Assessing the Productivity of Insurance Companies in Indonesia: A Non-Parametric Approach

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Abstract:

This study empirically explores the contributions of technical and efficiency changes to the growth of productivity in the Indonesian insurance industries by applying the generalized output-oriented Malmquist index based on the non-parametric approach of Data Envelopment Analysis (DEA) during the period 2012 to 2015. In measuring the productivity of nine general insurance firms, two inputs (i.e., commission and management expenses) and two outputs (i.e., premium and net investment income) were utilised. The study documented that, on average, the total factor productivity of the insurance companies in Indonesia was mainly contributed by the technical change rather than the efficiency change. The study also found that the main source of the efficiency change was due to the pure efficiency rather than scale efficiency. These findings implied that in order to enhance the productivity of the firms, the manager should be able to selectively combine the exiting inputs to produce outputs in the least cost way, supported by the adoption of the advanced technology.

Keywords: efficiency, insurance, data envelopment analysis, Malmquist index, Indonesia.

JEL Classification: G2, G22, G34, L11.

Introduction

The efficiency of the financial institution in all economic sectors has been studied widely and intensively in the last few decades. Earlier studies have measured efficiency using traditional approaches based on the financial ratios (Farrell, 1957). However, recent studies have adopted the frontier approach, comprising parametric and non-parametric approaches to measure firms' efficiency. While there have been many studies investigated the efficiency of the insurance industry in the U.S (Gardner et al., 1993; and Meador et al., 2000) and other developed countries (Eling and Luhnen, 2010, Berger et al., 1997), however, limited similar studies conducted on the emerging Asian countries, particularly in Indonesia. Comparing to the vast growing of insurance companies in Indonesia to the other Asian countries, empirical studies on the productivity of insurance companies in the country has been limited. Thus, this study is hoped to fill up the previous studies' shortcomings and provides the latest empirical evidences on the relative productivity level of the insurance companies in Indonesia. Specifically, it attempts to empirically explore the contributions of efficiency and technical changes to the Total Factor Productivity (TFP) of general insurance companies in Indonesia during the period 2012-2015 by using the DEA and Malmquist index. The use of the Malmquist index enables the study to identify the detailed sources of firms' efficiency, comprising technical efficiency, pure efficiency, and scale efficiency.

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The findings of the study are expected to shed some lights for the companies in designing their policy to improve their productivity level, for the public to identify the companies with the better performance, and for the regulators or the government, in particular the relevant institutions such as the Financial Services Authority in designing the effective policies measures to promote the growth of the insurance industry in Indonesia.

The rest of this study is organised as follows. Section 2 reviews the selected relevant and recent studies on the issue investigated. Section 3 highlights the data utilised and empirical model of the DEA and Malmquist index. Section 4 presents the empirical results and discussions. Finally, Section 5 concludes the paper.

1. Selected Literature Review

As a non-bank financial institution, insurance company has been playing an important role in the financial industry in Indonesia. The insurance industry has contributed 1.98% to the national economy during the last ten years. During the same period, on average, the numbers of insurance companies in Indonesia and their gross premium have respectively increased by 0.02% and 18.0% annually (Financial Service Authority of Indonesia, 2016). The number of businesses supporting insurance companies, such as insurance brokers, reinsurance brokers, actuarial consultants and insurance agents has also continued to increase yearly. According to Rahim (2013), conducive regulatory and government policies supporting the insurance industry as well as stable national economic condition have contributed to the increase in number of insurance companies in Indonesia.

Based on the above positive trends, it is predicted that the insurance industry in Indonesia will continue to grow in line with the national economic growth. Indonesia is one of the countries in Asian regions that have been experiencing positive growth in addition to India and China. In fact, Indonesia has been categorised as the middle income country based on the Global Competitiveness Report of the World Economic Forum in 2011 (Rahim, 2013). Obviously, this creates an opportunity as well as challenges for the insurance industry to continue increasing its market share both in terms of the number of the insured and the yearly accumulated premiums. One potential target market that is potentially to be captured by the companies is residents in the category of middle class through disseminating a variety of financial schemes related to the benefits and risk management they could offer. However, to grasp this opportunity, the company has to be able to face the competitive challenges so as to maintain and improve its performance. Thus, the insurance company should professionally manage for the sake of enhancing its efficiency and productivity levels.

The efficiency of the financial institution has been studied widely and intensively in the last few decades (Yuengert, 1993; Saad et al., 2006; Omar et al., 2006; Omar et al., 2007; Majid et al., 2010, 2012; Ismail et al., 2013; Syamni and Majid, 2016). According to Berger et al. (1993), efficiency denotes an enhancement in profitability, a large amount of funds disbursed, price and better quality services to customers, and greater security in terms of increased capital buffers in managing the risk of financial institutions. In earlier studies, measuring the productivity of the firm was mostly conducted using traditional approaches that used financial ratios, such as the Return on Assets (ROA), Return on Equity (ROE), and the ratio of operating expenses to operating income (Farrell, 1957). However, the measurement of productivity could also be performed using the frontier approach, comprising parametric and non-parametric approaches (Majid et al., 2006). Parametric approach includes the Stochastic Frontier Approach (SFA), the Distribution Free Approach (DFA) and the Thick Frontier Approach (TFA), while the non-parametric approach that most commonly used was the Data Envelopment Analysis (DEA) and the Free Disposable Hull (FDH) (Cummins et al., 1999; Cummins and Zi, 1998).

Of those approaches, the DEA was the most widely adopted model to measure the productivity of the institutions in all economic sectors in the developed countries. Some of them have been used to measure the aggregate productivity of the firms in agricultural sector (Tauer, 1998; and Mao and Koo, 1996), telecommunications (Asai and Nemoto, 1999; and Calabrese et al., 2001), banking (Tulkens and Malnero, 1996; Rodolfo and Negrin, 2005; and Sufian, 2007), and university (Avkiran, 2001). Specifically, the measurement of productivity of insurance companies using the DEA have been conducted by Berger et al. (1997), Cummins et al. (1999), and Meador et al. (2000) in the U.S, Fukuyama (1997) in Japan, Cummins et al. (1996) in Italy, and Cummins and Rubio-Misas (2001) in Spain. Additionally, Diacon (2002) compared the efficiency of insurance companies across the U.K, Spain, Sweden and Denmark, while Rees and Kessner (2000) comparatively investigated the productivity of insurance companies in the European countries.

While there have been many studies investigated the efficiency of the insurance industry in the U.S (Gardner et al., 1993; and Meador et al., 2000) and other developed countries (Eling and Luhnen, 2010,

Berger et al. (1997), however, limited similar studies could only be found in Asian countries. These studies included Dutta and Sengupta (2010) in India, Sabet and Fadavi (2013) in Iran, Mansor and Radam (2000) and Majid et al. (2006) in Malaysia, Saad and Idris (2011) in Malaysia and Brunei, and Makmun (2002) in Indonesia.

In their study, Mansor and Radam (2000) have measured the productivity of 12 life insurance industry in Malaysia using the DEA and Malmquist Index during the period 1987 to 1997. They found that, although the industrial productivity performance was increased, but their growths were relatively lower when compared to the economic growth of Malaysia. Technical efficiency and technical progress contributed to an overall increase in productivity growth in the insurance industry. Majid et al. (2006) investigated both the Islamic and conventional insurance companies in Malaysia with a comparative treatment. Using non-parametric approach of the DEA and Malmquist index, they found that the overall productivity growth in the insurance industry in Malaysia during the period 2002-2005 was contributed most by the technical efficiency. In their study on insurance companies in Malaysia and Brunei, Saad and Idris (2011) documented that the productivity of companies in the two countries was positively related to economic growth that was largely due to the technical and scale efficiency improvements.

Comparing to the vast growing of insurance companies in Indonesia to the other Asian countries, empirical studies on the productivity of insurance companies in the country has been limited. Among the studies on the efficiency of firms in Indonesia include Makmun (2002), Viverita and Ariff (2008), Prabowo and Cabanda (2011), Cabanda and Viverita (2012), Abidin and Cabanda (2011), Prabowo and Cabanda (2011). In their studies, Makmun (2002) and Abidin and Cabanda (2011) examined the performance of insurance companies in Indonesia using the DEA approach. However, these studies did not analyze the contribution of components of efficiency changes to the productivity of insurance companies, but only focused on the analysis of level of efficiency of the government insurance. The studies found that, on the average, the insurance companies in Indonesia were efficient. Viverita and Ariff (2008) only explored the efficiency of 141 state- and non-firms in Indonesia, but not the insurance companies. Prabowo and Cabanda (2011) investigated the Indonesian firm efficiency using stochastic frontier analysis, but excluding the insurance firms from their analysis. Iswati and Anshori (2007) investigated the influence of intellectual on insurance company's performance in Indonesia, while Cabanda and Viverita (2012) examined the managerial efficiency, innovation, and productivity of the Indonesian life insurance industry during the global financial crisis. In their studies, they measured performance of the firms by using a traditional approach of financial ratios, which has a drawback in measuring the performance on the firm accurately and comprehensively.

In view of the above survey of literature, thus this study is hoped to fill up the previous studies' drawbacks and provides the latest empirical evidences on the relative productivity level of the insurance companies in Indonesia. Specifically, it attempts to empirically explore the contribution of efficiency and technical changes to the Total Factor Productivity (TFP) of general insurance companies in Indonesia during the period 2012-2015 by using the DEA and Malmquist index. The use of the Malmquist index enables the study to identify the detailed sources of firms' efficiency, comprising technical efficiency, pure efficiency, and scale efficiency.

2. Empirical Framework

2.1. Data

This study adopts the DEA and Malmquist index to measure productivity of the general insurance companies in Indonesia during the period 2012 to 2015. Of 11 general insurance companies listed on the Indonesian Stock Exchange, only 9 companies were selected to be analysed in this study due to their data availability. These companies include: PT Asuransi Bina Dana Arta Tbk (ABDA), PT Asuransi Bintang Tbk (ASBI), PT Asuransi Dayin Mitra Tbk (ASDM), PT Asuransi Harta Aman Pratama Tbk (AHAP), PT Asuransi Jasa Tania Tbk (ASJT), PT Asuransi Multi Artha Guna Tbk (AMAG), PT Asuransi Ramayana Tbk (ASRM), PT Lippo General Insurance Tbk (LPGI), and PT Panin Insurance Tbk (PNIN).

Secondary data of the annual reports of the insurance companies were utilised in the study gathered from the website of the Indonesian Stock Exchange (www.idx.com). In order to measure the companies' productivity, the input-output data were needed. Following Worthington and Hurley (2000) and Majid et al. (2006), this study utilised two inputs (i.e., management and commission expenses) and two outputs (i.e., net premium and net investment income) in measuring companies' productivity.

A management expense is one of the most important expenses used to pay the salary and finance the operational management, while the commission expense is provided to pay for the commission. Furthermore, the

net premium is gross premium income minus both the reinsurance and unearned premiums, while the net investment income is an income earned by the companies from their investment activities (Majid et al., 2006).

2.2. Data Envelopment Analysis (DEA)

The DEA is a non-parametric method, which is based on the linear programming, used to analyze the functions of production through production frontier mapping (Trick, 1996; Ramanathan, 2003; and Anderson et al, 2004). The DEA has been the most widely adopted approach to measure productivity in a wide range of scientific disciplines and various operational activities (Cooper et al., 2000) that was firstly introduced by Charnes et al. (1978). The DEA has been used by more than 400 studies measuring efficiency and productivity of the organisation worldwide over the last few decades (Ali and Seiford, 1993). The DEA is superior compared to other approaches to measure productivity, as it enables to identify the input or output of a company that is used as a reference to identify the sources of inefficiency (Hadad et al., 2003). In addition, the DEA takes into account all inputs-outputs as well as differences in technology, capacity, competition, and demographics, it then compares the individual company with the best-practice (efficiency) frontier among the investigated companies.

Thus, the generalized output-oriented Malmquist index (or so called Total Factor Productivity), developed by Fare et al. (1989), is adopted in this study. The Malmquist indexes are constructed using the Data Envelopment Approach (DEA) and estimated using Coelli's (1996) DEA Program. The Malmquist index was selected as there are a number of desirable features suited to this particular study. Not only does the DEA not require input prices or output prices in their construction, which makes the method particularly useful in situations where prices are not publicly available or non-existent, it also does not require a behavioural assumption such as cost minimization or profit maximization in the case where producers' objectives differ, are unknown or unachieved. Thus, the DEA is a suitable approach to be adopted in this study to measure the productivity of the insurance companies in Indonesia.

Following the study by Fare et al. (1994), the formulation of changes in productivity based on the output-oriented Malmquist index could be written as follows:

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

Where:

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

where M_o is the Malmquist index of total factor productivity, D_o is the distance function, x and y represent input and output for t and $t+1$ periods, respectively, a is the technical change, and b is the efficiency change. In this regards, efficiency change (EFFch) shows how well is the production process in converting inputs into outputs between t and $t+1$ periods, while the technical change (TECHch) represents the improvement of the technology involved in the production process, between t and $t+1$ periods.

Following Fare et al. (1994), this study further decomposes the Malmquist total factor productivity index of the EFFch into two sub-components, namely: pure technical efficiency change (PEch) and scale efficiency change (SEch). PEch highlights on how well the managerial performance in managing the inputs into outputs in the production process, SEch indicates the management's ability to choose the optimum production scale that is able to achieve expected production levels. The optimum scale is related to the size of the company, if the scale of a company is too big or too small, it can lead to inefficiencies in the company. In view of this, thus components of Total Factor Productivity (TFP) of the Malmquist index could be further re-written as follows:

$$\begin{aligned} M_o(x^t, y^t, x^{t+1}, y^{t+1}) &= (a) \times (b) \\ &= (a) \times (c \times d) \end{aligned} \tag{2}$$

Where:

$$a = \left[\left(\frac{D_o^{t+1}(x^t, y^t)}{D_o^t(x^t, y^t)}\right)\left(\frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^t(x^{t+1}, y^{t+1})}\right)\right]^{\frac{1}{2}}; c = \left(\frac{D_o^t(x^t, y^t)}{D_o^{t+1}(x^{t+1}, y^{t+1})}\right); \text{ and}$$

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

a is the technical change (TECHch), *b* is the efficiecy change, *c* is the pure efficiency change (PEch), and *d* is the scale efficiency change (SEch).

3. Results and Discussion

3.1. Descriptive Statistics

Table 1 reported the descriptive statistics for the investigated insurance companies in Indonesia during the period 2012-2015. The table showed that the highest value of outputs, both premiums and net investment income were owned by PT Panin Insurance Tbk with the values amounting IDR2.536,193 trillion and IDR1.193,636 billion, respectively. Meanwhile, PT Asuransi Bintang Tbk and PT Asuransi Dayin Mitra Tbk recorded the lowest values of output amounting IDR59,951 billion and IDR1,340 billion, respectively. Meanwhile, as for the inputs, PT Asuransi Harta Aman Pratama Tbk recorded the highest value of commission expenses of IDR86,790 billion and PT Panin Insurance Tbk recorded the highest value of management expenses of IDR149,423 billion. On the contrary, the lowest value of inputs for the commission and management expenses amounting to IDR0,510 and IDR16,000 were, respectively recorded by PT Asuransi Dayin Mitra Tbk and PT Asuransi Harta Aman Pratama Tbk. On the average, the premiums and net investment income were IDR404,857 billion and IDR100,400 billion, respectively. Meanwhile, the average values for inputs of the commission and management expenses were IDR28,482 billion and IDR65,492 billion, respectively. The standard deviation for the inputs was found to be higher than that of inputs.

Table 1. Descriptive Statistics (in Million IDR)

	Output		Input	
	Premium	Net Investment Income	Commission Expenses	Management Expenses
Mean	404,857	100,400	28,482	65,492
Median	222,014	20,345	21.869	53,751
Std. Dev.	578,386	271,528	20,944	32,277
Minimum	59,951	1,340	0,510	16,000
Maximum	2.536,193	1.193,636	86,790	149,423

Table 2 reported productivity score based on the value of geometric mean for the insurance companies in Indonesia, calculated based on the Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS) of the DEA Malmquist index. The Geometric mean is calculated to measure the overall companies' productivity. It is the most useful measures to calculate the average change in percentages, ratios, index, or rate of growth over time (Lind et al., 2011). Value of 1.000 in the table indicated that the company is on the frontier line or efficient, while the value of lesser than 1.000 indicated that the companies is technically inefficient (not being at the frontier).

Referring to Table 2, only PT Panin Insurance Tbk was found to be efficient, both based on the CRS and VRS models. This simply showed by the greatest output value of the company over the period of study amounted of more than a trillion IDR, while their inputs were comparable to the other companies. On the other hand, PT Asuransi Harta Aman Pratama Tbk and PT Asuransi Dayin Mitra Tbk were found to be efficient only under the VRS model, but not under the model of CRS.

On the contrary, PT Asuransi Jasa Tania Tbk recorded the lowest efficiency value, and its efficiency level continued declining during the study period based on the model of CRS. Meanwhile, under the model of the VRS, PT Asuransi Ramayana Tbk is found to be the lowest efficient company as compared to the other insurance companies in Indonesia. As for PT Asuransi Multi Artha Guna Tbk, the company was able to achieve its efficiency level in the last two years of 2014 and 2015 as their values achieved 1.000.

Values of geometric mean in Table 2 showed the percentage of realised output levels compared to the maximum potential output level the companies could achieved at a given inputs. For example, in 2012, PT Asuransi Bina Dana Arta Tbk recorded the level of potential output by 41.0% and 48.7% based on the CRS and VRS models, respectively. These figures further implied that the company could improve its productivity to the maximum level by 59.0% and 51.3%. Overall, the average of productivity levels of the whole company were lower and almost stagnant under the CRS model, but instead showed a relatively higher productivity scores and significant increase each year in the model of the VRS during the 2012-2015 period.

Table 2. Mean of Productivity Scores for the Insurance Companies in Indonesia based on the CSR and VRS

No.	Insurance Company	Year				Geometric Mean
		2012	2013	2014	2015	
1.	PT Asuransi Bina Dana Arta Tbk	(0.410) [0.487]	(0.522) [0.588]	(0.365) [0.394]	(0.593) [0.674]	(0.464) [0.525]
2.	PT Asuransi Harta Aman Pratama Tbk	(0.381) [1.000]	(0.428) [1.000)	(0.277) [1.000]	(0.478) [1.000]	(0.383) [1.000]
3.	PT Asuransi Multi Artha Guna Tbk	(0.403) [0.473]	(0.361) [0.426]	(0.605) [1.000]	(0.611) [1.000]	(0.482) [0.670]
4.	PT Asuransi Bintang Tbk	(0.106) [0.249]	(0.107) [0.297]	(0.141) [0.323]	(0.175) [0.718]	(0.129) [0.362]
5.	PT Asuransi Dayin Mitra Tbk	(0.642) [1.000]	(0.368) [1.000]	(0.531) [1.000]	(0.131) [1.000]	(0.358) [1.000]
6.	PT Asuransi Jasa Tania Tbk	(0.181) [0.399]	(0.165) [0.389]	(0.099) [0.230]	(0.215) [0.770]	(0.159) [0.407]
7.	PT Asuransi Ramayana Tbk	(0.212) [0.213]	(0.163) [0.163]	(0.140) [0.142]	(0.159) [0.160]	(0.167) [0.168]
8.	PT Lippo General Insurance Tbk	(0.308) [0.528]	(0.351) [0.589]	(0.614) [0.872]	(0.443) [0.537]	(0.414) [0.618]
9.	PT Panin Insurance Tbk	(1.000) [1.000]	(1.000) [1.000]	(1.000) [1.000]	(1.000) [1.000]	(1.000) [1.000]
	Geometric Mean	(0.405) [0.594]	(0.385) [0.606]	(0.419) [0.662]	(0.423) [0.762]	(0.405) [0.653]

Note: Figures in the bracket (.) showed the Geometric Mean of the Productivity Scores based on the CRS, while the Figures in the squared bracket [.] showed the Geometric Mean of the Productivity Scores based on the VRS.

3.2. Analysis of Total Factor Productivity (TFP)

Tables 3 to 5 reported the scores of Total Factor Productivity Changes (TFPch) and its two sub-components, i.e., technical change (TECHch) and efficiency change (EFFch) of the insurance companies in Indonesia for the period 2012 to 2015. The scores were calculated based on the Malmquist TFP Index. If the score was lesser than one, it implies a reduction in the productivity of the company, while the value of greater than one, indicating that improvements in the productivity of the company. Finally, if the value is equal to one, it implies no changes in the TFP level and its components.

Table 3. Total Factor Productivity Changes of the Insurance Companies in Indonesia

No.	Insurance Company	2012- 2013	2013-2014	2014-2015	Geometric Mean
1.	PT Asuransi Bina Dana Arta Tbk	1.400	1.363	1.550	1.435
2.	PT Asuransi Harta Aman Pratama Tbk	1.202	1.021	1.243	1.151
3.	PT Asuransi Multi Artha Guna Tbk	0.959	1.942	0.965	1.216
4.	PT Asuransi Bintang Tbk	1.088	1.419	0.323	1.223
5.	PT Asuransi Dayin Mitra Tbk	0.647	1.529	1.000	1.043
6.	PT Asuransi Jasa Tania Tbk	0.978	1.949	0.230	1.130
7.	PT Asuransi Ramayana Tbk	0.824	1.171	0.142	0.968
8.	PT Lippo General Insurance Tbk	1.220	1.796	0.872	0.865
9.	PT Panin Insurance Tbk	0.956	1.211	1.000	0.956
	Geometric Mean	1.007	1.485	0.885	1.098

As observed from Table 3, PT Asuransi Bina Dana Arta Tbk and PT Asuransi Harta Aman Pratama Tbk documented a consistent positive growth in their TFP during the study period with an average annual increase of 43.5% and 15.1%, respectively. Although the TFP for PT Asuransi Multi Artha Guna Tbk, PT Asuransi Jasa Tania

Tbk and PT Asuransi Ramayana Tbk have decreased in 2012-2013 and 2014-2015, but their TFP had experienced an increase in 2013 -2014. Meanwhile, PT Asuransi Bintang Tbk and PT Lippo General Insurance Tbk experienced an increase in their TFP at the beginning of the year, but their TFP showed a decrease in 2014-2015. In contrast, PT Asuransi Dayin Mitra Tbk and PT Panin Insurance Tbk showed a decrease in their TFP during the period 2012-2013, but the firms managed to increase the value of TFP changes in the years 2013-2014 and 2014-2015. Overall, during the study period, the highest score for the TFPch of 43.5% was recorded by PT Asuransi Bina Dana Arta Tbk, followed by the PT Asuransi Bintang Tbk (22.3%) and PT Asuransi Multi Artha Guna Tbk (21.6%). The TFP, on average, only showed an increase by 0.7% in the period 2012-2013, and by 48.5% in the period 2013-2014. However, during the 2014-2015, the TFP declined to 11.5% below the frontier.

Furthermore, Tables 4 and 5 reported the sub-components of the Malmquist TFP index, namely the technical and efficiency changes. Table 4 showed the index value on the advancement and technical changes as measured by the average changes of best practice frontier over the study period. The findings indicated that none of the company experienced an increase in technical change in the period 2014-2015. During the period of 2012-2013, only PT Panin Insurance Tbk (PNIN) showed a regress on the technical changes, while during similar period, 6 of the 9 companies recorded the same value of technical change of 7%. These companies were PT Asuransi Harta Aman Pratama Tbk, PT Asuransi Multi Artha Guna Tbk, PT Asuransi Bintang Tbk, PT Asuransi Jasa Tania Tbk, PT Asuransi Ramayana Tbk, and PT Lippo General Insurance Tbk. PT Asuransi Dayin Mitra Tbk (ASDM) recorded the highest technical changes of 12.8% during the period.

Table 4. Technical Changes of the Insurance Companies in Indonesia

No.	Insurance Company	2012- 2013	2013-2014	2014-2015	Geometric Mean
1.	PT Asuransi Bina Dana Arta Tbk	1.098	1.951	0.955	1.269
2.	PT Asuransi Harta Aman Pratama Tbk	1.070	1.579	0.719	1.067
3.	PT Asuransi Multi Artha Guna Tbk	1.070	1.160	0.955	1.058
4.	PT Asuransi Bintang Tbk	1.070	1.084	0.955	1.034
5.	PT Asuransi Dayin Mitra Tbk	1.128	1.922	0.831	1.770
6.	PT Asuransi Jasa Tania Tbk	1.070	1.579	0.719	1.067
7.	PT Asuransi Ramayana Tbk	1.070	1.364	0.826	1.064
8.	PT Lippo General Insurance Tbk	1.070	0.456	0.924	0.767
9.	PT Panin Insurance Tbk	0.956	1.211	0.756	0.956
	Geometric Mean	1.066	1.444	0.843	1.091

Furthermore, during the period 2013-2014, PT Asuransi Dayin Mitra Tbk was able to increase its technical changes from 12.8% to 92.2%. The highest technical change of 95.1% was recorded by PT Asuransi Bina Dana Arta Tbk (ABDA) during the period. In 2014-2015, PT Asuransi Harta Aman Pratama Tbk and PT Asuransi Jasa Tania Tbk have recorded the lowest negative value of technical changes by -28.1%. Overall, the highest value of the technical change during the study period were obtained by PT Asuransi Dayin Mitra Tbk (77.0%), followed by PT Asuransi Bina Dana Arta Tbk (26.9%), and PT Asuransi Harta Aman Pratama Tbk (6.7%).

In short, the technical efficiency showed an increase at the beginning of the study periods (from 2012-2013 to 2013-2014), and then decreased from the period 2013-2014 to 2014-2015. Overall, the technical changes of the companies have increased yearly, indicating the advancement of technology experienced by the insurance companies in Indonesia.

Next, Table 5 reported the changes in efficiency level of the insurance companies during the period 2012-2015 in Indonesia. The study documented that only one company, i.e., PT Panin Insurance Tbk where its efficiency level has not changed over the study period. The highest changes in efficiency level were recorded by PT Asuransi Bintang Tbk (18.3%), followed by PT Asuransi Multi Artha Guna Tbk (14.9%) and PT Bina Dana Arta Tbk (13.1%). Meanwhile, a negative value of efficiency change were recorded by PT Asuransi Ramayana Tbk recorded (-9.1%) and PT Asuransi Dayin Mitra Tbk (-41.1%). Overall, during the period of study, some companies recorded positive and negative changes in efficiency levels. In 2012-2015, the efficiency level of the companies have increased from -5.5% in 2012-2013 to 5% in 2013-2015.

Table 5. Efficiency Changes of the Insurance Companies in Indonesia

No.	Insurance Company	2012- 2013	2013-2014	2014-2015	Geometric Mean
1.	PT Asuransi Bina Dana Arta Tbk	1.275	0.699	1.624	1.131
2.	PT Asuransi Harta Aman Pratama Tbk	1.124	0.647	1.728	1.079
3.	PT Asuransi Multi Artha Guna Tbk	0.896	1.675	1.011	1.149
4.	PT Asuransi Bintang Tbk	1.017	1.310	1.242	1.183
5.	PT Asuransi Dayin Mitra Tbk	0.574	1.440	0.248	0.589
6.	PT Asuransi Jasa Tania Tbk	0.914	0.601	2.163	1.059
7.	PT Asuransi Ramayana Tbk	0.770	0.859	1.136	0.909
8.	PT Lippo General Insurance Tbk	1.141	1.747	0.721	1.129
9.	PT Panin Insurance Tbk	1.000	1.000	1.000	1.000
	Geometric Mean	0.945	1.028	1,050	1.007

In the TFP Malmquist index, the changes in efficiency were further contributed by the two sub-components, namely pure efficiency change (PEch) and scale efficiency change (SEch). The findings of these two components of the efficiency changes were reported in Table 6.

Table 6. Pure Efficiency Changes (PEch) and Scale Efficiency Change (SEch) of the Insurance Companies in Indonesia

No.	Insurance Company	2012- 2013		2013-2014		2014-2015	
		PEch	SEch	PEch	SEch	PEch	SEch
1.	PT Asuransi Bina Dana Arta Tbk	1.207	1.056	0.670	1.043	1.710	0.950
2.	PT Asuransi Harta Aman Pratama Tbk	1.000	1.124	1.000	0.647	1.000	1.728
3.	PT Asuransi Multi Artha Guna Tbk	0.899	0.997	1.350	0.713	1.000	1.011
4.	PT Asuransi Bintang Tbk	1.193	0.852	1.088	1.204	1.222	0.559
5.	PT Asuransi Dayin Mitra Tbk	1.000	0.574	1.000	1.440	1.000	0.248
6.	PT Asuransi Jasa Tania Tbk	0.976	0.936	0.590	1.018	1.349	0.646
7.	PT Asuransi Ramayana Tbk	0.767	1.004	0.868	0.989	1.129	1.006
8.	PT Lippo General Insurance Tbk	1.115	1.023	1.480	1.181	1.616	1.172
9.	PT Panin Insurance Tbk	1.000	1.000	1.000	1.000	1.000	1.000
	Geometric Mean	1.009	0.937	1.029	0.999	1.274	0.824

The study documented that only PT Panin Insurance Tbk has a stable efficiency level with the score of 1.000, both for PEch and SEch during the study period. Meanwhile, PT Asuransi Harta Aman Pratama Tbk and PT Asuransi Dayin Mitra Tbk recorded a stable PEch with the score of 1.000 (unchanged) during the 2012-2013 period. However, these companies registered the lowest decline in the SEch. In 2012-2013, PT Asuransi Dayin Mitra Tbk experienced the lowest deterioration in its SEch by -42.6% as compared to other companies, but its value again increased by 44% in 2013-2014, and then decreased to the lowest level by -75.2% in 2014-2015.

Furthermore, the highest increase in the SEch during the period 2012-2013 and 2014-2015 was documented by PT Asuransi Harta Aman Pratama Tbk, with an increase by 12.4% and 72.8%, respectively, while during the period 2013-2014, the SEch decreased by -35.3%. In terms of the PEch, the highest increase was achieved by PT Asuransi Bina Dana Arta by 20.7% and 71% in 2012-2013 and 2014-2015, and PT Lippo General Insurance Tbk by 48.0% in the period 2013-2014. Overall, the decline in overall efficiency changes was dominated by the scale inefficiencies as it shown by the value of scale efficiencies was lower than the pure technical inefficiency.

Finally, Table 7 reported the entire Malmquist TFP index of the insurance companies in Indonesia during the period 2012-2015. Based on Table 7, the study found that PT Asuransi Bina Dana Arta Tbk recorded the highest TFP value of 43.5%, where its EFFch and TECHch increased by 13.1% and 26.9%, respectively. In contrast, PT Lippo General Insurance Tbk recorded the lowest TFP value of 13.5%, contributed primarily by its technical change of -23.3%. On the average, growth of TFP of the insurance company industry in Indonesia was generally contributed

by the technical change (9.1%) as compared to the contribution by the changes in efficiency (0.7%). These findings implied that the innovation in technological components has played an important role in enhancing the productivity of insurance industry in Indonesia. To further enhance the productivity of the company, more attention should be given to the advancement of technical components, such as technology and information system as it provides convenience and speed in the provision of insurance services to its customers. Thus, the use of information and communication technology to produce a good service to consumers should be enhanced. This empirical finding was in harmony with the study by Mansor and Radam (2000) on the performance of the insurance companies in Malaysia.

Table 7. Malmquist TFP Index of the Insurance Companies in Indonesia

No.	Insurance Company	TFPch	EFFch	TECHch	PEch	SEch
1.	PT Asuransi Bina Dana Arta Tbk	1.435	1.131	1.269	1.114	1.015
2.	PT Asuransi Harta Aman Pratama Tbk	1.151	1.079	1.067	1.000	1.079
3.	PT Asuransi Multi Artha Guna Tbk	1.216	1.149	1.058	1.283	0.896
4.	PT Asuransi Bintang Tbk	1.223	1.183	1.034	1.423	0.831
5.	PT Asuransi Dayin Mitra Tbk	1.043	0.589	1.770	1.000	0.589
6.	PT Asuransi Jasa Tania Tbk	1.130	1.059	1.067	1.245	0.851
7.	PT Asuransi Ramayana Tbk	0.968	0.909	1.064	0.910	1.000
8.	PT Lippo General Insurance Tbk	0.865	1.129	0.767	1.005	1.123
9.	PT Panin Insurance Tbk	0.956	1.000	0.956	1.000	1.000
	Geometric Mean	1.098	1.007	1.091	1.098	0.917

Furthermore, the changes in the components of efficiency were dominated by changes in pure efficiency (9.8%) as compared to the changes in scale efficiency (-8.3%). These findings indicated that the ability of insurance company's management to choose the optimum size of the input to produce the expected production level (Kumar and Gulati, 2008) in Indonesia was improper as the companies experienced diseconomies of scale as shown by the negative value of the SEch. Most of the insurance company in Indonesia operated on a small scale, thus it was unable to enhance the efficiency level of the companies. Thus, mergers between small-scale companies would strengthen the company's capital structure and economies of scale. Additionally, the merger was often considered as one of the business strategies to win the competition (Abidin and Endri, 2009). These findings contradicted the findings by Majid et al. (2006) and Saad and Idris (2011) on the insurance company in Malaysia, where the value of SEch was found to be greater than that of the PEch.

Conclusion

This study empirically investigated the contributions of technical and efficiency changes to the growth of productivity in the Indonesian insurance industries by applying the generalized output-oriented Malmquist index based on the non-parametric approach of Data Envelopment Analysis (DEA) for the year 2012 to 2015. In measuring the productivity of nine general insurance firms, two inputs (i.e., commission and management expenses) and two outputs (i.e., premium and net investment income) were utilised. The study documented that, on average, the total factor productivity the insurance companies in Indonesia was mainly contributed by both efficiency and technical changes. The study also found that the main source of the efficiency change was pure efficiency rather than scale efficiency.

These findings implied that in order to enhance the productivity of the firms, the manager should be able to selectively combine the exiting inputs to produce outputs in the least cost way, supported by the adoption of the advanced technology. The managerial performance to manage inputs into outputs in the production process has greatly enhanced the efficiency of the insurance companies in Indonesia. It is also suggested for a small-scale company to expand the size of the company by mergers. This would hopefully contribute towards enhancing the scale efficiency so that it would be in a better position to gain competitive edge of the insurance companies over their competitors.

As there was only 9 insurance companies investigated in this study, the findings might only be indicative and definitely not conclusive for the entire insurance industry in the country as a whole. Since there have been more insurance companies existed in the country, further comprehensive studies are suggested to empirically

explore the productivity of entire companies in the Indonesian insurance industry. It is also suggested for the future study to investigate the Islamic insurance companies and compare it to their conventional counterparts to provide a better picture on the performance of the insurance industry in Indonesia.

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