=\left[m_o^{s}\left(\mathbf{q}_s,\mathbf{q}_t,\mathbf{x}_s,\mathbf{x}_t\right)\times m_o^{t}\left(\mathbf{q}_s,\mathbf{q}_t,\mathbf{x}_s,\mathbf{x}_t\right)\right]^{0.5}$$

$$=\left[\frac{d_o^{s}\left(\mathbf{x}_t,\mathbf{q}_t\right)}{d_o^{s}\left(\mathbf{x}_s,\mathbf{q}_s\right)}\times\frac{d_o^{t}\left(\mathbf{x}_t,\mathbf{q}_t\right)}{d_o^{t}\left(\mathbf{x}_s,\mathbf{q}_s\right)}\right]^{0.5}$$

3. Results and Discussions

The econometric results of analysis are described following.

4.1 Descriptive Analysis

In this segment of descriptive statistics, the maximum value, minimum value, mean and standard deviation are taken year wise from 2007 to 2017. Investment income, net premium earned, and other income are output variables while total assets and number of employees are the input variables.

Table 4: Descriptive Statistics

Variables	Max	Min	Mean	SD
Output Variables		**2007**		
Investment Income	14812.3	0.55	1166.93	3061.5
Net Premium Earned	6110.5	16.25	712.588	1487.24
Other Income	124.71	0.23	18.526	32.052
Input Variables				
Total Assets	27390	174.62	3453.5	6370.8
No. of Employees	1388	13	249.222	339.76
Output Variables		**2008**		
Investment Income	255149	157476	3459.57	57608.7
Net Premium Earned	7488	18.29	824.155	1750.47
Other Income	20989	0.113	935.436	3993.36
Input Variables				
Total Assets	1.3E+07	222.89	538093	2494892
No. of Employees	1400	13	284.296	377.95
Output Variables		**2009**		
Investment Income	414649	561658	-5268.5	134254
Net Premium Earned	6807	16.1	783.371	1595.69
Other Income	154027	0.09	6219.98	29039.8
Input Variables				
Total Assets	1.2E+07	236.9	485369	2333293
No. of Employees	1400	13	284.37	377.897
Output Variables		**2010**		
Investment Income	929.34	358	117.817	252.94
Net Premium Earned	6883	9	802.299	1643.1
Other Income	171	0.05	23.043	43.969
Input Variables				

Total Assets	27886	214.6	3857.7	6944.22
No. of Employees	1236	14	237.778	273.475
Output Variables			**2011**	
Investment Income	852	0.4	132.214	215.811
Net Premium Earned	6983	5	863.481	1704.56
Other Income	156	0.12	22.543	38.085
Input Variables				
Total Assets	24378	202.38	3865.21	6492.34
No. of Employees	1236	14	237.815	273.452
Output Variables			**2012**	
Investment Income	6817	3.33	440.887	1288.59
Net Premium Earned	210671	3	8646.85	39649.2
Other Income	17762	0.03	695.65	3348.53
Input Variables				
Total Assets	912834	176.02	38064.1	171702
No. of Employees	1217	15	239.481	267.879
Output Variables			**2013**	
Investment Income	6012	3.15	478.902	1186.09
Net Premium Earned	6342	2	928.443	1563.71
Other Income	13020	0.01	520.549	2453.39
Input Variables				
Total Assets	935120	164.82	39238.2	175854
No. of Employees	1217	15	239.481	267.879
Output Variables			**2014**	
Investment Income	2061	3.77	267.988	457.807
Net Premium Earned	6532	2	964.087	1690.1
Other Income	550.11	0.02	46.991	106.307
Input Variables				
Total Assets	29227.3	331.32	5697.27	8326.22
	1162	15	253.926	295.199
Output Variables			**2015**	
Investment Income	2404.31	1	339.623	576.574
Net Premium Earned	7747	0.3	1106.64	1896.7
Other Income	2725.94	0.05	130.53	511.346
Input Variables				
Total Assets	32264	333.09	5504.3	8531.75
No. of Employees	1162	15	253.926	295.199
Output Variables			**2016**	
Investment Income	3502.04	5.58	441.907	770.59
Net Premium Earned	76310	0.673	4202.26	14311.6
Other Income	892.68	197.14	51.637	175.945
Input Variables				
Total Assets	335902	465.76	18415.5	62889.1
No. of Employees	1232	14	267.481	290.988
Output Variables			**2017**	
Investment Income	2353	48.02	343.996	571.612

Net Premium Earned	44643	1.874	3185.97	8516.2
Other Income	963.09	0.11	75.087	183.856
Input Variables				
Total Assets	68604	517.56	8807.7	15680.1
No. of Employees	1232	14	267.481	290.988

4.2 Results on Technical Efficiency

To analyze the production frontier, panel data were used for the years 2007-17, obtained from the insurance association of Pakistan (IAP) on 27 Insurance Companies, (11 years * 27 firms= 297 0bservations). The sample consisted of 27 non-life insurance companies which represent the major market share.

Table 5 shows the analysis of efficiency. Keeping in mind total assets as a factor of determination of big and small firms, following were found as big firms, (1). EFU General Insurance Limited (2). Adamjee Insurance Company Limited (3) IGI Insurance Limited (4). Jubilee General Insurance Co Limited (5). Security General Insurance Co Limited, while small were, (1) ACE Insurance Limited, (2) TPL Direct Insurance Limited, (3) The Crescent Star Insurance Co Limited, (4) Pakistan General Insurance (5) Alpha Insurance Company Limited. Among the five big insurance companies two firms, Adamjee Insurance Company Limited and IGI Insurance Limited were found efficient with a frequency of 9 and 8 respectively with averages of 0.95 and 0.89 respectively. While EFU General Insurance Limited and Jubilee General Insurance Co Limited were found less efficient with a frequency of 4 and 2 with averages 0.85 and 0.82 respectively. Among the small firms ACE insurance limited and TPL direct insurance limited were found highly efficient with a frequency level of 9 and 8 with averages 0.89 and 0.93 respectively, remaining small firms were found less efficient, the frequency of Crescent Star is 1 with an average of 0.63 and the frequency of Pakistan general is 2 with an average of 0.53, so the Crescent Star and Pakistan General are found less efficient in this study while the Alpha insurance Co Limited is highly inefficient with a zero frequency and an average of 0.58.

- These results of study are contradictory with Saad et al. (2011) regarding technical efficiency of insurance companies of Malaysia and Brunei. Their findings indicate that the bigger the size of companies the higher was the possibility of being more efficient. While this study indicates that some big firms are less efficient while some small firms are highly efficient like ACE insurance limited and TPL direct insurance limited while authors results are corresponding in some sense to Jaloudi et al. (2019) where they studied the efficiency of insurance firms of Jordan. By Using Data Envelopment Analysis Approach, they concluded that there is special efficiency difference among insurance firms every year. In this study some large firms were found less efficient while some small firms were found efficient. This may be due to better managerial skills of the employees or good reputation of the firm Iqbal (2015). In 2011 eleven firms were efficient that was best score in all the years as compared to lowest in 2008 when only five firms were found efficient. So in terms of technical efficiency, it is difficult way to cover yet with persistence to meet the best efficiency. When we see the average of all companies from 2007-2017, we observed technical efficiency 0.69 in the year 2007 with a high rate of technically efficiency 0.78 in 2010 and minimum efficiency were found 0.43.

Table 5: Technical efficiency Score- of Non-Life Pakistan Insurance Companies

Sr.	Company Name	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average	Frequency
1	ACE Insurance Limited	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.45	0.31	0.89	9
2	Adamjee Insurance Company Limited	0.92	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.47	0.95	9
3	Alfalah Insurance Company Limited	0.33	0.25	0.72	0.69	0.73	0.62	0.60	0.64	0.61	0.62	0.53	0.58	0
4	Alpha Insurance Company Limited	0.70	0.30	0.39	0.69	1.00	0.70	1.00	0.82	0.36	0.34	0.19	0.59	2
5	Asia Insurance Company Limited	0.25	0.08	0.38	0.46	0.56	0.37	0.46	0.53	0.60	0.77	1.00	0.5	1
6	Askari General Insurance Co. Limited	0.83	0.22	0.73	0.83	0.81	0.56	0.60	0.22	0.70	0.59	0.46	0.6	0
7	Atlas Insurance Limited	0.78	0.45	0.64	1.00	1.00	0.87	0.92	1.00	0.85	0.76	0.96	0.84	3
8	Century Insurance Co. Limited	0.54	0.37	0.50	0.88	0.36	0.65	0.68	0.80	1.00	0.67	0.36	0.62	1
9	The Cooperative Insurance	0.13	0.18	0.12	0.06	0.05	0.03	0.02	0.02	0.02	0.02	0.02	0.06	0
10	The Crescent Star Insurance Co. Limited	0.86	0.32	0.69	0.77	0.62	0.51	1.00	0.33	0.47	0.70	0.71	0.63	1
11	East West Insurance Company Limited	0.85	1.00	0.33	1.00	1.00	0.99	1.00	1.00	1.00	0.93	0.60	0.88	6
12	EFU General Insurance Limited	1.00	0.67	0.77	0.80	0.74	0.73	0.85	0.73	1.00	1.00	1.00	0.85	4
13	Excel Insurance Company Limited	0.35	0.32	0.23	1.00	0.21	1.00	0.70	1.00	0.32	1.00	0.01	0.56	4
14	Habib Insurance Company Limited	0.50	0.27	0.93	1.00	0.97	0.88	0.80	0.89	0.50	0.54	0.29	0.69	0
15	IGI Insurance Limited	0.73	1.00	1.00	1.00	1.00	0.64	1.00	1.00	1.00	1.00	0.44	0.89	8
16	Jubilee General Insurance Co. Limited	0.89	0.50	0.93	1.00	1.00	0.98	0.94	0.83	0.85	0.65	0.42	0.82	2
17	The Pakistan General Insurance	0.29	1.00	0.37	0.41	0.39	0.51	0.42	0.42	0.49	0.46	1.00	0.53	2
18	PICIC Insurance Limited	0.83	0.32	0.62	0.90	0.72	0.72	0.71	0.86	0.67	1.00	1.00	0.76	2
19	Premier Insurance Limited	0.43	0.28	0.69	0.67	0.70	0.54	0.70	0.52	0.47	0.51	0.24	0.53	0
20	Reliance Insurance Co. Limited	0.84	0.27	0.58	0.82	1.00	0.59	0.54	0.65	0.42	0.47	0.31	0.59	1
21	Saudi Pak Insurance Company Limited	0.56	0.33	0.47	0.62	0.54	0.56	0.74	0.80	0.95	0.81	0.73	0.65	0
22	Security General Insurance Company Ltd	1.00	0.19	1.00	0.81	1.00	1.00	1.00	1.00	0.84	0.67	0.75	0.84	6
23	Shaheen Insurance Company Limited	1.00	0.39	1.00	1.00	1.00	1.00	0.62	0.65	0.51	0.64	0.46	0.75	5
24	TPL Direct Insurance Limited	1.00	0.38	0.89	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.93	8
25	UBL Insurers Limited	0.24	0.31	0.69	0.57	0.72	0.59	0.53	0.44	0.41	1.00	1.00	0.59	2
26	The United Insurance Company	0.79	0.11	0.63	0.77	0.77	0.61	0.55	0.15	0.10	0.68	0.74	0.54	0
27	Universal Insurance Company Limited	1.00	0.16	0.54	0.49	0.47	1.00	1.00	0.30	0.79	1.00	1.00	0.7	5
	Average	0.69	0.43	0.66	0.79	0.75	0.73	0.76	0.69	0.66	0.71	0.59		

4.3 Malmquist Productivity Analysis of Insurance Companies

There are many ways to estimate Malmquist index (Fare et al. 1994). This study has applied output oriented Malmquist based on DAE utilizing panel data of 27 countries. The value one represents no change while value less than one shows aggravation and the vice versa. The results of Malmquist-Productivity Indices for every of the 27 companies during the year 2008 to 2017 are reported in Table 6 the results based on previous years mean the indices are relative to previous years. For example, the results of 2008 depend on the data for the year 2007 and the same is true for the next years as well.

By analyzing carefully, the annual average productivity performance of companies, it can be noticed that productivity in several years has been improved while in some years it receded. By looking at the average of all the years' productivity it can be seen that out of 27 firms 22 firms are productive while remaining are not productive. The maximum average of productivity is 3.15 belongs to IGI insurance limited while minimum is 0.88 belongs to the cooperative insurance. Looking at the average of all years, it seems that the best productive firms are IGI insurance limited, universal insurance, PICIC and Pakistan general insurance.

According to assets record of firms the top five are EFU, Adamjee, IGI, Jubilee general and security general. Results of productivity shows that EFU is a big firm but lack in productivity with an average of 0.95, while Adamjee, IGI, Jubilee and security general are productive in nature with a maximum productivity score 3.15 that contain IGI insurance limited. Looking at average the cooperative insurance, reliance insurance, Askari general, EFU general and Shaheen insurance company limited are not productive in nature among 27 insurance companies of the study.

When we see the average of all companies from 2007 to 2017 year wise it is seen that 2008 and 2016 are the best years for productivity, in these years most of the companies are productive. While looking at year wise average it can be seen that years 2010 and 2014 are the worse years for productivity of insurance companies. In these two years the most companies are not productive.

Table 6: MPI Scores of Non-Life Insurance Companies in Pakistan

Sr No.	Company Name	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average
1	ACE Insurance Limited	1.382	1.121	0.738	1.753	1.273	0.792	2.137	1.173	0.13	0.989	1.1486
2	Adamjee Insurance Company Limited	3.584	4.557	0.072	1.093	0.826	0.919	1.075	1.065	1.28	0.857	1.5328
3	Alfalah Insurance Company Limited	1.761	1.24	0.878	0.969	1.011	1.272	1.137	0.703	1.09	1.075	1.1138
4	Alpha Insurance Company Limited	1.359	0.566	0.711	1.177	0.945	1.661	0.932	1.652	1.07	1.102	1.1179
5	Asia Insurance Company Limited	0.739	0.911	0.967	1.102	0.912	2.268	1.307	2.526	1.13	2.189	1.4055
6	Askari General Insurance Co. Limited	1.075	1.058	1.003	0.931	0.768	1.195	0.505	1.053	0.87	0.9	0.936
7	Atlas Insurance Limited	1.174	0.784	1.208	1.036	0.895	1.197	1.079	1.217	1.03	2.006	1.1625
8	Century Insurance Co. Limited	1.06	0.912	0.796	1.005	0.998	1.172	1.233	1.879	1.21	0.936	1.1198
9	The Cooperative Insurance	1.315	0.61	0.538	0.556	0.354	0.667	0.981	1.391	1.24	1.201	0.8849
10	The Crescent Star Insurance Co. Limited	0.863	0.752	0.912	1.134	0.733	3.523	0.302	1.086	1.26	1.034	1.1597
11	East West Insurance Company Limited	11.37	1.889	0.421	1.038	1.043	1.142	1.318	1.236	0.84	0.956	2.1251

12	EFU General Insurance Limited	1.047	0.897	1.002	1.068	0.909	1.056	1.059	0.994	0.46	1.057	0.9545
13	Excel Insurance Company Limited	1.133	0.933	0.776	0.387	1.208	0.654	1.541	1.099	2.41	0.016	1.0161
14	Habib Insurance Company Limited	1.382	0.877	1.136	1.084	1.011	0.971	0.998	1.07	1.22	0.751	1.0498
15	IGI Insurance Limited	20.94	0.726	0.221	1.182	1.108	1.109	1.003	1.1	0.91	3.204	3.1507
16	Jubilee General Insurance Co. Limited	1.227	0.999	0.952	1.018	1.022	1.062	0.976	1.123	0.92	1.051	1.0354
17	The Pakistan General Insurance	11.875	1.094	0.28	1.148	1.391	0.715	1.149	0.836	0.94	1.175	2.0603
18	PICIC Insurance Limited	1.105	1.143	0.662	1.237	1.296	1.013	1.455	1.091	15.2	1.288	2.5452
19	Premier Insurance Limited	0.941	1.122	1.043	1.185	1.214	1.187	0.743	1.004	1.13	0.881	1.045
20	Reliance Insurance Co. Limited	0.948	0.739	0.816	0.771	0.718	1.125	1.141	0.937	1.11	1.024	0.9327
21	Saudi Pak Insurance Company Limited	1.268	0.822	0.908	0.939	1.567	1.409	1.264	6.108	0.89	0.908	1.6081
22	Security General Insurance Company Ltd	0.866	1.74	0.701	1.237	1.154	1.683	0.231	0.687	1.3	0.612	1.0208
23	Shaheen Insurance Company Limited	1.155	0.842	0.88	0.998	1.13	0.655	1.091	0.858	1.25	0.768	0.9622
24	TPL Direct Insurance Limited	0.834	1.128	1.205	1.245	1.455	0.913	1.169	1.223	0.86	1.028	1.1057
25	UBL Insurers Limited	3.001	0.955	0.811	0.975	1.035	1.191	0.654	0.909	3.06	1.066	1.3656
26	The United Insurance Company	0.621	0.986	1.069	1.001	0.845	0.978	0.134	2.247	10.9	1.105	1.99
27	Universal Insurance Company Limited	0.566	0.819	0.856	0.966	18.19	0.092	0.164		0.39	1.216	2.58422

Table 7 shows the Malmquist indices summary of annual means where we see total factor productivity changes (TFPCH). The mean value of TFPCH is 1.035. The table 7 tells us that in seven years the firms are productive while in remaining years firms are not productive. In 2008 the total factor productivity change is 1.521. This productivity change is due to technical change that is 2.333. In the year 2009 total factor productivity change is 1.008 that is due to efficiency change valued as 1.507. In the year 2010 companies are found unproductive. In the year 2011, the total factor productivity change is 1.014 which is due to technical change valued as 1.218. In the year 2012, the total factor productivity change is 1.108 that is due to technical change valued as, 1.293. In the year 2013, total factor productivity change is, 1.022 that is due to efficiency change valued as 1.357. In 2014 the companies are found nonproductive. In the year 2015, the total factor productivity change is 1.206 that is due to efficiency change valued as 1.330. In the year 2016 total factor productivity change is 1.186 that is due to efficiency change valued as 1.194. While in the year 2017 the companies are found unproductive. The aggravating situation of productivity may be due to the political instability, global financial crunch, floods and inflation.

Table 7: Malmquist index- summary- of annual means

Years	EFFCH	TECHCH	PECH	SECH	TFPH
2	0.652	2.333	0.611	1.067	1.521
3	1.507	0.669	1.512	0.997	1.008
4	0.972	0.730	1.017	0.955	0.709
5	0.832	1.218	0.902	0.922	1.014
6	0.857	1.293	0.864	0.991	1.108
7	1.357	0.753	1.264	1.074	1.022
8	0.653	1.291	0.782	0.835	0.844
9	1.330	0.906	1.172	1.135	1.206
10	1.194	0.993	1.091	1.095	1.186
11	0.705	1.326	0.863	0.817	0.935
Mean	0.962	1.076	0.978	0.983	1.035

Table 8 shows the change of efficiency, technical change and total factor productivity change of all the 27 companies taken in study. Data shows that 16 companies out of 27 are productive in nature. Out of these 16 productive companies, 8 companies are productive due to both efficiency change (EFFCH) and technical change (TECHCH), while 7 companies are productive only and only due to technical change.

Table 8: Malmquist index- Summary of firm means

Firm	EFFCH	TECHCH	PECH	SECH	TFPH
1	0.867	1.069	1.000	0.867	0.926
2	0.932	1.106	0.937	0.995	1.031
3	1.056	1.070	1.056	0.999	1.130
4	0.866	1.128	0.874	0.990	0.976
5	1.151	1.069	1.106	1.040	1.231
6	0.944	1.057	0.930	1.015	0.998
7	1.033	1.076	1.008	1.025	1.112
8	0.963	1.083	0.959	1.005	1.044
9	0.710	1.169	0.718	0.989	0.830
10	0.974	1.021	0.968	1.006	0.995
11	1.011	1.277	1.000	1.011	1.290
12	1.019	0.934	1.000	1.019	0.952
13	0.686	0.956	1.000	0.686	0.656
14	0.973	1.068	0.955	1.018	1.039
15	0.969	1.356	0.926	1.047	1.314
16	0.932	1.106	0.925	1.007	1.030
17	1.052	1.135	1.109	0.949	1.195
18	1.023	1.384	1.020	1.002	1.415
19	0.952	1.095	0..946	1.006	1.043
20	0.905	1.023	0.919	0.985	0.926
21	1.030	1.033	1.055	0.977	1.065
22	0.988	1.124	0.948	1.042	1.110
23	0.926	0.998	0.968	0.956	0.924
24	0.996	1.056	1.000	0.996	1.052
25	1.174	1.039	1.148	1..022	1.220
26	0.993	0.983	1.023	0.971	0.977

27	1.000	0.804	1.000	1.000	0.804
Mean	0.962	1.076	0.978	0.983	1.035

4. Conclusion and Policy Implications

Insurance industry is one among the rapidly growing industries of Pakistan. Many studies have been conducted in recent past to examine growth of insurance industry. This study has been conducted to see the technical efficiency and productivity of insurance companies of Pakistan. In this study 27 non-life insurance companies are taken. Total assets and number of employees are taken as input, while investment income, net premium earned and other income are output variables. For this two by three model data from year 2007 to 2017 has been taken from insurance association of Pakistan. Data Envelopment Analysis and Malmquist- Productivity Indices have been used to calculate the results regarding technical efficiency and productivity of insurance firms. It is concluded that there is a mix type of results regarding technical efficiency and productivity. Some firms are efficient while some are not. In the same way some firms are productive while others are not. But it is found that overall the results are satisfactory and insurance industry is growing in Pakistan. It is found that ACE Insurance Limited, Adamjee Insurance Company Limited are found to be technically most efficient firms in Pakistan. These two firms has attained technical efficiency score '1' nine times during the study period. In 2010 the non-life insurance companies in Pakistan obtain highest technical efficiency score 0.79. Considering the productivity analysis by exercising Malmquist Productivity Index it has been found that that 16 companies out of 27 are productive in nature. Out of these 16 productive companies, 8 companies are productive due to both efficiency change and technical change, while 7 companies are productive only due to technical change.

5.1 Policy Implications

The study has recommended following recommendations.

Government may control rate of inflation. When the price level rises, people cannot meet their basic necessities so they do not intend for insurance. They do not want to cut their income for future because of immediate needs. So, government may control inflation and adopt such policies that uplift living standards of common people, when the people will prosperous, they will prefer to be insured.

Government may ensure political stability in Pakistan. There is huge scope of insurance sector but share of multinational firms is disappointing. One of the causes is political instability in the country that shakes the interest of international investors. When there is political stability and smooth democracy in any country it will motivate the multinational corporation to invest in insurance sector.

The existing insurance companies may improve skills of their employees. When modes of operandi will change and the companies will invest in their human resources by professional training and fringe benefits the efficiency of the companies will improve as well. The insurance companies may improve their managerial skills and should give proper training to the employees for better outcomes.

5. Agenda for the Future

The present study has assessed the technical efficiency and productivity of non-life insurance firms in Pakistan from 2007-2017. The future research may be extended to include efficiency of insurance companies up to recent year. The future study may also be extended to assess the economic efficiency of life insurance firm and takaful firm.

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