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Efficiency Performance Of Non-Life Insurance Sector Of Pakistan

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ABSTRACT

This study examines the efficiency of non-life insurance industry including non-family general Takaful firms operating in Pakistan by taking a panel data of 32 firms for the period 2017 to 2024. Non-parametric Data Envelopment Analysis approach along with Malmquist Index for total factor productivity (TFP) is used. The study uses enhanced decomposition of Malmquist index proposed by Fare et al. (1994) and decomposes TFP into efficiency change and technical change. Efficiency change is further decomposed into scale efficiency and pure efficiency. The study finds that efficiency change for non-life insurance industry of Pakistan is contributed by both pure and scale efficiency change; however, main component contributing to efficiency is pure efficiency change.

Keywords: Non-Parametric DEA, Malmquist Index, TFP, Efficiency and Technical Change.

Introduction

In the modern world, whether an individual or a business organization, almost everyone is exposed to certain possible risk of losses. One way to minimize possibility of such losses is to buy insurance (Hussain & Pasha, 2011). Protection against losses by transferring risk is the main function of insurance (Sabbir, 2002). Insurance works on the concept of mutual cooperation between two parties, to protect the insured party from possible expected losses in future. It is a device through which risk of one party (insured) is reduced by transferring it to other party (insurer), in compliance with underlying contract (Hussain & Pasha, 2011). Several countries in the world are operating under dual financial systems. These are traditional (conventional) financial system and Islamic financial system. Islamic finance covers almost every area of prevailing financial system (Masud, 2011). In Islamic financial system, Takaful is an alternative to conventional insurance and is an innovative approach (Masud, 2011). Takaful literally means “assuring each other”. It works on the principle of pooled contributions which are used to support the participants (Usmani, 2007). Being an Islamic contract, acceptance of offer is necessary for Takaful (Mohammad, 1988). It is based on the principle that uncertainty to individual can be ceased by grouping of such individuals (Ahmad, Masood & Khan, 2010).

The idea of takaful has drawn a lot of interest in the international insurance market in recent years. According to a study by Hassan et al. (2018), the takaful business has been expanding at an average rate of 12% year and is predicted to keep rising in the future. The rising demand for financial goods that adhere to Shariah among Muslim consumers is one of the factors contributing to this increase. Takaful is also becoming more popular with



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non-Muslim investors who are seeking ethical and socially responsible investing opportunities (Sulaiman et al., 2019).

The basic concepts are one of the main distinctions between Takaful and conventional insurance. In takaful, the participants share the risk and pay into a pooled fund that is used to cover any potential losses. This is founded on the Tabarru (volunteer contribution or giving) philosophy. Conventional insurance, on the other hand, is founded on the idea that risk is transferred from the policyholder to the insurer in exchange for a premium payment (Arshad et al., 2015). Moreover, Takaful runs according to the Mudharabah or Wakalah principle, where the surplus from the pool is distributed among the participants or used for charity causes (Hassan et al., 2018). This is consistent with the Islamic notion of wealth redistribution and social welfare.

The current study measures the efficiency performance of insurance industry of Pakistan. The economy of Pakistan is operating under the dual financial system where Takaful operators are operating in parallel with conventional insurance operators in the industry. Therefore, insurance firms of Pakistan are analyzed along with Takaful firms operating in the industry.

According to the statistics provided by the State Bank of Pakistan, insurance industry of Pakistan witnessed 2.7% growth in financial year 2023 in comparison to 2024. Income before tax and income after tax are increased by 1.9 % and 4.9%, respectively. Takaful companies' assets are increased by 49%, which is 19% of the overall growth of the insurance industry. Non-life insurance sector of industry contributed 87.7%, life insurance sector contributed 10.30%, and Takaful sector contributed 2.05% of the overall equity of the insurance industry.

This study seeks to investigate the efficiency of non-life insurance sector including non-family Takaful firms operating in Pakistan for the period 2017 to 2024. It aims to analyze the sources of efficiency change and technical change. It also isolates the contribution of efficiency change, technical change, pure efficiency change and scale efficiency change. The results of study can be helpful for operators to improve operating performance of their firms. Policy makers may utilize information of efficiency performance for designing strategy for future to improve insurance sector's stability and to contribute to financial system's effectiveness. It can also be helpful for Takaful operators operating in competition with well established conventional insurance sectors to improve efficiency of their firms. Efficiency measurement of insurance sector may increase the level of satisfaction for their customers, thus leading to high growth of firms with higher efficiency. The rest of the paper is organized as follow: Section 2 provides an account of the relevant literature, Section 3 explains methodology, Section 4 presents analysis and empirical results, and Section 5 concludes the study.

Review of literature

In insurance sector, studies based on efficiency measurement of insurance have been growing rapidly (Eling & Luhnen, 2010). A well established stream of efficiency measurement of insurance industry is available in literature for developed economies (Cummins, Weiss, Xiaoying & Hongmin, 2010; Diacon, 2001) as well as for emerging economies (Dutta & Sengupta 2010; Saad, Majid, Yusof, Duasa & Abdul Rahman, 2006). Rees and Kessner (2000) and Diacon Starkey and O'Brien (2002) made international comparative efficiency analyses of European insurance companies. German insurance companies were found 48% efficient at average and British insurance firms' efficiency was found slight higher than German's, i.e. 57% at average around mean by Rees and Kessner (2000). Diacon et al., (2002) made comparative efficiency analysis of insurance



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industries of Spain, Denmark, UK and Sweden and found UK insurance companies at low level of scale and mix efficiency. Abu Mansor and Radam (2000) conducted study for measuring efficiency performance of Malaysian life insurance industry through non-parametric approach, i.e. DEA in combination with Malmquist Index for total factor productivity. The study evaluated Malmquist Index of 12 Malaysian life insurance companies extending from 1987-1998 for the purpose of measuring performance efficiency. The study found technical progress and technical efficiency as major contributors to overall productivity growth of Malaysian insurance industry.

A comparative study for Chinese insurance industry was conducted by Chen, Powers and Qiu (2009). The study made comparison of foreign and domestic life insurance companies operating in China. Data used for the analysis purpose extended from 2002 to 2008. By using Data Envelopment Analysis (DEA), the study found domestic life insurance companies as more efficient in comparison with foreign life insurance companies operating in China. Study argued that foreign life insurance companies had not brought more efficiency in Chinese market; however, a gap of efficiency between foreign and domestic life insurance companies had been shrinking since 2005. Apart from USA, UK, European and Asian countries, efficiency of insurance industry is also evaluated in African countries. Barros, Caporale and Ibiwoye (2008) conducted study to analyze the efficiency of Nigerian insurance industry over the period extending from 1994 to 2005. It was the period of intense volatility for Nigerian insurance industry due to deregulation of the industry. The study used DEA technique for analysis and found Nigerian insurance industry with declining efficiency for the period of analysis. However, this declining efficiency is contributed by scale and technical efficiencies along with inadequacies in management.

Numerous studies of insurance efficiency performance have been reviewed. Most of them are carried out in European countries and United States, e.g. (see Cummins et al., 2010; Diacon et al., 2001). A few studies have also been conducted in Asian context and emerging economies, e.g. (see Dutta & Sengupta 2010; Saad et al., 2006) and African countries, e.g. (see Barros et al., 2008). However, a large amount of insurance efficiency performance focused only on life insurance companies, e.g. (see Chen et al., 2009; Saad & Haji Idris 2011; Saad et al., 2006). To the extent of reviewed literature, rare work has been found for non-life insurance efficiency performance, e.g. (see Diacon 2001; Kader, Adams, & Hardwick, 2010). Current study mainly focuses on non-life or general insurers rather than life insurers.

Saad et al. (2006) conducted study for measuring efficiency of insurance industry in Malaysia. The study realized the essence of Takaful insurance in the economy and also included Takaful insurance companies operating in Malaysia for the analysis purpose. A sample of 13 life insurance and family Takaful companies over a period of 2002 to 2005 was used for the analysis purpose. Management expenses and commission expenses were used as inputs and premiums and investment income were considered as output. DEA, in combination with Malmquist Index approach was used to evaluate the technical efficiency, efficiency change, pure and scale efficiencies for life insurance and takfaul operators. Saad et al. (2006) reported that technical change (1.6%) on average contributed to total factor productivity growth in Malaysian insurance industry; whereas, a negative change (-1.5%) was contributed by efficiency change in the said industry. Below average total factor productivity (1.000) shown by Takaful where it was slightly above (1% higher than average) the average of technical change (1.016) and was almost equal to industry average scale efficiency (1.008).

Moreover, Saad and Haji Idris (2011) conducted comparative but cross country efficiency



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measurement study for insurance and takful firms in Malaysia and Brunei. Study analyzed insurance as well as Takaful firms operating in Malaysia and Brunei. Sample of 11 life insurance firms including Takaful over the period of 2000 to 2005 was used. Study considered management expenses and commission expenses as input along with premiums and investment income as output. Non-parametric technique Data Envelopment Analysis (DEA) along with Malmquist Index approach has been applied for analysis. Saad and Haji Idris (2011) found that total factor productivity of life insurance industry is on average contributed by efficiency change and technical change; however, efficiency change is mainly due to the scale efficiency rather than pure efficiency, which indicates that efficiency change is influenced by size of the companies. Study argued that the probability of utilizing input and output efficiently by companies increases as the size of the company increases.

A study by Ali et al. in 2020 looked at Malaysia's Takaful industry's development and performance. According to the survey, Malaysia's takaful market has been steadily expanding in recent years, with an increase in total assets, contributions, and policyholders. The report also emphasised the significance of regulatory support and product innovation in sustaining the expansion of the Takaful business (Ali et al., 2020).

Al-khalidi et al (2021) 's investigation into Saudi Arabian customers' sentiments towards Takaful goods was part of a larger study. According to the report, consumers view takaful products favourably and think that they are more morally and socially responsible than traditional insurance. The report also noted certain elements that can prevent the development of the Takaful market in Saudi Arabia, such as consumer ignorance of Takaful and a lack of marketing efforts on the part of Takaful operators.

A study conducted in 2022 by Mustafa et al. looked at how COVID-19 affected Malaysia's Takaful business. According to the survey, the pandemic has had a variety of effects on the Takaful industry, including a drop-in company activity and a change in consumer behaviour towards digital channels. The report did, however, also point out the opportunity for the Takaful sector to play a bigger part in fostering financial inclusion and aiding economic recovery in the post-pandemic period (Mustafa et al., 2022).

Efficient frontier approaches are mostly focused for measuring efficiency performance of insurance industries. These approaches use multiple inputs and outputs to assess efficiency levels and develop efficiency frontier. Efficiency levels and efficiency frontiers have been utilized to evaluate the efficiency of decision making unit (DMU) in comparison with other DMUs in sample (Saad & Haji Idris, 2011). Two widely used methodologies in literature for measuring efficiency of insurance industry are Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA). Both SFA and DEA approaches utilize inputs and outputs from sample to measure efficiency of DMUs (Saad et al., 2006). DEA approach provides single measure for productive efficiency of a firm by using input and output information of the firm. Efficiency scores lie between zero and one. Zero indicates complete inefficiency of the firm while unity demonstrates complete efficiency of DMU (Leong, Dollery, & Coelli, 2003). DEA approach finds combination of linear estimates, and estimates the frontier that envelops the observed data (Leong et al., 2003). Thus, this approach is a standard approach which makes efficient firms to lie on the efficient frontier by enveloping inefficient firms (Neal, 2004). The firms producing optimal possible output by utilizing a specific required level of input lie on the efficient frontier, whereas inefficient firms are considered by program by comparing these with efficient firms (enveloping) (Coelli et al., 2005).

However, it is still an ongoing debate about which approach is appropriate for measuring efficiency performance (Saad et al., 2006). Current study applies Data Envelopment



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Analysis by using Malmquist Index. Malmquist index of total factor productivity approach is the widely used approach in combination with DEA for measuring efficiency performance of insurance industry, e.g. (see Cummins et al., 1996; Cummins & Rubio-Misas, 2006). Through Malmquist index, total factor productivity growth can be decomposed into technical efficiency change and technical change (Eling & Luhn, 2010). Technical efficiency change can be further decomposed into pure efficiency and scale efficiency (Saad et al., 2006). Since Malmquist index allows to measure detailed performance efficiency including technical efficiency change, technical change, pure efficiency and scale efficiency to total productivity growth, therefore, current study uses Malmquist index in combination with DEA to measure the efficiency of insurance and Takaful firms. Efficiency measurement requires input and output to develop a best practice frontier (Eling & Luhn, 2010). It has remained a challenge for analysts to define input and output for insurance firms (Cummins & Zi, 1998). However, different studies used different kinds of inputs and outputs to measure the efficiency of insurance firms (Saad et al. 2006; Saad & Haji Idris 2011; Kader et al. 2010). Current study utilizes operating expenses as input, and gross premium and investment income as outputs for the analysis.

Methodology

The study uses a data of 29 non-life insurance firms and 3 non-family general Takaful firms from 2017 to 2024 for analysis purpose. Major sources of data for study are Financial Statement Analysis (FSA) reports of financial sector, published by State Bank of Pakistan, obtained from State Bank of Pakistan (SBP) official website (www.sbp.org.pk).

In order to explore the contribution of technical efficiency change and technical change to total productivity growth in insurance industry of Pakistan, the current study uses output oriented Malmquist index. Malmquist index developed by Fare et al. (1989) is estimated through Data Envelopment Analysis (DEA). The study considers that insurance firms use operating expense (input) (Kader et al., 2010) to produce premiums and net investment income (outputs) (Saad et al., 2006; Saad & Haji Idris, 2011)

Estimation of Malmquist index

Total factor productivity growth Malmquist index was introduced by Fare et al. (1989). It was developed to capture the effect of technical efficiency change and technical change. It is written as follow:

$$M_o(x^t, y^t, x^{t+1}, y^{t+1}) = (a) \times (b)$$

$$a = \frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)}$$

$$b = \left[\left(\frac{D_o^t(x^{t+1}, y^{t+1})}{D_o^{t+1}(x^{t+1}, y^{t+1})} \right) \left(\frac{D_o^t(x^t, y^t)}{D_o^{t+1}(x^t, y^t)} \right) \right]^{1/2}$$

Notation $D_o^t(x^{t+1}, y^{t+1})$ denotes technological difference of firm between time period t and time period $t+1$. In above model component “(a)” measures relative change in efficiency. It captures the effect that current production is how far from efficient possible production between time t and $t+1$. Component “(b)” of above model is geometric mean of two ratios. It captures the effect of technological change and measures the shift of efficient frontier due to shift in technology. It is calculated between input “ x ” used in time “ t ” and time “ $t+1$ ”. Relative efficiency change reflects the efficient usage of input to convert it into output. It is measured through finding distance of firm from efficient



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frontier. Technical change results in overall shift in efficient frontier with introduction of new and improved technology.

Fare et al. (1994) argued that the value of Malmquist index greater than one depicts growth in productivity and less than one value of Malmquist index shows deterioration in productivity. This interpretation can also be applied to TFP Index calculated through Malmquist index. The value of efficiency component of Malmquist index, greater than one, shows improvement in firm’s efficiency (decrease in distance from efficient frontier). Technological progress can be judged through technical change component’s value, greater than one and vice versa.

Malmquist index model developed by Fare et al. (1989), calculates four distances. These distances are calculated for each firm for every adjacent pair of time period (between t and t+1). Using DEA, Constant Return to Scale (CRS) model for every firm at each time period “t” can be written as:

$$\left[\begin{aligned} (\mathbf{x}^t, \mathbf{y}^t): \mathbf{y}_m^t &\leq \sum_{k=1}^K \mathbf{z}_k^t \mathbf{Y}_{k,m}^t & \mathbf{m} = 1, \dots, \mathbf{M}, \\ \sum_{k=1}^K \mathbf{z}_k^t \mathbf{x}_{k,n}^t &\leq \mathbf{x}_n^t & \mathbf{n} = 1, \dots, \mathbf{N}, \\ \mathbf{z}_k^t &\geq 0 & \mathbf{k} = 1, \dots, \mathbf{K}, \end{aligned} \right]$$

In above model K denotes firms and equals to 1,..., K. The firm K produces output m, equals to 1,..., M and shown as $y_{k,m}^t$. These outputs are produced by inputs n, equals to 1,..., N and shown as $x_{k,n}^t$ for each time period t equal to 1,..., T. Specific weights are assigned to each cross sectional observation. These weights are denoted by z_k^t . According to Afriat (1972), by taking summation of cross sectional observations’ weights as 1, Constant Return to Scale (CRS) assumption can be changed to Variable Return to Scale (VRS).

$$\sum_{k=1}^K \mathbf{z}_k^t = 1 \quad (\text{VRS})$$

Current study applies enhanced decomposition of Malmquist index, proposed by Fare et al. (1994). Through this enhanced decomposition, efficiency change can be decomposed into pure efficiency and scale efficiency. Efficiency change component is calculated relative to Constant Return to Scale (CRS) technology. It is then further decomposed into pure efficiency by calculating it relative to Variable Return to Scale (VRS) technology, and scale efficiency which measures the deviation of efficiency between CRS and VRS technology. The insurance firms’ relative ability to convert input into output is measured through pure efficiency change. However, scale efficiency change captures the effect of altering scale to get benefit of optimal production.

By using DEA approach, study constructs Malmquist index for productivity by calculating four distance functions for firm k, between time t and time t+1.

$$D_o^t(\mathbf{x}^t, \mathbf{y}^t), D_o^{t+1}(\mathbf{x}^t, \mathbf{y}^t), D_o^t(\mathbf{x}^{t+1}, \mathbf{y}^{t+1}), D_o^{t+1}(\mathbf{x}^{t+1}, \mathbf{y}^{t+1})$$

Output oriented Farrell’s measures for technical efficiency are reciprocal of these functions. These functions are calculated through taking reciprocals of Farrell’s measure for technical efficiency. Output oriented Farrell’s measure for technical efficiency can be expressed as:

$$[D_o^t(\mathbf{x}_k^t, \mathbf{y}_k^t)]^{-1} = \max \lambda^k$$



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Where,

$$\begin{aligned} \lambda^k Y_{k,m}^t &\leq \sum_{k=1}^K z_k^t Y_{k,m}^t & \mathbf{m} = 1, \dots, \mathbf{M}, \\ \sum_{k=1}^K z_k^t X_{k,n}^t &\leq x_{k,n}^t & \mathbf{n} = 1, \dots, \mathbf{N}, \\ \sum_{k=1}^K z_k^t &= 1 & \text{(VRS)} \\ z_k^t &\geq 0 & \mathbf{k} = 1, \dots, \mathbf{K}, \end{aligned}$$

Distance function for time t+1 is also calculated by applying similar method, mentioned above. However, t is substituted with t+1.

Remaining two mixed distance functions, which are measured by finding the distance between observations of one time period from another best practice frontier in another time period, are also required for constructing Malmquist index. These distances are calculated by taking inverse of mixed distance function, expressed as:

$$[D_o^t(x_k^{t+1}, y_k^{t+1})]^{-1} = \max \lambda^k$$

Where

$$\begin{aligned} \lambda^k Y_{k,m}^{t+1} &\leq \sum_{k=1}^K z_k^t Y_{k,m}^t & \mathbf{m} = 1, \dots, \mathbf{M}, \\ \sum_{k=1}^K z_k^t X_{k,n}^t &\leq x_{k,n}^{t+1} & \mathbf{n} = 1, \dots, \mathbf{N}, \\ \sum_{k=1}^K z_k^t &= 1 & \text{(VRS)} \\ z_k^t &\geq 0 & \mathbf{k} = 1, \dots, \mathbf{K}, \end{aligned}$$

For measuring scale efficiency change, output oriented inverse functions are also calculated for VRS technology by relaxing the assumption of CRS, though adding following into above distance functions:

$$\sum_{k=1}^K z_k^t = 1 \quad \text{(VRS)}$$

Main Model

$$M_o(x^t, y^t, x^{t+1}, y^{t+1}) = (\mathbf{a}) \times (\mathbf{b}) \times (\mathbf{c})$$

Where,

$$\mathbf{a} = \left[\left(\frac{D_o^{t+1}(x^t, y^t)}{D_o^t(x^t, y^t)} \right) \left(\frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^t(x^{t+1}, y^{t+1})} \right) \right]^{1/2}$$

$$\mathbf{b} = \frac{D_o^t(x^t, y^t)}{D_o^{t+1}(x^{t+1}, y^{t+1})}$$



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$$c = \left(\frac{D_{oc}^{t+1}(x^t, y^t) D_o^{t+1}(x^{t+1}, y^{t+1}) D_{oc}^t(x^t, y^t) D_o^t(x^{t+1}, y^{t+1})}{D_o^{t+1}(x^t, y^t) D_{oc}^{t+1}(x^{t+1}, y^{t+1}) D_o^t(x^t, y^t) D_{oc}^t(x^{t+1}, y^{t+1})} \right)^{1/2}$$

In above model, component “a” represents Technical change, component “b” represents Pure Efficiency change and component ”c” represents Scale Efficiency change. Constant Return to Scale (CRS) assumption is applied for calculating technical change. By finding the ratio of distance function calculated relative to CRS to distance function calculated relative to VRS, scale efficiency change is calculated. Pure efficiency change is calculated through finding ratio between distance functions of current and lead time period, calculated with VRS technology.

Analysis and Results

This chapter performs several analyses. It starts with presenting descriptive statistics for overall non-life insurance industry. Rest of the chapter presents efficiency scores for the insurance and Takaful firms under Constant Return to Scale (CRS) and Variable Return to Scale (VRS) assumptions, Malmquist index total factor productivity change, technical change, efficiency change and changes in component of efficiency. At the end summary of Malmquist index is presented.

Table 1: Descriptive Statistics

	Outputs		Input
	Investment income	Gross premium	Operating expenses
Mean	300,594	1,190,000	312,764
Standard deviation	1,348,000	2,509,000	699,272
Minimum	(5,299,619)	0	0
Maximum	14,812,295	13,270,288	8,337,214

Source: Author's Analysis

Notes: This table reports descriptive statistics for the overall non-life insurance industry of Pakistan, including 32 firms, for the period of year 2017 to 2024. It provides input used by insurance company to produce output. Input is proxied by operating expenses incurred by firms. Outputs are investment income earned by firms and gross premiums of the firms. All figures are in thousands.

Efficiency measurement

For estimating Malmquist index of total productivity, the basic component is measure of efficiency. Study reports efficiency measure and change in efficiency measure for non-life insurance sector of Pakistan consisted of 32 firms from 2017 to 2024. Table 4 and 5 present efficiency scores for overall non-life insurance industry of Pakistan under Constant Return to Scale (CRS) assumption proposed by Charnes, Cooper and Rhodes (1978) and Variable Return to Scale (VRS) assumption proposed by Banker, Charnes and Cooper (1984) respectively.

Table 2: Efficiency of Insurance Firms under Constant Return to Scale

S. No	Insurance firms	2017	2018	2019	2020	2021	2022	2023	2024
		7	8	9	0	1	2	3	4



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1	ACE Ins Aid Pacific Ltd.	0.00 33	0.00 31	0.00 00	0.00 31	0.00 19	0.01 08	0.00 42	0.04 94
2	Adamjee Ins Company Ltd.	0.00 12	0.00 12	0.00 16	0.00 10	0.00 11	0.00 09	0.00 11	0.00 11
3	Alflah Ins Company Ltd	0.00 10	0.00 09	0.00 08	0.00 06	0.00 06	0.00 15	0.00 13	0.00 13
4	Asia Ins Company Ltd.	0.00 12	0.00 09	0.00 07	0.00 03	0.00 03	0.00 03	0.00 02	0.00 04
5	Askari General Ins Company Ltd.	0.00 11	0.00 10	0.00 10	0.00 02	0.00 12	0.00 09	0.00 09	0.00 11
6	Atlas Ins Company Ltd.	0.00 27	0.00 20	0.00 17	0.00 03	0.00 05	0.00 15	0.00 14	0.00 13
7	Capital Ins Company Ltd.	0.00 11	0.00 10	0.00 00	0.00 07	0.00 11	0.00 35	0.00 35	0.00 35
8	Central Ins Company Ltd.	0.00 08	1.00 00	0.00 85	0.00 00	0.00 04	0.05 33	0.00 01	0.00 01
9	Century Ins Company Ltd.	0.00 14	0.00 11	0.00 13	0.00 09	0.00 11	0.00 10	0.00 10	0.00 10
10	Crescent Star Ins Company Ltd.	0.00 06	0.00 06	0.00 00	0.00 00	0.00 05	0.00 05	0.00 04	0.00 04
11	E.F.U.General Ins Company Ltd.	0.00 16	0.00 15	0.00 11	0.00 14	0.00 12	0.00 14	0.00 14	1.00 00
12	East West Ins Company Ltd.	0.00 06	0.00 06	0.00 00	0.00 07	0.00 03	0.00 07	0.00 08	0.00 08
13	Excel Ins Company Ltd.	0.00 03	0.00 04	0.00 05	0.00 06	0.00 04	0.00 01	0.00 01	0.00 01
14	Habib Ins Company Ltd.	0.00 09	0.00 10	0.00 09	0.00 09	0.00 10	0.00 12	0.00 11	0.00 11
15	IGI Co. of Pakistan Ltd.	0.00 09	0.00 09	0.00 04	0.00 06	0.00 08	0.00 05	0.00 04	0.00 97
16	New Hampshire Ins Company Ltd.	0.00 00	0.00 00	0.00 00	0.00 06	0.00 07	0.00 11	0.00 59	0.00 23
17	New Jubilee Ins Company Ltd.	0.00 18	0.00 18	0.00 07	0.00 16	0.00 15	0.00 14	0.00 15	0.00 15
18	PICIC Ins Ltd.	0.00 11	0.00 07	0.00 09	0.00 12	0.00 15	0.00 17	0.00 09	0.00 09
19	Pakistan General Ins Company Ltd.	0.00 00	0.00 00	0.00 00	0.00 00	0.00 11	0.00 18	0.00 24	0.00 06
20	Pakistan Mutual Ins Company Ltd.	0.00 02	0.00 02	0.00 00	0.00 02	0.00 02	0.00 26	0.00 04	0.00 03
21	Premier Ins Company Ltd.	0.00 06	0.00 06	0.00 03	0.00 04	0.00 07	0.00 07	0.00 08	0.00 07
22	Reliance Ins Company Ltd.	0.00 07	0.00 07	0.00 07	0.00 06	0.00 07	0.00 08	0.00 07	0.00 08
23	Saudi Pak Ins Company Ltd	0.00 06	0.00 08	0.00 02	0.00 09	0.00 08	0.00 08	0.00 05	0.00 05
24	Security General Ins Company Ltd.	0.00 08	0.00 08	0.00 02	0.00 03	0.00 04	0.00 06	0.00 07	0.00 20



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25	Shaheen Ins Company Ltd.	0.00 09	0.00 08	0.00 07	0.00 05	0.00 06	0.00 06	0.00 06	0.00 05
26	Silver Star Ins Company Ltd.	0.00 12	0.00 15	0.00 00	0.00 05	0.00 06	0.00 06	0.00 05	0.00 05
27	UBL Insurers Ltd	0.00 00	0.00 09	0.00 09	0.00 08	0.00 12	0.00 12	0.00 14	0.00 13
28	United Ins Company of Pakistan Ltd.	0.00 09	0.00 09	0.00 06	0.00 06	0.00 07	0.00 07	0.00 07	0.00 06
29	Universal Ins Company Ltd.	0.00 09	0.00 10	0.00 00	0.00 07	0.00 04	0.00 04	0.00 04	0.00 03
30	Pak Kuwait Takaful Company Ltd	0.00 52	0.00 12	0.00 09	0.00 12	0.00 14	0.01 20	0.00 32	0.00 48
31	Pak Qatar General Takaful Ltd.	0.00 00	0.00 00	0.00 00	0.00 08	0.00 05	0.00 07	0.00 12	0.00 22
32	Takaful Pakistan Ltd.	0.00 00	0.00 03	0.00 05	0.00 02	0.00 06	0.00 06	0.00 06	0.00 08
	Mean	0.00 10	0.03 21	0.00 08	0.00 07	0.00 08	0.00 33	0.00 13	0.03 41

Source: Author's Analysis

Empirical Results (Constant Return to Scale)

Table 2 reports efficiency of insurance industry of Pakistan, under constant return to scale assumption. During analysis period, Central Insurance Company limited is efficient in year 2018. Its efficiency decreases gradually and reaches to minimum in 2020 and again gets some pace to attain efficiency in proceeding years. EFU General Insurance Company shows slow but steady pace to attain efficiency in analysis period and in year 2024 and reaches to efficiency frontier.

For overall industry, Pakistan General Insurance Company limited, New Hampshire Insurance Company limited and Pak Qatar Takaful limited are inefficient respectively from 2017 to 2020. Non-family Takaful sector is comparatively at more distance from efficient frontier. Pak Kuwait Takaful Company limited is relatively efficient in Takaful sector, while Pak Qatar General Takaful limited and Takaful Pakistan limited are inefficient. However, Pak Qatar General Takaful Limited shows significant pace to shorten the distance from efficient frontier as compare to Takaful Pakistan limited.

The result of CRS output oriented model indicates that Central Insurance Company Limited and EFU General Insurance Company limited utilize exact required level of input to produce certain efficient level output for the years 2017 and 2024 respectively. However, Pak Kuwait Takaful Company limited consumes 12% more than required level of input to produce efficient level of output. On average overall industry efficiency increases from year 2017 to 2018 and starts decreasing from 2018 to 2023. However, industry on average attains a certain level of efficiency in year 2024.

Table 3: Efficiency of Insurance Firms under Variable Return to Scale

S. No	Insurance Firms	2017	2018	2019	2020	2021	2022	2023	2024
	ACE Ins Aid Pacific Ltd.	0.13 46	0.20 96	0.00 00	0.17 50	0.00 00	0.00 00	0.00 00	0.00 00
2	Adamjee Ins Company Ltd.	0.68 10	0.71 77	1.00 00	0.61 51	0.67 84	0.55 48	0.65 52	0.64 49



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3	Alflah Ins Company Ltd	0.01 31	0.00 25	0.00 08	0.00 07	0.00 07	0.14 33	0.12 39	0.12 71
4	Asia Ins Company Ltd.	0.00 38	0.00 24	0.00 19	0.00 11	0.00 10	0.00 09	0.00 08	0.00 05
5	Askari General Ins Company Ltd.	0.09 53	0.09 22	0.09 70	0.17 45	0.11 96	0.08 91	0.08 21	0.11 17
6	Atlas Ins Company Ltd.	0.21 83	0.17 91	0.16 02	0.03 14	0.04 48	0.14 04	0.14 02	0.12 98
7	Capital Ins Company Ltd.	0.00 97	0.00 90	0.00 00	0.00 19	0.00 28	0.02 21	0.02 21	0.02 21
8	Central Ins Company Ltd.	0.01 96	1.00 00	0.01 13	0.00 00	0.00 04	0.07 30	0.00 01	0.00 01
9	Century Ins Company Ltd.	0.08 68	0.07 23	0.09 35	0.06 53	0.08 34	0.07 77	0.08 24	0.08 36
10	Crescent Star Ins Company Ltd.	0.02 17	0.01 73	0.00 00	0.00 00	0.00 07	0.00 08	0.00 06	0.00 07
11	E.F.U.General Ins Company Ltd.	0.90 99	1.00 00	0.77 37	0.85 67	0.78 40	0.95 73	0.91 99	1.00 00
12	East West Ins Company Ltd.	0.03 93	0.04 78	9.67 65	0.05 91	0.17 25	0.05 62	0.07 54	0.07 48
13	Excel Ins Company Ltd.	0.00 16	0.00 16	0.00 17	0.00 19	0.00 19	0.00 14	0.00 11	0.00 11
14	Habib Ins Company Ltd.	0.07 03	0.08 79	0.08 02	0.08 02	0.09 11	0.11 12	0.09 94	0.10 39
15	IGI Co. of Pakistan Ltd.	1.00 00	0.20 50	0.13 43	0.16 66	0.07 59	0.04 83	0.03 83	1.00 00
16	New Hampshire Ins Company Ltd.	0.00 00	0.00 00	0.00 00	0.05 66	0.06 54	0.11 25	0.58 51	0.22 79
17	New Jubilee Ins Company Ltd.	0.50 14	0.65 50	0.48 02	0.64 80	0.64 86	0.66 03	0.74 10	0.82 03
18	PICIC Ins Ltd.	0.07 50	0.05 57	0.06 73	0.09 64	0.11 79	0.13 91	0.07 69	0.07 92
19	Pakistan General Ins Company Ltd.	0.00 00	0.00 00	0.00 00	0.04 34	0.05 60	0.13 50	0.16 93	0.03 70
20	Pakistan Mutual Ins Company Ltd.	0.00 62	0.00 45	0.00 00	0.00 00	0.00 00	0.00 00	0.00 00	0.00 00
21	Premier Ins Company Ltd.	0.04 86	0.05 13	0.02 80	0.03 64	0.06 51	0.06 33	0.07 66	0.06 31
22	Reliance Ins Company Ltd.	0.05 47	0.06 32	0.06 26	0.05 09	0.05 31	0.06 27	0.06 20	0.07 48
23	Saudi Pak Ins Company Ltd	0.00 81	0.04 18	0.01 18	0.04 82	0.02 54	0.02 35	0.02 51	0.03 65
24	Security General Ins Company Ltd.	0.04 02	1.00 00	0.00 87	0.01 98	0.02 29	0.04 74	0.05 77	0.20 08
25	Shaheen Ins Company Ltd.	0.08 20	0.06 82	0.05 80	0.04 29	0.05 14	0.05 24	0.05 04	0.03 26
26	Silver Star Ins Company Ltd.	0.00 13	0.03 99	0.00 00	0.01 92	0.02 62	0.03 07	0.02 87	0.03 16



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27	UBL Insurers Ltd	0.00 00	0.06 03	0.07 20	0.06 87	0.10 08	0.10 07	0.12 37	0.11 73
28	United Ins Company of Pakistan Ltd.	0.06 62	0.07 36	0.05 17	0.05 16	0.06 33	0.06 88	0.17 99	0.11 38
29	Universal Ins Company Ltd.	0.07 08	0.07 87	0.00 00	0.05 64	0.03 51	0.03 21	0.02 85	0.00 52
30	Pak Kuwait Takaful Company Ltd	0.00 96	0.05 70	0.03 54	0.05 72	0.08 63	0.86 49	0.25 25	0.38 73
31	Pak Qatar General Takaful Ltd.	0.00 00	0.00 18	0.00 00	0.06 87	0.00 05	0.01 29	0.06 28	0.18 64
32	Takaful Pakistan Ltd.	0.00 00	0.00 07	0.01 65	0.00 03	0.02 25	0.01 29	0.01 78	0.03 29
	Mean	0.13 34	0.18 43	0.40 39	0.11 23	0.10 93	0.14 67	0.14 94	0.17 96

Source: Author's Analysis

Empirical Results (Variable Return to Scale)

Table 3 reports efficiency of Pakistani Insurance Industry under Variable Return to Scale assumption. In analysis period, EFU General Insurance Company limited is efficient in 2018 and 2024, International General Insurance Company limited in year 2017 and 2024, Century Insurance Company limited in year 2018 and Security General Insurance Company limited in year 2018.

ACE Insurance Aid Pacific limited, Capital Insurance Company limited, Crescent Star Insurance Company limited, Pakistan General Insurance Company limited, Pakistan Mutual Insurance Company limited, Pakistan General Insurance Company limited, Silver Star Insurance Company limited, UBL Insurers Company limited, Universal Insurance Company limited, Pak Qatar general Takaful limited and Takaful Pakistan limited are inefficient in one or other year under analysis.

Non-family general Takaful insurance sector of Pakistan again found inefficient in comparison with conventional insurance sector under VRS assumption. During analysis period, Pak Kuwait Takaful Company limited is efficient; whereas Pak Qatar and Takaful Pakistan limited found inefficient. On average, the efficiency of overall industry enhances in 2017 to 2019 and starts decreasing from 2020 to 2021. However, efficiency of industry increases in year 2022, 2023 and 2024 with a sluggish pace.

Malmquist Total Factor Productivity performance

This section provides Malmquist total factor productivity performance of non-life insurance industry of Pakistan. Table 4 presents Malmquist index total factor productivity change. Table 5 and 6 present two subcomponents of Malmquist index TFP productivity i.e. technical change and efficiency change for analysis period. Table 7 presents changes in efficiency components for the firms between two adjacent time periods.

Malmquist index total factor productivity, technical change and efficiency change figures provided in tables, more than unity imply productivity growth and less than unity imply deterioration in productivity. Average growth or deterioration in productivity of a firm for a certain period can be obtained by subtracting 1 from reported Malmquist index TFP figures provided in tables. However, in whole study relative efficiency measurement is made. Efficiency scores for firms imply their efficiency relative to best practice firms operating in industry.



Table 4: Malmquist Index Total Factor Productivity Change

S.No	Insurance Firms	17-18	18-19	19-20	20-21	21-22	22-23	23-24	Mean
1	ACE Ins Aid Pacific Ltd.	1.0521	0.0000	0.0004	1.6451	0.1763	1.0000	0.0844	0.5655
2	Adamjee Ins Co. Ltd.	0.9215	0.7085	1.3264	1.3962	1.2670	0.6708	0.6984	0.9984
3	Alflah Ins Company Ltd	0.9969	1.2199	1.0709	1.0000	0.6469	1.1235	1.0732	1.0188
4	Asia Ins Company Ltd.	1.3374	1.3108	1.5590	1.0496	0.9135	1.0057	1.1153	1.1845
5	Askari General Ins Co Ltd.	1.0625	0.9851	1.0000	0.1360	1.2583	1.0656	0.7743	0.8974
6	Atlas Ins Company Ltd.	1.2852	1.1680	1.0000	0.8293	0.3028	0.8881	1.0427	0.9309
7	Capital Ins Company Ltd.	0.9852	0.0000	0.0617	0.7675	0.2858	1.0000	1.0000	0.5857
8	Central Ins Company Ltd.	0.0004	0.0000	0.0000	0.0572	1.0000	0.1164	1.0592	0.3190
9	Century Ins Company Ltd.	1.1626	0.8370	1.4718	0.4508	1.0000	0.6140	0.9122	0.9212
10	Crescent Star Ins Co Ltd.	1.0840	0.0000	0.0000	0.0000	1.0832	0.9882	0.9208	0.5823
11	E.F.U.General Ins Co Ltd.	0.8081	1.5463	0.6722	1.5651	0.7542	0.7821	1.0108	1.0198
12	East West Ins Co Ltd.	0.8606	1.0000	0.9219	1.0000	0.4120	0.8308	0.8877	0.8447
13	Excel Ins Company Ltd.	0.9046	0.7338	1.4163	0.3144	0.0000	0.2584	1.0000	0.6611
14	Habib Ins Company Ltd.	0.9317	1.1149	1.0000	0.5172	0.9941	0.8472	0.8578	0.8947
15	IGI Co. of Pakistan Ltd.	1.5728	1.0000	0.6891	0.2244	1.0000	1.6661	0.0287	0.8830
16	New Hampshire Ins Co Ltd.	0.0000	0.0000	0.2034	0.8088	0.7008	0.2068	1.0000	0.4171
17	New Jubilee Ins Co Ltd.	1.0049	1.0000	0.3649	1.1089	0.9665	0.9870	0.9318	0.9091
18	PICIC Ins Ltd.	1.5306	0.8224	0.6649	0.8661	0.9255	1.6779	0.9860	1.0676
19	Pakistan General Ins Co Ltd.	0.0000	0.0000	0.0000	0.7762	0.6703	0.7068	1.0000	0.4505
20	Pakistan Mutual Ins Co Ltd.	1.5130	1.0000	0.0401	0.9473	0.0737	1.0000	1.3532	0.8468
21	Premier Ins Company Ltd.	0.9500	1.8584	0.7610	0.7425	1.2610	1.1532	0.9625	1.0984
22	Reliance Ins Company Ltd.	0.9348	1.0190	0.9722	0.9362	0.7218	0.9478	1.0850	0.9452
23	Saudi Pak Ins Company Ltd	0.7608	1.0000	0.2075	1.2767	0.9255	1.6245	0.8939	0.9555
24	Security General Ins Co Ltd.	0.3401	1.0000	0.7172	0.7805	0.8333	0.9108	0.8436	0.7751
25	Shaheen Ins Company Ltd.	1.1817	1.1585	0.9632	1.1077	1.0945	1.0841	1.2502	1.1200
26	Silver Star Ins Co Ltd.	0.8605	1.0000	0.1962	0.9198	1.2848	1.2495	0.7216	0.8903
27	UBL Insurers Ltd	0.0051	0.9891	1.0993	0.6035	0.7698	0.8662	1.1405	0.7819
28	United Ins Co Ltd. (Pak)	0.9825	1.4735	1.0128	0.8383	0.9854	1.0185	1.0871	1.0569
29	Universal Ins Company Ltd.	0.8824	0.0000	0.0000	1.6319	1.0922	0.9081	1.4398	0.8506
30	Pak Kuwait Takaful Co Ltd	1.0000	1.2700	0.7708	0.8264	0.1191	1.0000	0.6817	0.8097
31	Pak Qatar General Takaful Ltd.	0.0000	1.0000	0.01904	0.6305	1.0000	0.61529	0.54031	0.5436
32	Takaful Pakistan Ltd.	0.0000	0.63653	1.0000	0.4105	0.9659	0.93136	0.77059	0.6736
	Mean	0.8410	0.8391	0.6619	0.8176	0.7964	0.9295	0.9110	0.8281

Source: Author's Analysis



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Empirical results (Malmquist Total Factor Productivity change)

Table 4 presents Malmquist Index Total Factor productivity change between t and t+1. On average only few firms are found with positive productivity growth in analysis period and rest of the firms, depicts deterioration in TFP growth. However, several firms have positive productivity growth in adjacent periods.

Asia Insurance Company limited and Shaheen Insurance Company limited, on average has higher growth of 18.5% and 12% respectively. These firms show deterioration for only one adjacent period i.e. 2021-2022 and 2019-2020 respectively. Alfalah Insurance Company limited, EFU General Insurance Company limited, PICIC Insurance limited, Premier Insurance Company limited and United Insurance Company of Pakistan also found with positive productivity growth of 1.8%, 1.9%, 6.7%, 9.8% and 5.6% respectively. Rest of firms show deterioration in productivity.

None of adjacent periods from 2017 to 2024 shows TFP growth, on average, for overall non-life insurance sector of Pakistan. Least deterioration of 8% and 9% is witnessed for 2022-2023 and 2023-2024. Non-family general Takaful sector of industry also shows deterioration in productivity. Pak Kuwait Takaful Company limited, Pak Qatar General Takaful limited and Takaful Pakistan limited are found with 20%, 46% and 23% decrease in productivity growth.

Table 5: Relative Technical Change of Insurance Firms

S. No	Insurance firms	17-18	18-19	19-20	20-21	21-22	22-23	23-24	Mean
1	ACE Ins Aid Pacific Ltd.	0.0052	1.0000	1.0000	1.6451	0.1575	1.0000	0.1191	0.7039
2	Adamjee Ins Company Ltd.	0.0045	1.0000	1.0000	1.1631	0.2645	0.9035	0.3183	0.6648
3	Alflah Ins Company Ltd	0.0045	1.0000	1.0000	1.0108	0.3585	0.9836	0.2360	0.6562
4	Asia Ins Company Ltd.	0.0050	1.0000	1.0000	0.8764	0.6423	0.6020	0.3693	0.6421
5	Askari General Ins Company Ltd.	0.0052	1.0000	1.0000	1.5468	0.2203	1.2848	0.1892	0.7495
6	Atlas Ins Company Ltd.	0.0044	1.0000	1.0000	1.1977	0.3163	1.0000	0.3184	0.6910
7	Capital Ins Company Ltd.	0.0045	1.0000	1.0000	1.0841	0.3836	0.7270	0.3224	0.6460
8	Central Ins Company Ltd.	0.0009	1.0000	1.0000	0.7796	0.8445	0.5121	0.4579	0.6564
9	Century Ins Company Ltd.	0.0045	1.0000	1.0000	1.3071	0.3167	0.9794	0.3238	0.7045
10	Crescent Star Ins Company Ltd.	0.0051	0.0000	0.0000	0.0000	0.1677	1.5092	0.2392	0.2745
11	E.F.U.General Ins Company Ltd.	0.0038	1.0000	1.0000	1.4851	0.1676	1.3717	0.2146	0.7490
12	East West Ins Company Ltd.	0.0044	1.0000	1.0000	1.5136	0.2355	1.3041	0.2154	0.7533
13	Excel Ins Company Ltd.	0.0037	1.0000	1.0000	1.0285	0.8053	0.5513	0.4473	0.6909



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14	Habib Ins Company Ltd.	0.00 36	1.00 00	1.00 00	1.32 95	0.37 97	0.72 73	0.32 87	0.68 13
15	IGI Co. of Pakistan Ltd.	0.00 13	1.00 00	1.00 00	1.12 70	0.64 28	0.67 86	0.33 18	0.68 31
16	New Hampshire Ins Company Ltd.	0.00 00	0.00 00	1.00 00	1.11 51	0.37 57	0.75 48	0.29 61	0.50 60
17	New Jubilee Ins Company Ltd.	0.00 48	1.00 00	1.00 00	1.24 11	0.31 51	0.80 25	0.29 45	0.66 54
18	PICIC Ins Ltd.	0.00 52	1.00 00	1.00 00	1.54 86	0.16 61	1.79 85	0.15 03	0.80 98
19	Pakistan General Ins Company Ltd.	0.00 00	0.00 00	0.00 00	1.06 70	0.19 67	1.57 60	0.21 16	0.43 59
20	Pakistan Mutual Ins Company Ltd.	0.00 52	1.00 00	1.00 00	1.60 32	0.15 75	1.00 00	0.11 91	0.69 79
21	Premier Ins Company Ltd.	0.00 33	1.00 00	1.00 00	0.98 37	0.40 28	0.89 56	0.26 52	0.65 01
22	Reliance Ins Company Ltd.	0.00 51	1.00 00	1.00 00	1.23 93	0.34 67	0.72 86	0.31 83	0.66 26
23	Saudi Pak Ins Company Ltd	0.00 51	1.00 00	1.00 00	1.49 68	0.19 58	1.41 16	0.16 89	0.75 40
24	Security General Ins Company Ltd.	0.00 13	1.00 00	1.00 00	0.78 05	0.83 33	0.56 28	0.38 94	0.65 25
25	Shaheen Ins Company Ltd.	0.00 51	1.00 00	1.00 00	1.30 10	0.19 28	1.74 55	0.14 58	0.77 00
26	Silver Star Ins Company Ltd.	0.00 51	1.00 00	1.00 00	1.36 56	0.19 26	1.89 68	0.16 99	0.80 43
27	UBL Insurers Ltd	0.00 52	1.00 00	1.00 00	1.52 07	0.26 71	0.86 82	0.25 51	0.70 23
28	United Ins Company Ltd. (PAK)	0.00 52	1.00 00	1.00 00	1.52 88	0.18 95	1.55 11	0.16 23	0.77 67
29	Universal Ins Company Ltd.	0.00 52	0.00 00	0.00 00	1.52 38	0.17 52	1.75 24	0.15 89	0.51 65
30	Pak Kuwait Takaful Company Ltd	0.00 52	1.00 00	1.00 00	1.62 12	0.15 84	1.00 00	0.12 54	0.70 15
31	Pak Qatar General Takaful Ltd.	0.00 00	1.00 00	1.00 00	1.16 38	0.35 96	1.63 06	0.15 21	0.75 80
32	Takaful Pakistan Ltd.	0.00 00	1.00 00	1.00 00	1.45 29	0.16 64	1.86 41	0.13 08	0.80 20
	Mean	0.00 38	0.87 50	0.90 63	1.23 90	0.33 11	1.12 42	0.24 83	0.67 54

Source: Author's Analysis

Empirical Results (Technical Change)

Table 5 reports technical progress or regress for insurance industry of Pakistan between time t and $t+1$. It is further decomposition of Malmquist index Total Factor Productivity along with efficiency change. In adjacent periods 2020-2021 and 2022-2023, total of 29 firms experienced technical progress for achieving growth in total factor productivity. However, in rest of adjacent periods there is no technical progress, for any firm. On



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average, for periods of 2020-2021 and 2022-2023, overall industry also shows technical progress of 23% and 12% respectively.

Higher technical progress of firms is in period 2022-2023. Silver Star Insurance Company limited, Takaful Pakistan limited and PICIC Insurance limited witnessed higher technical progress of 89.68%, 86.4% and 79.85% respectively. On average, none of the firms experienced technical progress over the period of analysis. Takaful firms included in analysis also experienced technical progress in periods of 2020-2021 and 2022-2023. Maximum technical progress (86.4%) is experienced by Takaful Pakistan limited in 2022-2023. Pak Qatar General Takaful limited and Pak Kuwait Takaful Company limited are found with technical progress of 63% (2022-2023) and 62% (2020-2021) respectively. Takaful sector is found with some technical progress contributing to TFP, but as a whole this progress is less than that of insurance sector of insurance industry of Pakistan.

Table 6: Relative Efficiency Change of Insurance Firms

S. No	Insurance firms	17-18	18-19	19-20	20-21	21-22	22-23	23-24	Mean
1	ACE Ins Aid Pacific Ltd.	1.0000	1.0000	0.0001	1.0000	1.1189	1.2619	0.7082	0.8699
2	Adamjee Ins Company Ltd.	1.0000	0.0061	0.2470	1.2004	1.0000	0.7425	2.1942	0.9129
3	Alflah Ins Company Ltd	1.0000	0.0104	0.1985	0.9893	1.8046	1.1422	1.0000	0.8779
4	Asia Ins Company Ltd.	1.0000	0.0112	0.2187	1.1976	1.4224	1.6705	1.0000	0.9315
5	Askari General Ins Company Ltd.	1.0000	0.0084	1.9878	0.0879	1.0000	0.8293	1.0000	0.8448
6	Atlas Ins Company Ltd.	1.0000	0.0100	0.9849	0.6924	0.9574	1.1557	1.0000	0.8286
7	Capital Ins Company Ltd.	1.0000	0.3497	0.0054	0.7079	0.7450	1.3754	1.0000	0.7405
8	Central Ins Company Ltd.	0.4768	1.0000	1.0000	0.0733	1.0000	0.2272	2.3129	0.8700
9	Century Ins Company Ltd.	1.0000	0.0071	0.5374	0.3449	1.0000	0.6269	2.8173	0.9048
10	Crescent Star Ins Company Ltd.	1.0000	0.0000	0.0000	0.0000	1.0000	0.6548	1.0000	0.5221
11	E.F.U General Ins Company Ltd.	1.0000	0.0111	0.2080	1.0539	1.0000	0.5702	1.0000	0.6919
12	East West Ins Company Ltd.	1.0000	0.0225	0.1238	1.4087	1.7491	0.6371	1.0000	0.8487
13	Excel Ins Company Ltd.	1.0000	0.0063	0.2423	0.3056	1.0000	0.4687	1.0000	0.5747
14	Habib Ins Company Ltd.	1.0000	0.0095	0.3651	0.3890	2.6178	1.1649	2.6100	1.1652
15	IGI Co. of Pakistan Ltd.	1.0000	0.0171	0.2516	0.1991	1.0000	2.4553	0.0866	0.7157
16	New Hampshire Ins Company Ltd.	0.0000	0.0000	0.0199	0.7254	1.8654	0.2739	1.0000	0.5550



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17	New Jubilee Ins Company Ltd.	1.00 00	0.02 35	0.09 12	0.89 35	1.00 00	1.22 99	1.00 00	0.74 83
18	PICIC Ins Ltd.	1.00 00	0.00 70	0.22 86	0.55 93	1.00 00	0.93 29	1.00 00	0.67 54
19	Pakistan General Ins Company Ltd.	0.00 00	0.00 00	0.00 00	0.72 75	1.00 00	0.44 85	1.00 00	0.45 37
20	Pakistan Mutual Ins Company Ltd.	1.00 00	0.48 46	0.00 52	0.59 09	0.46 79	1.00 00	1.00 00	0.64 98
21	Premier Ins Company Ltd.	1.00 00	0.01 59	0.09 52	0.75 49	1.00 00	1.28 77	1.00 00	0.73 62
22	Reliance Ins Company Ltd.	1.00 00	0.00 87	0.26 18	0.75 54	2.08 18	1.30 08	1.00 00	0.91 55
23	Saudi Pak Ins Company Ltd	1.00 00	0.03 13	0.06 84	0.85 30	1.00 00	1.15 08	1.00 00	0.72 91
24	Security General Ins Company Ltd.	1.00 00	0.02 21	0.03 53	1.00 00	1.00 00	1.61 84	2.16 64	0.97 75
25	Shaheen Ins Company Ltd.	1.00 00	0.00 99	0.25 65	0.85 14	1.00 00	0.62 11	1.00 00	0.67 70
26	Silver Star Ins Company Ltd.	1.00 00	0.28 07	0.02 15	0.67 35	1.00 00	0.65 87	1.00 00	0.66 21
27	UBL Insurers Ltd	0.99 19	0.00 84	0.38 96	0.39 68	2.88 20	0.99 76	1.00 00	0.95 23
28	United Ins Company Ltd. (PAK)	1.00 00	0.01 26	0.35 05	0.54 83	1.00 00	0.65 66	1.00 00	0.65 26
29	Universal Ins Company Ltd.	1.00 00	0.00 00	0.00 00	1.07 09	1.00 00	0.51 82	1.00 00	0.65 56
30	Pak Kuwait Takaful Company Ltd	1.00 00	0.01 08	0.27 78	0.50 98	0.75 18	1.81 36	1.00 00	0.76 63
31	Pak Qatar General Takaful Ltd.	0.00 00	0.02 90	0.00 25	0.54 18	1.00 00	0.37 73	1.00 00	0.42 15
32	Takaful Pakistan Ltd.	0.00 00	0.00 54	0.64 79	0.28 25	1.00 00	0.49 96	1.00 00	0.49 08
	Mean	0.85 84	0.10 69	0.28 51	0.66 83	1.20 20	0.94 90	1.18 42	0.75 06

Source: Author's Analysis

Empirical Results (Efficiency Change)

Table 6 presents relative efficiency change for insurance industry of Pakistan over the period of analysis, between time t and $t+1$. Certain variations are found in results of efficiency change. Several firms in industry experienced more than 100% efficiency change. Adjacent periods 2021-2022, 2022-2023 and 2023-2024 witnessed most of efficiency changes. Similarly, 21 firms in different time periods showed positive change in efficiency. UBL insurers limited and Century Insurance Company limited depicted 188% and 181% efficiency change in adjacent periods 2021-2022 and 2023-2024 respectively.

Overall industry under analysis, on average, showed positive efficiency change of 20% and 18%, for periods 2021-2022 and 2023-2024 respectively. In Takaful insurance sector, Pak Kuwait Takaful Company limited show positive efficiency change of 81% for 2022-2023. However, rest of other firms in sector, are found with negative efficiency change



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and to some extent with no change. Overall efficiency change of Takaful sector is found less than conventional insurance sector of industry. No firm at all, found with positive efficiency change, on average, over the period of analysis, except Habib Insurance Company limited (16.5%).

Table 7: Changes in Efficiency Components for Insurance Firms

Firm s No.	2017-18		2018-19		2019-20		2020-21		2021-22		2022-23		2023-24	
	PE ch	SE ch												
1	1.000	1.640	1.210	0.024	0.044	0.129	1.000	1.000	1.000	1.118	1.399	0.901	0.714	0.991
2	1.000	1.940	1.000	0.006	1.000	0.247	1.000	1.204	1.000	1.790	1.000	0.742	1.000	2.194
3	1.093	1.819	0.950	0.011	0.775	0.256	0.981	1.008	0.616	2.927	1.562	0.730	1.197	1.797
4	1.585	1.533	0.847	0.013	0.582	0.375	1.275	0.938	1.496	0.950	1.708	0.977	2.469	1.222
5	1.043	1.996	0.884	0.009	1.572	0.434	0.165	0.532	1.424	1.008	1.363	0.608	0.939	1.356
6	1.078	1.400	0.968	0.010	1.952	0.249	0.768	0.900	0.380	2.514	1.407	0.821	1.277	2.563
7	2.374	1.748	1.835	0.091	0.033	0.165	0.727	0.972	1.000	0.745	1.000	1.375	1.000	1.101
8	0.531	0.896	1.000	1.000	1.538	1.661	0.118	0.620	1.088	1.480	0.815	0.278	1.000	2.312
9	1.106	1.199	0.724	0.009	1.410	0.381	0.575	0.599	1.851	1.499	1.314	0.477	1.402	2.009
10	1.058	1.207	0.000	0.000	0.000	0.000	0.000	0.000	2.142	1.015	2.049	0.319	1.657	2.322
11	1.000	1.361	1.088	0.010	0.919	0.226	1.000	1.053	1.000	1.498	1.000	0.570	1.000	2.710
12	0.924	1.758	0.387	0.058	2.020	0.061	2.305	0.611	0.471	1.709	1.046	0.609	1.136	1.627
13	1.201	1.827	0.564	0.011	0.610	0.397	0.305	1.001	6.528	0.800	0.465	1.006	2.229	1.002



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14	0.9 33 9	1.2 93 0	0.9 93 5	0.0 09 6	0.9 82 8	0.3 71 5	0.6 86 7	0.5 66 5	1.1 02 0	2.3 75 5	1.4 11 4	0.8 25 3	1.4 29 3	1.8 26 1
15	1.7 91 5	1.9 69 0	2.1 82 0	0.0 07 8	0.6 64 4	0.3 78 8	0.3 85 0	0.5 17 1	1.2 33 7	1.8 13 5	2.6 51 3	0.9 26 1	0.3 05 7	0.2 83 2
16	0.0 00 0	0.0 00 0	0.0 00 0	0.0 00 0	0.6 06 0	0.0 32 9	0.8 03 1	0.9 03 2	0.7 24 7	1.5 74 0	0.7 32 0	0.3 74 2	1.6 97 9	1.4 25 9
17	1.0 00 0	1.4 32 0	2.5 12 2	0.0 09 4	0.3 98 1	0.2 29 2	1.0 00 0	0.8 93 5	1.0 00 0	1.0 67 4	1.0 04 6	1.2 24 3	1.0 34 4	2.0 58 1
18	1.3 27 5	1.1 26 0	0.7 50 9	0.0 09 4	0.7 51 4	0.3 04 2	0.7 28 0	0.7 68 2	1.3 96 3	1.9 89 4	2.0 45 9	0.4 56 0	1.3 13 4	1.9 93 4
19	0.0 00 0	0.0 00 0	0.0 00 0	0.0 00 0	0.0 00 0	0.0 00 0	1.5 44 7	0.4 71 0	1.1 31 7	1.0 10 6	1.3 67 1	0.3 28 0	1.1 00 4	1.9 60 1
20	2.2 27 6	1.5 32 0	1.8 96 2	0.0 14 7	0.0 00 7	1.2 60 0	1.0 00 0	0.5 90 9	1.0 00 0	0.4 67 9	1.2 02 2	0.2 34 8	1.1 91 1	2.1 88 1
21	1.0 53 3	1.0 14 0	0.7 53 4	0.0 21 1	0.9 58 5	0.0 99 3	0.8 05 1	0.9 37 6	1.2 27 9	2.5 49 5	1.2 17 9	1.0 57 3	1.3 02 0	2.7 87 9
22	0.9 23 3	1.2 75 0	0.9 22 6	0.0 09 4	1.1 07 6	0.2 36 3	0.8 42 3	0.8 96 8	0.9 59 4	2.1 69 8	1.5 04 1	0.8 64 8	1.2 25 9	2.7 80 7
23	0.6 90 1	1.6 45 0	2.8 38 9	0.0 11 0	0.2 77 5	0.2 46 4	0.9 96 6	0.8 55 9	1.7 94 7	2.6 33 1	1.7 07 1	0.6 74 1	1.0 64 3	1.9 74 1
24	0.3 65 0	1.4 74 0	1.0 00 0	0.0 22 1	1.0 00 0	0.0 35 3	1.0 00 0	1.0 00 0	1.0 00 0	1.0 00 0	1.5 06 4	1.0 74 4	0.8 08 2	2.6 80 6
25	1.1 88 8	1.7 36 0	1.0 52 7	0.0 09 4	1.1 10 0	0.2 31 0	0.8 51 7	0.9 99 7	1.1 65 0	1.8 73 1	1.3 54 0	0.4 58 7	1.7 95 4	1.7 77 1
26	0.8 60 7	1.5 71 0	7.0 07 1	0.0 40 1	0.2 55 3	0.0 84 3	0.7 22 0	0.9 32 8	1.4 77 4	1.5 15 1	1.5 75 6	0.4 18 1	1.2 56 1	1.3 80 9
27	0.0 03 3	1.0 91 0	0.8 36 7	0.0 10 1	1.0 59 8	0.3 67 6	0.6 42 8	0.6 17 4	1.2 36 0	2.3 31 6	1.4 42 7	0.6 91 5	1.2 61 6	1.5 43 8
28	0.9 40 6	1.1 80 0	1.2 62 1	0.0 10 0	1.0 11 9	0.3 46 4	0.7 96 7	0.6 88 3	1.0 34 0	1.0 29 8	1.2 50 6	0.5 25 0	1.0 77 0	1.2 17 8
29	0.9 04 7	1.1 96 0	0.0 00 0	0.0 00 0	0.0 00 0	0.0 00 0	1.3 99 0	0.7 65 5	1.1 88 3	1.2 45 2	1.4 54 2	0.3 56 4	2.4 05 9	1.7 66 1



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30	2.1 23 2	1.0 23 0	1.0 36 0	0.0 10 5	0.8 53 9	0.3 25 3	0.6 65 7	0.7 65 8	0.7 99 8	0.9 39 9	1.8 01 1	1.0 07 0	1.3 79 8	2.9 39 0
31	0.0 00 0	0.0 00 0	0.3 47 2	0.0 83 5	0.0 34 3	0.0 73 9	0.9 23 1	0.5 86 9	2.2 24 1	2.9 22 0	1.1 35 4	0.3 32 3	0.7 22 5	2.9 15 8
32	0.0 00 0	0.0 00 0	0.4 73 5	0.0 11 5	2.5 45 8	0.2 54 5	0.2 94 1	0.9 60 5	1.6 62 5	3.4 91 2	1.6 31 3	0.3 06 3	1.2 12 4	2.8 59 7
Mea n	0.9 79 1	1.2 77 6	1.1 66 4	0.0 48 2	0.8 13 5	0.2 95 6	0.8 22 2	0.7 86 1	1.3 54 9	1.6 58 1	1.3 78 9	0.6 73 6	1.2 69 0	1.9 24 0

Source: Author's Analysis

Empirical Results (Efficiency Components)

Table 7 reports change in efficiency components (pure efficiency and scale efficiency) between time t and t+1, for the period of analysis. Almost whole industry showed positive change in pure efficiency and scale efficiency for the adjacent periods 2017-2018, 2021-2022, 2022-2023 and 2023-2024. However, several firms showed more than 100% positive change in scale efficiency in period 2023-2024.

For overall industry, Pak Qatar General Takaful Company limited experienced maximum positive change of 249% in scale efficiency for period of 2021-2022. Whereas, 8 firms in industry showed 100% deterioration in efficiency components. ACE Insurance Aid Pacific limited found with 100% deterioration in pure efficiency for year 2019-2020, while Askari General Insurance Company limited, Century Insurance Company limited, International General Insurance Company of Pakistan limited, New Jubilee Insurance Company limited, PICIC Insurance limited, Reliance Insurance Company limited and Shaheen Insurance Company limited are found with 100% deterioration in scale efficiency for the period 2018-2019.

Out of 32 firms, 21 firms showed more than 100% positive change for different adjacent time period, in pure efficiency and scale efficiency component of efficiency change. On average, overall industry witnessed positive change, 27.7% in period 2017-2018 for scale efficiency, 35.49% in period 2021-2022 for pure efficiency, 65.8% in period 2021-2022 for scale efficiency, 37.8% in period 2022-2023 for pure efficiency, 26.9% in period 2023-2024 for pure efficiency, and 92.4% in period 2023-2024 for scale efficiency. Hence maximum efficiency growth is shown by scale efficiency component, in period 2023-2024. Result indicates that pure efficiency and scale efficiency contributed to efficiency change of insurance industry of Pakistan during analysis period. However, pure efficiency component is found as major contributor to efficiency change rather than scale efficiency, specifically in periods 2017-2018 and 2023-2024. Change in efficiency components is found more favorable for Takaful sector than insurance sector.

Summary of Productivity Performance of Industry

This section provides summary of Malmquist index total factor productivity. Table 8 provides total factor productivity change, efficiency change, technical change, pure efficiency change and scale efficiency change for the firms under analysis.

Table 8: Summary of Malmquist Index Total Factor Productivity Change



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S.No	Insurance firms	TFPh	EFFch	TECc	PEch	SEch
1	ACE Insurance Aid Pacific Ltd.	0.565 5	0.869 9	0.703 9	0.903 5	0.829 5
2	Adamjee Insurance Company Ltd	0.998 4	0.912 9	0.664 8	1.000 0	1.160 1
3	Alflah Insurance Company Ltd	1.018 8	0.877 9	0.656 2	1.025 3	1.221 4
4	Asia Insurance Company Ltd.	1.184 5	0.931 5	0.642 1	1.423 8	0.858 7
5	Askari General Insurance Company Ltd.	0.897 4	0.844 8	0.749 5	1.056 0	0.849 4
6	Atlas Insurance Company Ltd.	0.930 9	0.828 6	0.691 0	1.119 1	1.208 5
7	Capital Insurance Company Ltd.	0.585 7	0.740 5	0.646 0	1.138 7	0.885 6
8	Central Insurance Company Ltd.	0.319 0	0.870 0	0.656 4	0.870 2	1.178 8
9	Century Insurance Company Ltd.	0.921 2	0.904 8	0.704 5	1.197 6	0.882 1
10	Crescent Star Insurance Company Ltd.	0.582 3	0.522 1	0.274 5	0.986 8	0.694 9
11	E.F.U.General Insurance Company Ltd.	1.019 8	0.691 9	0.749 0	1.001 0	1.061 5
12	East West Insurance Company Ltd.	0.844 7	0.848 7	0.753 3	1.184 5	0.919 2
13	Excel Insurance Company Ltd.	0.661 1	0.574 7	0.690 9	1.700 9	0.863 7
14	Habib Insurance Company Ltd.	0.894 7	1.165 2	0.681 3	1.077 1	1.038 2
15	IGI Co. of Pakistan Ltd.	0.883 0	0.715 7	0.683 1	1.316 2	0.842 2
16	New Hampshire Insurance Company Ltd.	0.417 1	0.555 0	0.506 0	0.652 0	0.615 7
17	New Jubilee Insurance Company Ltd.	0.909 1	0.748 3	0.665 4	1.135 6	0.987 7
18	PICIC Insurance Ltd.	1.067 6	0.675 4	0.809 8	1.187 6	0.949 5
19	Pakistan General Insurance Company Ltd.	0.450 5	0.453 7	0.435 9	0.734 8	0.538 5
20	Pakistan Mutual Insurance Company Ltd.	0.846 8	0.649 8	0.697 9	1.216 8	0.898 3
21	Premier Insurance Company Ltd.	1.098 4	0.736 2	0.650 1	1.045 4	1.209 5
22	Reliance Insurance Company Ltd.	0.945 2	0.915 5	0.662 6	1.069 3	1.176 1
23	Saudi Pak Insurance Company Ltd	0.955 5	0.729 1	0.754 0	1.338 4	1.148 5



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24	Security General Insurance Company Ltd.	0.775 1	0.977 5	0.652 5	0.954 2	1.040 9
25	Shaheen Insurance Company Ltd.	1.120 0	0.677 0	0.770 0	1.216 8	1.012 2
26	Silver Star Insurance Company Ltd.	0.890 3	0.662 1	0.804 3	0.978 7	0.848 9
27	UBL Insurers Ltd	0.781 9	0.952 3	0.702 3	0.926 1	0.950 4
28	United Insurance Company of Pakistan Ltd.	1.056 9	0.652 6	0.776 7	1.053 3	0.713 9
29	Universal Insurance Company Ltd.	0.850 6	0.655 6	0.516 5	1.050 3	0.761 3
30	Pak Kuwait Takaful Company Ltd	0.809 7	0.766 3	0.701 5	1.237 1	1.001 5
31	Pak Qatar General Takaful Ltd.	0.543 6	0.421 5	0.758 0	0.769 5	0.987 8
32	Takaful Pakistan Ltd.	0.673 6	0.490 8	0.802 0	1.117 1	1.126 2
	Mean	0.828 1	0.750 6	0.675 4	1.083 9	0.951 9

Source: Author's Analysis

Empirical Results (Summary of TFP Change)

Table 8 presents summary of Malmquist Index for Total Factor Productivity change, over the period of 2017 to 2024, for non-life insurance industry of Pakistan. The table reports average values of total factor productivity change, efficiency change, technical change, pure efficiency change and scale efficiency change, for all the firms under analysis.

Asia Insurance Company limited is found with maximum total factor productivity growth of 18.45%. However, it shows deterioration in efficiency and technical change. Growth in TFP is contributed by pure efficiency only with 42% change. Shaheen Insurance Company limited showed 12% growth in TFP with deterioration in efficiency and technical change. Its growth is contributed by both pure and scale efficiency with 21% and 1% respectively. Alfalah Insurance Company limited, EFU General Insurance Company limited, PICIC Insurance limited, Premier Insurance Company limited and United Insurance Company limited experienced deterioration of 1.8%, 1.9%, 6.7%, 9.8% and 5.6% respectively.

Only one firm i.e. Habib Insurance Company limited found with positive efficiency change of 16.52%. Its efficiency is contributed by pure and scale efficiency with 7.7% and 3.8% change respectively. On average, during analysis period, pure efficiency component change remained positive with 8.39%; however, TFP, efficiency change, technical change and scale efficiency component deteriorated with 18%, 25%, 33% and 5% respectively. Hence average growth in TFP for different firms is mainly contributed by pure efficiency change for non-life insurance industry of Pakistan. Summary of Total Factor Productivity indicates that insurance sector of industry is consistent and attaining persistent growth in comparison with Takaful sector. However, Takaful sector of industry is found attaining a certain pace and expected to compete with its counterparts in the future.

Conclusions

The results of current study have practical implications for conventional insurance operators and Takaful operators operating in insurance industry of Pakistan. Study found



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that for non-life insurance industry of Pakistan, Total Factor Productivity, on average deteriorated with 18% TFP change. TFP deterioration of 18% is found due to 25%, 33% and 5% negative change in efficiency change, technical change and scale efficiency change, along with 8.3% growth in pure efficiency component. 7 firms in industry depicted TFP growth however, on average overall industry showed deterioration in TFP. For all firms under analysis, efficiency change experienced negative change, except one firm i.e. Habib Insurance Company limited.

Study found that efficiency change for non-life insurance industry of Pakistan is contributed by both pure and scale efficiency change; however, main component contributing to efficiency is pure efficiency change. Pure efficiency component contributed positive change of 8.3% to TFP growth. Scale efficiency contributed negative change of 5% to TFP. These results imply that for Pakistani insurance industry; efficiency of firms is due to the firms' enhanced skills used for converting input into output. Minimal deterioration of 5% in scale efficiency suggests that firms operating in Pakistani industry can attain efficiency growth by increasing their size of productivity.

Study also found negative technical change to TFP that is -33%. It implies that firms under analysis have deficiency in use of technology. Hence in order to improve efficiency, insurance operators of Pakistan may increase the use of enhanced technology i.e. communication and information technology etc. The study concludes that insurance industry of Pakistan has capacity to improve its efficiency. It can enhance its efficiency by increasing size and enhancing technology to provide service to their customers, as technical change and scale efficiency change showed deterioration of -33% and -5% respectively.

In the future a comprehensive efficiency measurement study can be conducted by separating the insurance industry into life and non-life firms (Saad et al., 2006; Saad & Haji Idris, 2011), foreign and domestic firms (Chen et al., 2009). However, efficiency scores can be regressed with firm specific variables (Barros et al. 2008), corporate governance variables (Kader et al. 2010) and risk management variables (Ansha-Adu et al., 2012), in order to find out the determinants of efficiency.

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