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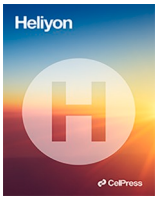

Research article

Determinants of sharia life insurance productivity in Indonesia

Puji Sucia Sukmaningrum [a,*], Achsania Hendratmi [a], Syadiyah binti Abdul Shukor [b], Mutiara Ramadhani Putri [a], Rosin Putra Gusti [a]

[a] Faculty of Economics and Business, Universitas Airlangga, Indonesia
[b] Faculty of Economics and Muamalat, Universiti Sains Islam Malaysia, Malaysia

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ABSTRACT

This study examines the productivity and factors influencing the productivity of Sharia-compliant life insurance businesses in Indonesia over six years, from 2014 to 2019. A Two-Stage Malmquist Productivity Index was utilized. The first stage examined productivity using the Malmquist Productivity Index (MPI) method, while the second used the panel data regression method to identify the factors influencing productivity. This research can give insurance management an overview of its productivity levels and the factors affecting productivity. According to the results of the MPI, Islamic life insurance businesses in Indonesia have not yet achieved productivity. The insignificance of technological advancements causes it. The variables of solvency, interest rate, inflation, currency rate, and production index substantially impact Sharia-compliant life insurance companies' productivity. Businesses must be aware of the elements that influence their level of production.

1. Introduction

Sharia insurance is a financial institution that, by Sharia principles, provides risk management services [1]. Assisting participants is the guiding premise of Sharia insurance risk management [2]. Insurance is a financial industry that plays a vital part in human existence but is subservient to fundamental requirements. The first is via Transfer Risk, Risk-Based Pricing, etc. In addition, the insurance function can stimulate a nation's economy and promote the growth of industry participants and businesses [3]. In Indonesia, there are typically three varieties of sharia insurance: Sharia Life Insurance, Sharia General Insurance, and Sharia Reinsurance.

Life insurance is a type of insurance that provides services for managing risks related to a person's life or demise [1]. Sharia insurance will devote much of *tabarru*'s assets to high-risk situations. Thus, it is essential to provide adequate money to meet claims [4]. Collecting Tabarru's funds in a specific account, referred to as the pool of 'Tabarru' participant funds, and 'Tabarru's funds will instantly become the group's assets [5]. Public understanding of the significance of self-protection contributes to the development of the life insurance industry. Sharia life insurance firms will continue to expand because they provide the public with a sense of confidence regarding the availability of participant funds in anticipation of future risks [4].

In 2019, Indonesia's Islamic insurance market share was 3.31%, with a penetration rate of 0.113%. It indicates that the market share and penetration are still low, which is counterintuitive given that the majority of the population in Indonesia is Muslim. This study focuses on organizations that provide Sharia-compliant insurance, a necessity for customers who shun non-halal finance. Consumers will choose Sharia life insurance over conventional insurance since it does not include Gharar (uncertainty), Maisir

* Corresponding author.
E-mail address: puji.sucia@feb.unair.ac.id (P.S. Sukmaningrum).

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(gambling), and Riba (interest) (interest). Thus, expanding the quality of Islamic life insurance firms is essential and may be accomplished by boosting the Company's performance [6].

Productivity is the most critical determinant of a company's crucial performance and one of the measures used to measure its competitiveness [7]. Excellent productivity is achieved when output improves while Input remains constant [8]. In addition to assessing productivity, firms must determine which variables affect productivity.

Past research has focused on the performance and efficiency of Islamic insurance businesses [2]. And [3] compare the effectiveness of Sharia and conventional Indonesian life insurance businesses. Using the two-stage data envelopment analysis method [9]. [4,10] explore the efficiency and factors that influence the efficiency of the Sharia insurance business. In addition, some study examines the effectiveness of Takaful firms in Indonesia [11], Bangladesh [12] and Middle East North Africa (MENA), and the Southeast East Asian (ASEAN) regions [13]. The research studied the productivity of Islamic insurance businesses in Indonesia [3], Malaysia [14], and India [15].

Prior research has only measured efficiency and productivity. This study fills the void by evaluating productivity using the MPI and determinants of Sharia Insurance performance that can influence productivity in Indonesia. This study employed a two-stage Malmquist Productivity Index methodology to determine the degree of corporate productivity and the variables that affect it.

Initially, productivity was measured using the Malmquist Productivity Index (MPI) technique. This indicator measures firm productivity to disclose efficiency and technology levels [16]. In addition, it can be used as a periodic tool for analyzing performance change [17]. The second stage consisted of testing the factors that influence changes in production. In addition to determining the degree of productivity, this is a vital stage. Because the empirical findings addressing the factor determinants or determinants impacting changes in productivity will give the relevant parties great and correct information and assistance (Kamarudin et al., 2017). In addition, productivity determinants will be evaluated using panel data regression. This study also examined the influence of seven variables on productivity changes: size, leverage, solvency, inflation, interest rates, production index, and exchange rates.

Islamic life insurance productivity in Indonesia is favorably correlated with company size. Larger companies are typically more productive than medium or small businesses [18,19]. Meanwhile [20], discovered a negative correlation between leverage and efficiency in the non-life insurance market in South Africa. Similarly, there is a negative correlation between inflation and productivity since higher inflation reduces business income. In addition, between 2016 and 2018, interest rates harmed the investment returns of Sharia insurance businesses in Indonesia [21]. In addition, [22] uncovered a significant correlation between the exchange rate and investment in Islamic life insurance firms.

The research focuses on the new era so that the outcomes might reflect current affairs. The research period is from 2014 to 2019 because there was a pandemic of COVID-19 in 2020. The influence of Covid-19 can destabilize the Indonesian economy, leading to a global economic downturn and a decline in the financial sector's performance This study utilizes the period preceding the pandemic to obtain the most accurate results regarding efficacy and prevent biased outcomes. To be able to concentrate on this, this research aims to:

1. Evaluating the value of Total Factor Productivity Change (TFPCH), Technological Change (TECHCH), Efficiency Change (EFFCH), Pure Technical Change (PTECH), and Scale Efficiency Change (SECH) in Indonesian Islamic life insurance
2. To determine the factors that influence productivity in Sharia life insurance firms

This research benefits Sharia insurance firms as a factor to consider when managing resources for best performance. In addition, businesses must prioritize productivity and concentrate on growth-influencing elements. Seldom is research conducted on the productivity of Islamic commercial banks and the factors that influence it. Seldom is research conducted on the effectiveness of Sharia Insurance and the elements that govern it. Consequently, this study issue can be investigated further.

The remainder of this paper consists of five sections. The literature review section provides an overview of sharia insurance, productivity, MPI, and hypothesis. The third section includes research methodology, data sources, and empirical models. The following part will discuss the findings and analysis, which describes the results and analyzes each problem formulation. The rest discusses conclusions and research suggestions.

2. Literature review

Indonesia is a country that has the largest Muslim population in the world, or nearly 13% of the total world Muslim population. It is

Tabel 1
The Sharia insurance companies in Indonesia for the period 2015–2019.

Description	2015	2016	2017	2018	2019
Sharia Life Insurance Companies	5	6	7	7	7
Sharia Non-Life Insurance Companies	3	4	5	5	5
Sharia Reinsurance Companies	0	1	1	1	1
Sharia Unit of Life Insurance Companies	19	21	23	23	23
Sharia Unit of Non-Life Insurance Companies	24	24	25	24	24
Sharia Unit of Reinsurance Companies	3	2	2	2	2
Total	54	58	63	62	62

Source: The Financial Services Authority (2019)

estimated that there are 231 million Muslims, or 86.7% of Indonesia's population. Indonesia is one of Southeast Asia's most significant contributors to the gross contribution of sharia insurance. It implies that the premium growth of Sharia insurance businesses in Indonesia is increasing and consolidating its position in the Indonesian insurance market.

Sharia life insurance companies in Indonesia are experiencing expansion and the global expansion of Sharia insurance. The development of Sharia-compliant life insurance firms and business units is encouraged.

The number of Sharia insurance businesses in business units and full-fledged Sharia insurance companies increased between 2015 and 2019, as shown in Table 1. In 2019, the number of full-fledged Sharia life insurance firms climbed to seven, while the number of life insurance companies with Sharia units increased to 23.

2.1. Sharia Insurance

According to Indonesian law No. 2 of 1992, insurance is a contract between two or more parties. By collecting insurance premiums, the insurer ties themselves to the insured. They compensate the insured for loss, damage, loss of anticipated profits, and legal liability to third parties. Moreover, Sharia Insurance intends to safeguard and assist multiple individuals through investments. Assets and tabarru' Funds offer risk reimbursement by Islamic law (Fatwa No. 21/DSN-MUI/X/2001).

In brief, the essence of Islamic insurance is mutual protection and assistance (*ta'awun*). In addition to the contract, Sharia and conventional insurance differ in fund ownership, premiums, risks, investments, claims, and profits [2]. The tabarru' fund collects all contributions from participants in Islamic insurance. The purpose of Tabarru's finances is to cover the risks of every Islamic insurance participant [23]. In addition, any individual possessing sharia insurance can be a guarantor of virtue for every human potential in society by cultivating unique advantages [3].

2.2. Productivity

One of how businesses can maximize their operational resources is by increasing their productivity. Productivity increase can accelerate firm performance, competitive pricing, service quality enhancement, and resource allocation expansion (Filippaki et al., 2009). The Firm will benefit from increased productivity since it can save money on its operations. These cost savings will further help the Company improve its profitability [7].

2.3. Two-Stage Malmquist Productivity Index

The research uses a two-stage approach. The first stage measures the productivity level of Islamic insurance companies using the Malmquist Productivity Index (MPI). The second stage is to measure the influence of internal variables on productivity.

The first Stage, The Malmquist Productivity Index (MPI), measures the amount of productivity of a business or organization. Sten Malmquist established the Malmquist Index in 1953. Hence, Caves, Christensen, and Diewert (CCD) created the Malmquist Index in 1982 [16,18,24,25]. The Malmquist index is based on the production function idea, which estimates the maximal production function with limited Input. The construction of the index includes different results: efficiency change, technological change, pure efficiency change, economic scale change, and total factor productivity (TFP) change [26].

The straightforward definition of productivity is the ratio of Output to Input. The criterion for productivity relates to the added value of outputs [27]. In addition, productivity is defined as the ratio of total output to the average of equal inputs. Simultaneously, labor productivity, which calculates the whole production per unit of labor, and total factor productivity, which measures the per unit output of the total Input, are two effective alternatives [3]. This relationship is represented as the ratio of the output index to the sum of all input indices. If the ratio increases, it indicates that more output can be produced with a certain number of inputs or that more work can be produced with fewer inputs [3]. Table 2 explains the input and outcome variables used in this investigation.

2.4. Determinant variables

In this instance, firm size refers to the size of the insurance company and is one of the factors defining the effectiveness of an Islamic insurance company. The smaller the Company, the greater the likelihood it will be more efficient at utilizing Input to generate more Output [12]. Big companies typically have superior resources, cheaper transaction costs, and excellent resistance to competition and economic shock. In other words, large firms or firms with substantial assets are typically more efficient [28]. Thus, the approximate

Tabel 2
Input and output variables.

Variables	Formula
Equity	*Total Capital Provided in Financial Report*
Total Expenses	*Overall Operating Costs + Total Insurance Expenses*
Total Investment	*Investments made by the Company in total*
Total profit	*Business earnings plus a surplus of the tabarru's fund*
Total Investment Income	*Investment-related revenue earned by the Company*

Source [2].

formula for bank size is the natural logarithm of total assets:

$$\text{Size} = ln(TotalAsset) \tag{1}$$

H1. Firm size has a strongly favorable effect on Sharia life insurance productivity in Indonesia.

Financial leverage rise raises insurance businesses' risk exposure [29]. To a certain point, growth in leverage is advantageous to the Company, but beyond that point, it increases the likelihood of financial issues [30]. High force makes it difficult for insurance companies to meet capital needs cheaply [15]. [20] revealed a negative correlation between power and efficiency in the non-life insurance market in South Africa. The equation for the leverage ratio is as follows:

$$\text{Leverage} = \frac{TotalDebt}{TotalAsset} \tag{2}$$

H2. Leverage has a substantial favorable effect on the level of Sharia life insurance productivity in Indonesia.

The solvency ratio assesses an insurance company's ability to discover sources of funds to finance its operations or as a tool for identifying insurance wealth to determine insurance management's efficiency. This ratio assesses the Firm's ability to meet its long-term liabilities in liquidation [9]. In the insurance industry, the solvency ratio is one of the most important indications of a company's health. Insurance is a somewhat unpredictable yet predictable industry. It is because participants in Sharia life insurance can submit claims at any moment, and the insurance firm must pay them. Thus, this ratio is essential so that participants and other interested parties have confidence that the insurance company can pay for their rights [31].

The formula for the solvency ratio is as follows:

$$\text{Solvency} = \frac{Total\ Solvency\ Rate}{\begin{array}{c}(Total\ funds\ needed\ to\ anticipate\ the\ risk\ of\ loss\ which\ may \\ arise\ due\ to\ deviations\ in\ asset\ management)\end{array}} \tag{3}$$

H3. The solvency ratio has a substantial favorable effect on the level of Sharia life insurance productivity in Indonesia.

Inflation is a globally prevalent monetary phenomenon. Increased inflation will result in a decline in the Company's revenue. Under Tabaru's fund administration, participant claims, and insurance management charges increase. Suppose the participant's share added by the insurance administration expense exceeds the insurance income, or there is a tabarru' underwriting fund shortfall. In that case, it will impact the Company's revenue. As the profit-sharing received is smaller than in the previous situation, a participant's confidence in the Company will fall if the income decreases [22]. The data on inflation is collected from Bank Indonesia.

H4. Inflation has a substantially favorable effect on Indonesia's Sharia life insurance productivity.

According to the findings of a study on Sharia insurance firms in Indonesia in 2016–2018, interest rates had a considerable negative impact on the investment returns of Sharia insurance companies 2016–2018 [21]. The interest rate is one of the macroeconomic variables that investors consider when allocating capital. Changes in interest rates can influence the return variability of an investment. As the cost of capital rises with an increase in the interest rate, the public's motivation to invest will diminish [21]. This study makes use of the BI rate as its interest rate. The interest rate information is collected from Bank Indonesia.

H5. Interest rate substantially affects the Sharia life insurance productivity in Indonesia.

The production index is a volume index developed to assess a country's industrial production's monthly, quarterly, and yearly growth [32]. This index is often designed to measure the rise and fall of production outcomes [33]. The production index can be approximated using Gross Domestic Product Growth (GDP). Moreover, economic growth will improve investment portfolio returns, influencing the profitability of insurance businesses. Also, the increase in profitability will enhance the effectiveness of insurance businesses [34,35]. Bank Indonesia provides the production index information.

H6. Production Index has a substantial favorable effect on Sharia life insurance productivity in Indonesia.

According to Ref. [36], the exchange rate represents the amount of domestic money necessary to purchase one unit of foreign currency. Theoretically, the impact of changes in exchange rates on investments is unpredictable. Moreover, a short-term decline in the rupiah's currency rate will restrict domestic absorption investment. A more substantial rupiah exchange rate will increase prices generally and reduce domestic demand, causing businesses to reduce their capital allocation for investment [22]. The exchange rate information is derived from Bank Indonesia.

H7. The currency rate has a substantial favorable effect on Sharia life insurance productivity in Indonesia.

3. Methodology

3.1. Data

This study utilized secondary data in the form of financial statements of Sharia life insurance firms in Indonesia for the years

2014–2019, which can be found on the websites of each post-audit Company.

3.2. Sample

The samples were determined using the technique of purposive sampling. The required sample criteria consisted of Sharia life insurance businesses with complete positive data relating to the variables employed between 2014 and 2019. Ten Islamic life insurance companies served as examples for this study in Indonesia.

3.3. Method

The quantitative approach used two research methods—the non-parametric and the parametric method—. The Malmquist Productivity Index (MPI) was utilized as the non-parametric tool to quantify the level of productivity of Islamic life insurance businesses in Indonesia. In testing the Malmquist index, the study used an output orientation based on the premise that Islamic life insurance firms desire to obtain numerous outputs for a fixed input [7,18,25]. In addition, the intermediation approach was chosen because it accurately describes the natural role of financial institutions [37].

This study's parametric model utilized panel data regression with the Eviews 9 tool. This method is believed to reduce the number of errors in the study as it evaluates the factors influencing changes in the productivity of Indonesian Islamic life insurance businesses. The panel data consisted of cross-sectional and time-series data from 2014 to 2019.

This study utilized capital, total expenditure, and total investment as input variables. In contrast, the total profit and investment income functioned as output variables. The Malmquist index was applied to the five factors to determine the level of productivity of Islamic insurance businesses in Indonesia and Malaysia. After that, additional testing was conducted to determine TECHCH, PTECH, and SECH.

3.4. Malmquist Productivity Index

This study measured productivity by assessing the change in Total Factor Productivity Change (TFPCH) value. TFPCH comprises Technological Change (TECHCH), which demonstrates the application of technology and innovation, and EFFCH, which reflects the Company's effectiveness (maximizing the output that can be generated with the Input it has). In the meantime, EFFCH is comprised of Pure Technical Efficiency Change (PTECH), which demonstrates the organizational operation capability of the companies, and Scale Efficiency Change (SECH), which reflects the condition of the companies in the most efficient position [18,38,39]. [25,38] describe the link between these indices in the graph below (see Fig. 1):

The preceding image illustrates the relationship between the components of the Malmquist index [18,38]. provide the following description of the Malmquist index:

1. TFPCH is the final value determining whether a Decision-Making Unit (DMU) will experience a productivity improvement or reduction.
2. TECHCH is a production process indicator that measures the utilization of technology and innovation.
3. EFFCH indicates the Company's capacity to optimize output from various accessible inputs.
4. PTECH is a measure of the Company's operational management capability.

The Malmquist index examined total factor productivity and its components. A business is deemed productive if its TFP exceeds one (1). The following are formulations of productivity [38,40]:

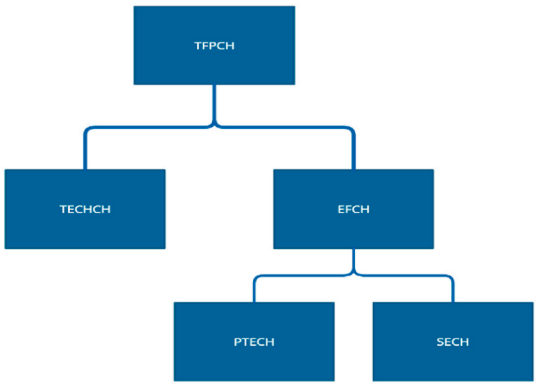

Fig. 1. Interaction of Performance Indices
Source: Fukuyama (1995); Kamarudin et al. (2017).

$$M_o\left(x^{t+1}, y^{t+1}, x^t, y^t\right) = \frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)} \; X \left[X \; \frac{D_o^t(x^t, y^t)}{D_o^{t+1}(x^t, y^t)} \; \right)\Big] ½ \tag{4}$$

Notes:
M_o = *Malmquist Index* (MI).
D_o = Distance function.
xt = The current time input.
xt + 1 = Input for the following period.
yt = output of the current time.
yt + 1 = Output of the subsequent interval.
According to Fukuyama (1995) and George Assaf, Barros, & Matousek (2011) According to:

$$MI = EC \; X \; TC \tag{5}$$

Notes:
MI = Variation in total output.
EC = Variation in overall efficiency.
TC = Technical change between t1 and t2.
MI > 1 Enhanced efficiency.
MI < 1 Productivity reduction.
MI = 1 Production is at a standstill.
Where:

$$EC = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \tag{6}$$

$$TC = \left[X \; \frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \; \right) \Big] \; (\hat{½}) \tag{7}$$

Total productivity or Total Factor Productivity (TFP) is the concurrent relationship between several inputs and outputs. The ratio of the output index to the aggregate input index expresses this relationship. If the ratio rises, it suggests that more work is created with a given amount of inputs or that several outputs can be generated with fewer inputs [41].

3.5. Panel data regression

The objective of this panel data regression research was to evaluate the productivity of Indonesian Sharia Life Insurance Companies. This study utilized several independent variables, time-series data, and cross-sectional information. Hence panel data regression was favored. Panel data combines time series data with cross-sectional data. Typically, time series data consists of a single object that spans numerous periods. Cross-data consists of multiple things and data for a given period. The regression model describes the variable link between financial and non-financial factors and Indonesian Sharia life insurance product development. This is how the estimating model might be written:

$$TF = \beta i + \mathrm{TFPCH_{it}} = \beta i + \beta_1 lnSize_{it} + \beta_2 Leverage_{it} + \beta_3 Solvancy_{it} + \beta_4 Inflation_{it} + \beta_5 InterestRate_{it} + \beta_6 PI_{it} + \beta_7 lnExchangeRate_{it} + e \tag{8}$$

Notes:
TFPCH: Sharia Life Insurance Productivity Level
β: Coefficients' vector
i: cross-section
t: time series
e: error variable.

4. Data result

4.1. Productivity of Indonesian Sharia Life Insurance Companies

During the research period, the productivity of Islamic life insurance businesses in Indonesia fluctuated. Between 2014 and 2017, Indonesian Sharia life insurance businesses operated inefficiently. The lowest productivity occurred in 2017–2018, accounting for a −27.3% decrease (0.727). This occurrence was brought about by a reduction in the utilization of technology as an innovative product and service by Sharia life insurance businesses (TECHCH score less than one). In contrast, Sharia life insurance businesses in Indonesia could operate productively in 2018–2019 and attained the highest productivity value during the study period, 32.6%. (1326). Table 3 depicts the increase in technological change indicators.

As demonstrated by the TFPCH score of 1, there was an overall decline in the productivity of Islamic life insurance businesses in Indonesia. PT AXA Financial Indonesia is the most productive Sharia-compliant life insurer. It is indicated by the Company's

achievement of one to three times over the research period. Moreover, PT AXA Financial Indonesia's productivity in 2014–2015 was 150.8%.

PT Great Eastern Indonesia Life has the lowest productivity value among Sharia insurance companies. In 2014–2015 and 2017–2018, the company's lowest unproductivity rates were 73,2% and 60,5%, respectively. PT Great Eastern Life became the Indonesian insurance firm with the lowest productivity value.

Factors Influencing the Productivity of Sharia Life Insurance Companies in Indonesia.

Based on the model test, a standard effect model with the Total Factor Productivity Change (TFPCH) variable as the dependent variable was obtained in Table 4.

According to the given regression equation, the influence of the independent variables on the constant variable is 122,4598. When size, leverage, solvency, inflation, interest rates, PI, and Exchange Rate are stable or zero, TFPCH's output will increase by 122,4598 units. The R-Squared value in the results of the preceding observation is 0.6111, indicating that the size, leverage, solvency, inflation, interest rates, PI, and lnExchangeRate variables have a simultaneous impact of 6.11% on the productivity of Islamic life insurance in Indonesia.

4.2. Size's influence on productivity

The t-statistic probability of the size variable is 0.4032. It indicates that the size variable has little impact on the TFPCH variable. In addition, the findings of this study indicate that the size of an Indonesian Sharia insurance company has little bearing on its productivity.

4.3. Impact of capitalization on productivity

The t-statistic probability value for the leverage variable is 0.4603. It specifies that the impact of the leverage variable on the TFPCH variable is negligible. Additionally, high debt will increase the insurance company's expenses, which will be deducted before the imposition of company tax. Therefore, the tax must be reduced, and the remaining profit must be surplus. The greater the Company's reliance on corporate debt, the higher its profitability [42].

4.4. Effect of financial stability on productivity

The t-statistic probability value for the solvency variable is 0.0121 at a significance level of 0.05. It specifies that the solvency variable influences the TFPCH variable significantly. Solvency has a positive impact on business output. The coefficient of the solvency variable is 4.90E-06, which indicates that a change of approximately 1 unit will increase to 4.90E-06 units in the TFPCH variable.

The solvency ratio measures an insurance company's ability to find sources of funds to finance its activities or as a measurement tool to identify insurance wealth to determine insurance management. This ratio measures the ability of a company to liquidate its long-term obligations. The higher the solvency ratio, the greater the risk and the possibility of profit-making. When expanding, Islamic life insurance companies require debt as additional capital. Therefore, the high solvency ratio can also boost Islamic life insurance productivity in Indonesia [9].

A solvency ratio measures an insurer's financial health and is commonly interpreted as an insurer's ability to pay claims. Thus, the higher the ratio, the better the insurer's financial health. Insureds who are willing to pay a premium for safety may prefer these insurers, which can have a positive impact on the insurer's profitability [43].

4.5. Inflation's impact on productivity

The inflation variable has a significance level of 0.05 and a t-statistic probability value of 0.0000. It describes how the inflation variable influences the TFPCH variable significantly. The inflation variable coefficient is −0.469843, so a change of 1 unit will result in

Table 3
Observations on Indonesian sharia life insurance companies by the MPI from 2014 to 2019.

No	Companies	2014–2015	2015–2016	2016–2017	2017–2018	2018–2019
1	PT AIA Financial	0.653	2.471	1.022	0.774	1.387
2	PT Asuransi Allianz Life Indonesia	0.880	0.762	0.874	0.846	1.735
3	PT Asuransi Jiwa Manulife Indoenesia	0.977	0.723	1.070	0.733	1.441
4	PT Asuransi Jiwa Syariah Al-Amin	0.868	0.890	0.843	0.916	1.048
5	PT Asuransi Takaful Keluarga	0.979	0.868	0.924	0.955	1.200
6	PT AXA Financial Indonesia	2.508	0.792	1.080	0.625	1.543
7	PT BNI Life Insurance	0.971	0.913	0.875	0.493	1.568
8	PT Great Eastern Life	0.268	1.335	1.129	0.395	1.463
9	PT Panin Dai-Ichi Life	0.899	1.181	0.700	0.830	0.989
10	PT Prudential Life Assurance	0.934	0.666	0.740	0.973	1.103
Mean		0.875	0.978	0.915	0.727	1.326

Source: DEAP 2.1 processed data

Table 4
Panel data regression results.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	122.4598	10.81618	11.32191	0.0000
Ln Size	0.014306	0.016976	0.842725	0.4032
Leverage	−0.001029	0.001383	−0.743872	0.4603
Solvency	4.90E-06	1.89E-06	2.599795	0.0121
Inflation	−0.469843	0.028786	−16.32165	0.0000
Interest rate	0.167739	0.034804	4.819494	0.0000
PI	0.027677	0.003871	7.150692	0.0000
In Exchange rate	−13.12051	1.199408	−10.93916	0.0000
R-squared	0.611134			
Prob (F-statistic)	0.000000			

The equation for the regression model is as follows:
$MPI = 122.4598 + 0.014306lnSize_{it} - 0.001029Leverage_{it} + 4.90E\text{-}06Solvency_{it} - 0.469843Inflation_{it} + 0.167739Interestrate_{it} + 0.027677PI_{it} - 13.12051Exchangerate_{it} + e.$
Source: Processed Eviews 9

a decrease of up to −0.469843 units for the TFPCH variable. The income of Islamic life insurance companies will decrease if inflation is high. Following tabaru's fund management, participant claims and insurance management expenses increase. The company's revenue will be affected if these factors are more significant than insurance income or a deficit in underwriting tabarru funds. If the company's income decreases, participants and investors will have less faith in the business because they will receive less profit-sharing than before. Moreover, high inflation will increase the risk of Sharia life insurance companies, resulting in a decline in the Company's productivity [22].

4.6. The effect of interest rate on productivity

The t-statistic probability value for the interest rate variable is 0.0000 with a significance level of 0.05. It describes how the interest rate variable significantly affects the variable of TFPCH. Moreover, the interest rate variable has a coefficient value of 0.167739 which means that if there is a change of 1 unit, the TFPCH variable will rise by 0.167739 units.

The interest rate is one of the most critical factors for insurance companies, as it reflects the return on investment funds the company will receive. The higher interest rate will increase the insurance company's profitability and enhance the benefits for policyholders. In other words, an increase in interest rates will increase the demand for insurance services. The greater the demand for insurance, the more productive the insurer will be [44].

4.7. The effect of the production index on productivity

The t-statistic probability value for the PI variable is 0.0000 with a significance level of 0.05. It shows that the PI variable substantially affects the TFPCH variable. The PI variable has a coefficient value of 0.027677, which indicates that a change of 1 unit will increase to 0.027677 units for the TFPCH variable.

The Gross Domestic Product can be a proxy for the Production Index (GDP). GDP is a measure of a nation's economic growth. Additionally, GDP describes a nation's financial state during a given period. Because it is reflected in GDP growth, an excellent economic environment will stimulate investment return. Investment return is directly proportional to changes in GDP. The increase in a country's GDP will stimulate investment activities, such as investments in Sharia life insurance and other companies that act as investors. Consequently, Islamic life insurance firms have become more productive [22,45].

4.8. Impact of currency exchange rate on productivity

The exchange rate variable has a significance level of 0.05 and a t-statistic probability value of 0.0000. It describes how the exchange rate variable influences the TFPCH variable significantly. The coefficient of the exchange rate variable is −13.12051, which indicates that for every 1 unit change in the exchange rate variable, the TFPCH variable will decrease by −13.12051 units.

The consistent fluctuation of the rupiah exchange rate against foreign currencies will significantly impact the domestic investment climate [21]. Theoretically, the impact of changes in the exchange rate on investment is uncertain. The strong rupiah exchange rate will increase prices and, consequently, reduce domestic demand, causing businesses to reduce their investment capital allocation. It renders Sharia life insurance companies ineffective [22].

5. Conclusion

The objective of measuring the productivity of Islamic life insurance companies in Indonesia was to determine the level of productivity attained by each company to boost its competitiveness in the Islamic financial industry, particularly the Sharia insurance sector. Considering the relatively small market share of Sharia-compliant life insurance in Indonesia, sharia-compliant life insurance

companies must operate efficiently. In addition, Sharia life insurance productivity determinants were analyzed to determine which factors can influence the productivity increase of Sharia life insurance companies. By focusing on these factors, it is anticipated that the productivity of Islamic life insurance companies will excel in terms of their competitiveness.

The findings of this study indicate that the TFPCH trend of Islamic companies in Indonesia fluctuated throughout the research period. Nonetheless, Islamic life insurance companies in Indonesia cannot generally operate profitably because the TFPCH value is negative. To be productive, sharia-compliant life insurance companies in Indonesia can begin utilizing rapid technological advancements and introducing new ideas. Therefore, businesses are anticipated to become more advanced and productive by establishing innovation in the technology sector.

This study also indicates that the internal and external variables influencing the productivity of Islamic life insurance companies in Indonesia are solvency, inflation, interest rate, production index, and exchange rate. In light of this, the management of Islamic life insurance companies in Indonesia must focus on these factors to boost company productivity.

This research contributes to numerous empirical and stakeholder literature. For Indonesia's Sharia life insurance industry to remain competitive, regulators can produce regulations. Second, for businesses in determining the productivity-enhancing potential of company resources. Thirdly, for the general public, this study will serve as a source of information for those interested in productivity analysis and the growth of the Sharia life insurance industry.

In addition, regulators must pay attention to macroeconomic variables to maintain stability and foster a competitive environment for the Islamic insurance industry. This study utilized only internal variables. It is a preliminary study for academics and researchers, and there are numerous opportunities for future research to explore or employ additional research variables. Future researchers are advised to use the recommended macro variables for this research.

Author contribution statement

Puji Sucia Sukmaningrum: Conceived and designing the analysis; Wrote the paper.
Achsania Hendratmi and Syadiyah binti Abdul Shukor: Analyzed and interpreted the data; Wrote the paper.
Mutiara Ramadhani and Rosin Putra Gusti: Contributed analysis tools or data; wrote the paper.

Data availability statement

Data included in article/supp. material/referenced in article.

Additional information

No additional information is available for this paper.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] M.S. Sula, Asuransi Syariah (Life and General): Konsep Dan Operasional, Gema Insani Press, Jakarta, 2004.
[2] Y.F. Astuti, N. Suprayogi, Perbedaan Efisiensi Perusahaan Asuransi Jiwa Syariah dan Konvensional di Indonesia dengan Metode Data Envelopment Analysis (DEA), J. Ekon. SyariahTeori dan Terap. 4 (8) (2017) 668–683, https://doi.org/10.1016/j.sbspro.2015.04.758.
[3] O. Suryoaji, E.F. Cahyono, Komparasi Efisiensi & Produktivitas Perusahaan Asuransi Jiwa Konvensional dan Syariah di Indonesia pada Tahun 2014-2017, dengan Pendekatan DEA & Indeks Malmquist, J. Ekon. Syariah Teor. dan Terap. 6 (9) (2019) 1877–1893.
[4] U. Benarda, Sumarwan, M.N. Hosen, Tingkat efisiensi industri asuransi jiwa syariah menggunakan pendekatan two stage data envelopment analysis, J. Apl. Bisnis dan Manaj. 2 (1) (2016), https://doi.org/10.17358/jabm.2.1.64, 64–64.
[5] N. Puspitasari, Model Proporsi Tabarru' dan Ujrah pada Bisnis Asuransi Umum Syariah di Indonesia, J. Akunt. dan Keuang. Indones. 9 (1) (2012) 43–55, https://doi.org/10.21002/jaki.2012.03.
[6] Basri, Sistem Yang Tepat Untuk Menilai Kinerja Karyawan Dan Meningkatkan Daya Saing Perusahaan. Jakarta: PT, Raja Grafindo Persada, 2016.
[7] J.M. Pitaloka, N. Cholis, A. Islamiyah, Z.B. Pambuko, Determinan Produktivitas Sosial Perbankan Syariah di Indonesia: two-Stage Malmquist Productivity Index, Li Falah J. Stud. Ekon. dan Bisnis Islam 3 (1) (2018) 36–50.
[8] Tarwaka, Dkk, Ergonomi Untuk Keselamatan, Kesehatan Kerja Dan Produktivitas, Uniba Press, Surakarta, 2005.
[9] N. Fauziah, H. Mulyati, W.J. Ermawati, The measurement of efficiency and factors that affect Indonesia sharia insurance efficiency, J. Apl. Manaj. 18 (2) (2020) 219–231, https://doi.org/10.21776/ub.jam.2020.018.02.02.
[10] E. Arianty, A. Ghoni, The SPIN-OFF effectiveness of sharia insurance in Indonesia: analyzing the efficiency and the criteria, J. Ekon. dan Bisnis Islam (Journal Islam. Econ. Business) 8 (1) (2022) 96–120, https://doi.org/10.20473/jebis.v8i1.31800.
[11] M.B. Sabiti, J. Effendi, T. Novianti, Efisiensi Asuransi Syariah di Indonesia Efisiensi Asuransi Syariah di Indonesia dengan pendekatan Data Envelopment Analysis Islamic Insurance Efficiency in Indonesia using Data Envelopment Analysis, Al-Muzara'ah 5 (1) (2017) 69–87.
[12] J. Islam, A. Rahman, Z.H. Bhuiyan, Measures of efficiency in the takaful industry of Bangladesh-A Bangladesh non approach, Eur. J. Bus. Manag. - Spec. Issue Islam. Manag. Bus. 5 (11) (2013) 163–173.
[13] Y. Karbhari, I. Muye, A.F.S. Hassan, M. Elnahass, Governance mechanisms and efficiency: evidence from an alternative insurance (Takaful) market, J. Int. Financ. Mark. Institutions Money 56 (2018) 71–92, https://doi.org/10.1016/j.intfin.2018.02.017.
[14] P.S. Sukmaningrum, A. Hendratmi, S.A. Rusmita, S. Abdul Shukor, Productivity analysis of family takaful in Indonesia and Malaysia: malmquist productivity index approach, J. Islam. Account. Bus. Res. 13 (4) (2022) 649–665, https://doi.org/10.1108/JIABR-03-2021-0097.

[15] A.M. Ilyas, S. Rajasekaran, An empirical investigation of efficiency and productivity in the Indian non-life insurance market, Benchmarking An Int. J. 26 (7) (2019), https://doi.org/10.1108/BIJ-01-2019-0039.
[16] A.S. Rusydiana, Indeks Malmquist untuk Pengukuran Efisiensi dan Produktivitas Bank Syariah di Indonesia, J. Ekon. Pembang. 26 (1) (2018) 47–58, https://doi.org/10.14203/jep.26.1.2018.47-58.
[17] L.N. Rani, T. Widiastuti, A.S. Rusydiana, Comparative analysis of islamic bank's productivity and conventional bank's in Indonesia period 2008-2016, Iciebp, in: 1st International Conference on Islamic Economics, Business, and Philanthropy, ICIEBP), 2017, pp. 118–123, https://doi.org/10.5220/0007077901180123.
[18] F. Kamarudin, Z.H. Chiun, F. Sufian, N. Aina, M. Anwar, Does productivity of islamic banks endure progress or regress? Empirical evidence using data envelopment analysis based malmquist productivity index, Humanomics 33 (1) (2017), https://doi.org/10.1108/H-08-2016-0059.
[19] A. Jreisat, H. Hassan, S. Shankar, Determinants of the productivity change for the banking sector in Egypt, Res. Financ. 34 (1) (2018) 89–116, https://doi.org/10.1108/S0196-382120170000034011.
[20] A.L. Alhassan, N. Biekpe, Efficiency, productivity and returns to scale economies in the non-life insurance market in South Africa, in: Geneva Papers on Risk and Insurance: Issues and Practice, 2015, pp. 1–23, https://doi.org/10.1057/gpp.2014.37.
[21] D. Wulandari, Pengaruh Tingkat Suku Bunga (BI Rate), Tingkat Inflasi, dan Nilai Tukar Rupiah terhadap Hasil Investasi Perusahaan Asuransi Syariah di Indonesia Tahun 2016-2018, Universitas Muhammadiyah Surakarta, 2020.
[22] F.D. Zein, A. Shofawati, Kondisi Makro Ekonomi Terhadap Hasil Investasi Asuransi Jiwa Syariah di Indonesia, J. Ekon. Syariah Teor. dan Terap. 4 (10) (2017) 773, https://doi.org/10.20473/vol4iss201710pp773-786.
[23] H.D. Mapuna, Asuransi jiwa syariah: konsep dan sistem operasionalnya, Al-Risalah 19 (1) (2019) 159–166.
[24] R. Bahrini, Productivity of MENA Islamic banks: a bootstrapped Malmquist index approach, Int. J. Islam. Middle E Finance Manag. 8 (4) (2015) 508–528, https://doi.org/10.1108/IMEFM-11-2014-0114.
[25] H. Bjurek, The malmquist total factor productivity index, Scand. J. Econ. 98 (2) (1996) 303–313, https://doi.org/10.2307/3440861.
[26] A.S. Rusydiana, Indeks malmquist untuk Pengukuran Efisiensi dan Produktivitas bank Syariah di Indonesia, J. Ekon. Pembang. 26 (1) (2018) 47–58, https://doi.org/10.14203/JEP.26.1.2018.47-58.
[27] A. Nurfikasari, H. Tanuatmodjo, S.A. Utami, Analisis Produktivitas Perbankan Syariah di Indonesia Berdasakan Malmquist Productivity Index, Iqtishaduna J. Ekon. Keuang. Islam 10 (2) (2019).
[28] Kepemilikan Ultimat Surifah, Tingkat Risiko, Efisiensi dan Kinerja Industri Perbankan di Indonesia, J. Siasat Bisnis 15 (1) (2011) 37–53, https://doi.org/10.20885/jsb.vol15.iss1.art4.
[29] J.M. Carson, R.E. Hoyt, Life insurer financial distress: classification models and empirical evidence, J. Risk Insur. 62 (4) (1995) 764–775, https://doi.org/10.2307/253595.
[30] R. Chen, K.A. Wong, The determinants of financial health of asian insurance companies, J. Risk Insur. 71 (3) (2004) 469–499.
[31] R. Wardana, Rasio Solvabilitas: Pengertian, Rumus, Dan Perhitungannya, Lifepal.co.id, 2020.
[32] C.-H. Gustafsson, A. Holmen, The Index of Industrial Production: A Formal Description of the Process behind it, 1993.
[33] A. Isnan, Analisis Pengaruh Ekspor Netto, Kurs, Dan Indeks Produksi Industri Terhadap Pertumbuhan Ekonomi Indonesia Tahun 2005 – 2015, Universitas Islam Negeri Syarif Hidayatullah Jakarta, 2017.
[34] T. Pavic Kramaric, M. Miletic, I. Pavic, Profitability determinants of insurance markets in selected central and eastern European countries, Int. J. Econ. Sci. VI (2) (2017), https://doi.org/10.20472/es.2017.6.2.006.
[35] A.A. Faoziyyah, N. Laila, Faktor Internal dan Faktor Makroekonomi yang Mempengaruhi Profitabilitas Asuransi Syariah di Indonesia Periode 2016-2018, J. Ekon. Syariah Teor. dan Terap. 7 (6) (2020) 1146–1163, https://doi.org/10.20473/vol7iss20206pp1146-1163.
[36] S. Sukirno, Makroekonomi Modern, PT. Raja Grafindo Persada, Jakarta, 2002.
[37] S.A. Otaviya, Analisis Produktivitas Bank Umum Syariah Indonesia Dengan Metode Malmquist Productivity Index Periode 2011-2017, Universitas Airlangga, 2019.
[38] H. Fukuyama, Measuring efficiency and productivity growth in Japanese banking: a nonparametric frontier approach, Appl. Financ. Econ. 5 (2) (1995) 95–107, https://doi.org/10.1080/758529177.
[39] L.N. Rani, P.S. Sukmaningrum, M.C.M. Salleh, A comparative analysis of the productivity of Islamic banking in Indonesia, Malaysia and Brunei Darussalam during the period 2012-2017, Int. J. Innov. Creat. Chang. 11 (11) (2020) 470–491.
[40] A. George Assaf, C.P. Barros, R. Matousek, Productivity and efficiency analysis of shinkin banks: evidence from bootstrap and bayesian approaches, J. Bank. Finance 35 (2) (2011) 331–342, https://doi.org/10.1016/j.jbankfin.2010.08.017.
[41] T.J. Coelli, D.S. Prasada Rao, C.J. O'Donnell, G.E. Battese, An Introduction to Efficiency and Productivity Analysis, second ed., Springer, United States of America, 2005.
[42] Hafizh tri syahbandi, "Pengaruh Peluang Investasi Dan Solvabilitas Terhadap Profitabilitas Perusahaan Non-Finansial di BEI, J. Wahana Akunt. 14 (2) (2019) 170–183, https://doi.org/10.21009/wahana.14.025.
[43] A. Hayrunnisa, Analysis the Effect of Liquidity, Profitability, and Solvency Ratio toward Company's Financial Distress, President University, 2016.
[44] A.M. Ginting, Pengaruh Faktor-Faktor Makro Ekonomi terhadap Permintaan Asuransi Umum di Indonesia, Pus. Penngkajian Pengolah. Data dan Inf. Setjen DPR RI 18 (2013).
[45] S. Hidayati, P.S. Sukmaningrum, Pengaruh VARIABEL makroekonomi terhadap jakarta islamic index periode 2011-2018, J. Ekon. Syariah Teor. dan Terap. 6 (9) (2020) 1894, https://doi.org/10.20473/vol6iss20199pp1894-1908.