EFFICIENCY AND PRODUCTIVITY OF INSURANCE INDUSTRY IN MALAYSIA: A COMPARISON BETWEEN CONVENTIONAL INSURANCE AND TAKAFUL

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ABSTRACT

EFFICIENCY AND PRODUCTIVITY OF INSURANCE INDUSTRY IN MALAYSIA: A COMPARISON BETWEEN CONVENTIONAL INSURANCE AND TAKAFUL

CHONG JIA KIUK

Motivated by the emergence of digital insurers in Malaysia, which poses a challenge to the long-term sustainability of established industry players, this study aims to evaluate the efficiency and productivity of the Malaysian insurance sector, focusing on a comparison between conventional insurers and Takaful operators. Additionally, with corporate governance receiving heightened attention after the collapse of American International Group (AIG) in 2008, attributed to improper accounting practices, and the rising significance of Environmental, Social, and Governance (ESG) considerations, this research further investigates the link between corporate governance attributes and the efficiency of these insurers.

The efficiency and productivity of the insurers are measured using Data Envelopment Analysis (DEA) and the Malmquist Productivity Index (MPI). Panel regression techniques, including pooled Ordinary Least Square (OLS), Fixed Effect Model (FEM), and Random Effect Model (REM), were applied to examine the factors influencing insurer performance, particularly corporate governance aspects. By utilising data from 59 conventional insurers and 29 Takaful operators from 2013 to 2021, this study reveals that scale efficiency exerts a more pronounced impact on overall industry efficiency compared to pure technical efficiency. Additionally, productivity showed a 10% improvement during the study period, largely driven by technological advancements. Parametric and non-parametric test results demonstrate a notable difference in the efficiency and productivity between conventional and Takaful insurance

sectors in Malaysia. Listed firms in the country displayed lower levels of both technical and pure technical efficiency, while scale efficiency was positively associated with GDP and the proportion of males on the Shariah committee. This study underscores the necessity for conventional insurers to enhance operational efficiency, strategic scaling, and technological adoption to mitigate inefficiencies associated with expansion and to maintain competitiveness. Furthermore, it highlights the positive influence of corporate governance attributes, such as firm size and foreign participation, on the technical efficiency of Malaysian insurers, emphasising the vital role of governance in boosting performance within the insurance sector.

Keywords: Insurance, efficiency, productivity, conventional insurers, takaful operators

Subject area: HG8011-9999 Insurance

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LIST OF ABBREVIATIONS

AE	Allocative Efficiency
BCC	Banker, Charnes, Cooper
BOARD	Board Size
BP	Breush Pragan Test
CCR	Charnes, Cooper and Rhodes
CEO	Chief Executive Officer
CRS	Constant Return to Scale
DEA	Data Envelopment Analysis
DITO	Digital Insurers and Takaful Operators
DMU	Decision Making Units
DRS	Decrease Return to Scale
EFFCH	Technical efficiency Change
FE	Fixed Effect
FOREIGN	Foreign Participation
GDP	Gross domestic product
IRS	Increase Return to Scale
LISTED	Listed or non-listed
LM	Lagrangian Multiplier Test
LNSIZE	Firm Size
MPI	Malmquist Productivity Index
NON_EX	Ratio of Non-executive Directors
OLS	Ordinary Least Square

PECH	Pure Technical Efficiency Change
PIAM	Persatuan Insurans Am Malaysia
PTE	Pure Technical Efficiency
R_BMEN	Ratio of Men in Board of Directors
R_SMEN	Ratio of Men in Shariah Committee
RE	Random Effects
ROA	Return on Assets
ROE	Return on Equity
ROI	Return on Investment
ROS	Return on Sales
SE	Scale Efficiency
SECH	Scale Efficiency Change
SHARIAH	Shariah Committee Size
SSB	Shariah Supervisory Board
TE	Technical Efficiency
TECHCH	Technological Change
TFPCH	Total Factor Productivity

CHAPTER 1

RESEARCH OVERVIEW

1.0 Introduction

This chapter outlines the study's background, presents the problem statement, and identifies the research questions and objectives. It also emphasises the research's significance. Furthermore, it provides an analysis of conventional insurers and Takaful operators in Malaysia, focusing on the impact of corporate governance on both. Lastly, the chapter discusses key challenges in the insurance sector that shaped the problem statement, research questions, objectives, and the study's overall importance.

1.1 Background of Study

Insurance serves as a financial safeguard against potential losses, offering reimbursement to consumers facing unforeseen financial setbacks. Both Islamic insurance (Takaful) and conventional insurance pool funds from numerous individuals with similar risks, utilising this collective pool to compensate those experiencing specific losses. This mechanism provides consumers with security and peace of mind, protecting them from sudden financial adversities such as the death of a primary breadwinner, fire incidents, maritime mishaps, and accidents.

The role of insurance in bolstering the Malaysian economy is noteworthy. According to Mohd Yunus (2018) the development of the insurance industry correlates positively with Malaysia's economic expansion. Insurance aids in mitigating inequality among lower-income groups and small businesses in the event of occurrences like disability of the breadwinner or business disruptions (Mohd Yunus, 2018). The penetration rate of insurance was projected to rise by

2022 (ISM Insurance Services Malaysia Berhad, 2021). However, insurers in Malaysia still struggle to meet the increased demand from the population (Lee, Cheng, Nassir, et al., 2019). Malaysia's insurance penetration rate of 4.8% is comparatively low, especially when contrasted with developed nations like Japan (Siti Noor, 2023). Table 1.1 below provides the penetration rate, calculated as the ratio of total insurance premiums to the gross domestic product for a given year. Comparing with developed countries serves as a benchmark for insurance companies in developing nations, guiding their efforts to expand their market and enhance their products, given the maturity of insurance markets in developed economies.

Table 1.1 Penetration Rate of Developed Country and Developing Country (2021)

		Penetration Rate %
Developed Countries	United Kingdom	11.1
	Japan	8.4
	United States	11.7
	Canada	8.1
	Germany	6.5
	Australia	4.4
	France	9.5
	South Korea	10.9
	Sweden	7.6
Developing Countries	India	4.2
	China	3.9
	Brazil	3.9
	Mexico	2.5
	Indonesia	1.6
	Turkey	1.3
	Nigeria	0.4
	Egypt	0.6
	Malaysia	4.8

Source: (Rudden, 2024)

However, with the working class and life expectancy in Malaysia expected to increase (Lee, Cheng, Nassir, et al., 2019), the persistent underperformance of insurers in meeting the

demands of a growing population remains a critical issue. If they underperform, there is a possibility that they may be unable to fulfil their responsibilities in the event of a claim. This situation could leave customers without the necessary financial protection, which can be devastating in times of illness, accidents, or death. The insurance industry's vitality is crucial for economic growth, particularly in developing countries like Malaysia (Lee, Cheng, Nassir, et al., 2019).

1.1.1 Conventional Insurance and Takaful

Within the domain of the insurance market, two primary streams of insurance products prevail: conventional insurance and Takaful. Takaful, often referred to as 'Islamic Insurance,' stands as a Shariah-compliant alternative to conventional insurance. It is meticulously tailored to cater to individuals, particularly Muslims, who seek insurance products infused with Shariah compliance principles (BenSaid, 2023). This preference stems from Takaful's alignment with Shariah values. Given Malaysia's demographic composition, where Muslims constitute a substantial portion of the population, and considering Islam's status as the nation's official religion, the country operates within a dual-insurance framework that encompasses both conventional insurance and Takaful.

Conventional insurance is an arrangement in which the insurer assumes responsibility for losses arising from defined accidents experienced by the policyholder, under the condition that the policyholder pays a premium to the insurer. Conventional insurance can be further categorised into life insurance and general insurance (ISM Insurance Services Malaysia Berhad, 2022). Life insurance is a contract that pledges to provide a benefit to the policyholder upon the policyholder's demise, in exchange for the payment of a premium. Figure 1.1 shows the growth of the new business premium for life insurance in Malaysia. In Malaysia, the new business premiums of the life insurance industry are in a growth phase from 2017 to 2021, but

have decreased by 6.9% to RM12.0 billion in 2022 from RM12.9 billion in 2021 (ISM Insurance Services Malaysia Berhad, 2022). This marks the highest decrease since 2017 and the outbreak of Covid-19. The decline in new business in 2022 is primarily attributed to whole-life and endowment insurance policies (ISM Insurance Services Malaysia Berhad, 2022).

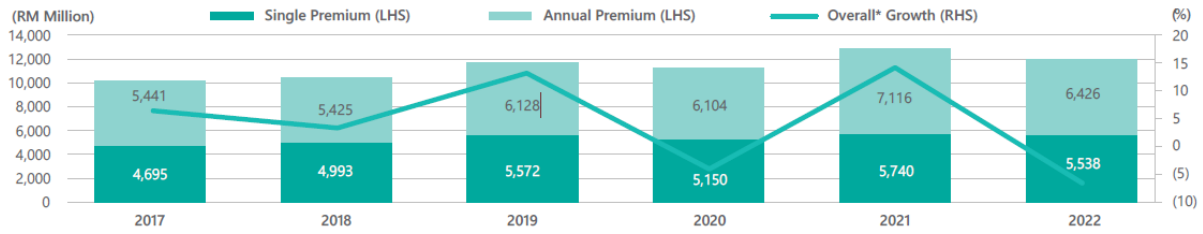

Figure 1.1 New Business Growth (Life Insurance) in Malaysia

Source: ISM Insurance Services Malaysia Berhad (2022)

On the other hand, general insurance, also referred to as non-life insurance, encompasses categories such as fire insurance, motor insurance, car insurance, health and medical insurance, travel insurance, personal accident insurance, commercial insurance, and other forms of insurance unrelated to life insurance. Figure 1.2 shows the gross direct premium for general insurance and its growth. Amidst the COVID-19 pandemic, the gross direct premium for general insurance in Malaysia increased to RM19.4 billion in 2022, reflecting a 10.0% increment compared to the previous year. This increase is primarily attributed to the growth in the motor insurance business, which saw a substantial 9.2% rise from 2021 to 2022. Additionally, the premium from fire insurance also experienced a notable increase of 6.1% compared to the previous year, 2021 (ISM Insurance Services Malaysia Berhad, 2022).

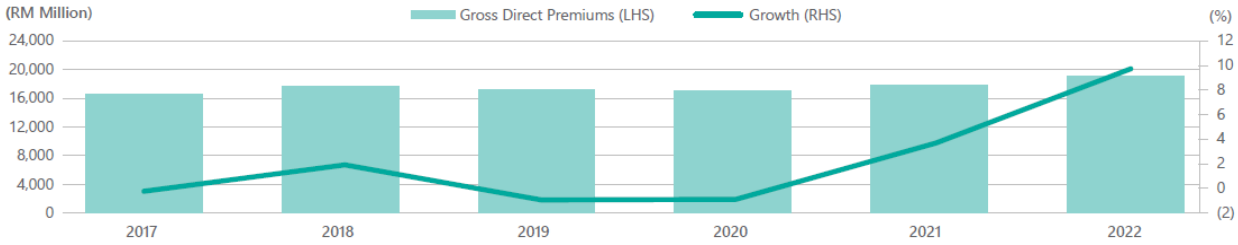

Figure 1.2 Gross Direct Premium and Growth (General Insurance) in Malaysia

Source: ISM Insurance Services Malaysia Berhad (2022)

Similar to conventional insurance but using distinct terminologies, Takaful can also be classified into two categories: Family Takaful and General Takaful (ISM Insurance Services Malaysia Berhad, 2022). Family Takaful encompasses insurance plans that offer long-term savings and protection to participants facing death or disability. Essentially, it provides compensation to participants or their family members in the event of disability or death. In Malaysia, contributions to the new business of Family Takaful have shown consistent growth since 2017. In 2022, new business contributions surged by 18.3% to RM10.1 billion, compared to RM8.5 billion in 2021 (ISM Insurance Services Malaysia Berhad, 2022).

Figure 1.3 illustrates the new business contributions for Family Takaful from 2017 to 2022. In 2022, the single contribution plan accounted for 78.3% of the total, marking a 25.6% increase to RM7.9 billion compared to the previous year. Conversely, the annual contribution plan, comprising 21.7% of the total new business, experienced a 2.0% decrease to RM2.2 billion from the previous year. The growth in new business contributions is primarily attributed to the group ordinary family plan, which holds a significant 58.2% share of the new business contributions in 2022.

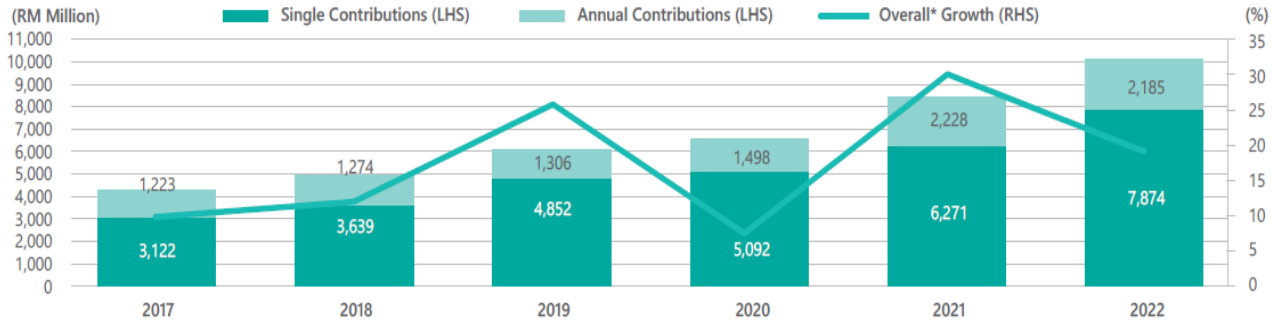

Figure 1.3 New Business Contribution and Growth (Family Takaful) in Malaysia

Source: ISM Insurance Services Malaysia Berhad (2022)

Looking ahead, general Takaful provides short-term protection for participants' properties and liabilities. This encompasses personal accident Takaful, motor Takaful, fire Takaful, car Takaful, medical and health Takaful, liabilities Takaful, and Takaful plans unrelated to family coverage. Among these, motor Takaful represents the largest category in Malaysia, comprising 66.2% of the total gross contributions for general Takaful in 2021 (ISM Insurance Services Malaysia Berhad, 2022). This is followed by fire Takaful and personal accident Takaful, accounting for 23.5% and 19.5%, respectively.

Figure 1.4 illustrates the gross direct contributions of general Takaful in Malaysia. The total gross direct contribution for general Takaful reached RM4.6 billion in 2022, indicating an increase compared to the previous year, primarily attributed to heightened public awareness due to the COVID-19 pandemic (ISM Insurance Services Malaysia Berhad, 2022). The growth is mainly supported by motor and fire Takaful, with the total gross direct contributions increasing by 20.7% and 23.7% respectively (ISM Insurance Services Malaysia Berhad, 2022).

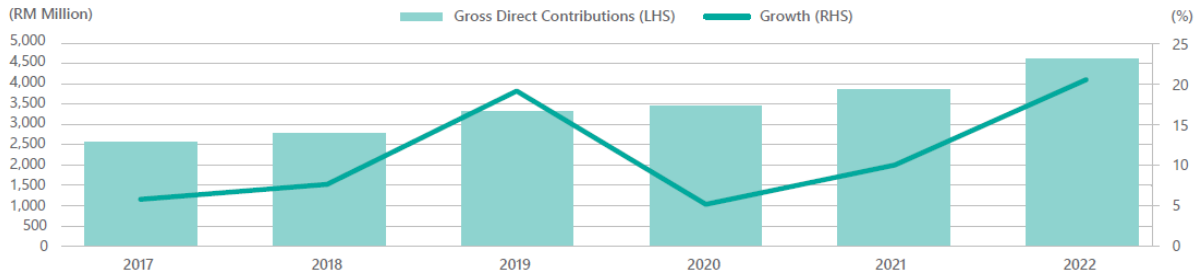

Figure 1.4 Gross Direct Contribution and Growth (General Takaful) in Malaysia

Source: ISM Insurance Services Malaysia Berhad (2022)

Despite conventional insurance having a bigger market share compared to Takaful in Malaysia, the growth of the insurance industry indicates that the development of Takaful was dominant, driven by its higher growth rate than conventional insurance. This development stems from Malaysia's predominantly Muslim population, with Muslims showing a preference for Shariah-

compliant products. This preference signifies that Takaful's growth is considerably stronger and more appealing to Muslims in Malaysia.

1.1.2 Key Differences between Takaful and Conventional Insurance

There are some differences between Takaful and conventional insurance. Firstly, conventional insurance violates three important prohibitions in Shariah compliance: uncertainty, interest, and gambling, hence leading to the birth of Takaful which is free from these three elements (Akmal & Aslam, 2019). The first violated element is Gharar (uncertainty) whereby conventional insurance companies have the chance to take profit from the premium, while the policyholders do not acquire the profit. However, Takaful allows participants and operators to share the profit. The second violated element is Riba (interest). For example, conventional endowment insurance allows policyholders to acquire guaranteed returns. Sometimes, the profit from investments is used to pay the policyholders and this offends the Riba prohibition due to most of the investment funds for conventional insurance investing in bonds and stocks which violate the Riba elements. The third violated element for conventional insurance is Maisir (gambling) where policyholders spend a small amount of money to get a larger sum insured from conventional insurance, but if the specific event does not occur, the policyholders will lose their premium. If the claims are higher than the premium, the conventional insurers will be in deficit.

The second difference lies in conventional insurance and Takaful having different ways to share the profit. Conventional insurance is the transfer of risk from policyholders to the insurance company through a contract while Takaful is a profit-sharing contract between contributors and Takaful operators, which is called the Mudarabah model (Bank Negara Malaysia, 2004). In conventional insurance, the insurers bear the profit and loss in exchange for the premium. However, in Takaful, the management, also called Mudarib, manages the

Takaful pool while the capital provider, also called contributors share the profit with the management on a pre-agreed ratio.

Thirdly, Takaful has an additional layer of governance compared to conventional insurance. While both conventional insurers and Takaful operators are regulated under the Financial Services Act 2013, Takaful operators are also governed by the Takaful Act 1984. This act mandates the establishment of a Shariah advisory board to oversee the operations of Takaful companies, ensuring their full compliance with Shariah principles, particularly in areas such as investments, which must be restricted to Shariah-compliant instruments (Bank Negara Malaysia, 2004). This can enhance the confidence of participants in Takaful operators. Table 1.2 summarises the differences between conventional insurance and Takaful.

Table 1.2 Difference between Conventional Insurance and Takaful

Takaful	Conventional Insurance
• Free from interest, uncertainty and gambling • Contributors and Takaful operators sharing the risk • Compliance with Shariah and government law	• Has elements of interest, uncertainty and gambling • Policyholders transfer the risk to the insurance company • Compliance with government law only

Source: author's own compilation

Consequently, it is worthwhile to investigate the efficiency and productivity levels of the Takaful operators and conventional insurance industries. Such research outcomes can provide valuable insights into their respective stability and resilience, fostering healthy competition between conventional insurance and Takaful operators.

1.1.3 Efficiency and Productivity

Efficiency and productivity are widely used by most researchers to measure the performance of the insurance industry, vis-à-vis the use of return on equity, return on investment, and return on sales to measure the performance of a general business (Eling & Luhnen, 2010; Lu et al., 2014; Masud et al., 2019; Taib et al., 2018b; William et al., 2007). Efficiency refers to how well a firm minimises its inputs (resources) to produce the same output. When a firm focuses on improving its efficiency, it can reduce its cost while achieving the same outputs. For example, an insurance firm that improves its labour efficiency can reduce its labour costs while achieving the same outputs, thereby increasing the firm's profitability. Therefore, numerous studies regarding the efficiency of insurance firms have been conducted (Anandarao et al., 2019; Che Mohd Salleh et al., 2022; Kaffash et al., 2020; Karbhari et al., 2018). For instance, Lim et al. (2021) studied and compared the efficiency of the Malaysian insurance industry before and after the implementation of the risk-based capital framework.

Meanwhile, productivity refers to the tendency of a firm to produce more output with constant input. If an insurance firm produces more output using the same inputs, it indicates that the firm is more productive. When a firm focuses on improving its productivity, it can achieve more outputs with the same inputs. There are several studies related to the productivity of the insurance industry (Masud et al., 2019; Oppong et al., 2019; Sukmaningrum et al., 2022; Taib et al., 2018a). For example, Sukmaningrum et al. (2022) evaluated the productivity of family Takaful in Malaysia and Indonesia from 2014 to 2019 using the Malmquist Productivity Index (MPI). The study found that family Takaful in Indonesia experienced a decline in productivity during the period, primarily due to a low rate of technological change (TECHCH). In contrast, family Takaful companies in Malaysia saw productivity improvements over the same period, driven by gains in both technological change (TECHCH) and efficiency change, although the increase in pure technical efficiency change remained modest.

According to the latest study regarding the efficiency and productivity of Malaysia's insurance industry from 2000 to 2017 by Lim et al. (2021), Takaful operators became more efficient after 2008 with the implementation of a risk-based capital framework, while conventional insurers became less efficient after 2008. Besides, the study found that conventional insurers had the same productivity level compared to Takaful operators prior to 2008, but the productivity of conventional insurance dropped after 2008 with the implementation of risk-based capital. This was because conventional insurers maintained their capital adequacy ratio above 245% compared to the 130% required by the risk-based capital framework, resulting in a reduction of their investment funds (Lim et al., 2021).

Nowadays, efficiency has become an important issue for insurance companies and Takaful operators to increase their competitiveness and profitability. According to Bahloul and Bouri (2016), the higher efficiency of an insurance company or Takaful operator can help them reduce their costs and lead to higher profits, making them more competitive and enabling them to acquire more market shares for better growth. On the other hand, productivity is also one of the measurements of firm performance widely used in the insurance industry. It measures the firm's efficiency growth due to managerial, technological, and other factors that affect the firm, indicating an increase in output growth.

1.1.4 Corporate Governance in the insurance industry in Malaysia

Corporate governance encompasses a set of rules guiding insurance companies and Takaful operators in managing their operations. It delves into the corporate structure, board of directors, senior management, business functions, organizational culture, mandates, strategies, and governing documents of these firms (National Association of Insurance Commissioners, 2021). This framework is pivotal in enhancing management performance within insurance entities.

Examining the corporate governance of insurance companies is paramount to safeguarding policyholders' interests. Policyholders entrust premiums to insurance companies, expecting fair claims settlements during insurable events. Effective governance fosters accountability and ensures management decisions align with the company's long-term sustainability goals.

Weak corporate governance within insurance firms can lead to fraudulent activities. For instance, American International Group (AIG), once a global insurance giant, faced allegations of improper accounting practices to inflate its financial standing and stock value. This misconduct involved reinsurance transactions with entities like General Re, artificially bolstering reserves and portraying a stronger financial position. AIG's former chief executive admitted to fraudulent practices, underscoring the failure of the board of directors to detect and address these issues promptly. Implementing robust corporate governance can mitigate such risks and enhance transparency and integrity within the organization.

While some research focuses on corporate governance in insurance sectors of countries like Saudi Arabia, there's a scarcity of such studies in Malaysia. For instance, Al-Faryan and Alokla (2023) examined corporate governance practices in Saudi Arabia's publicly listed insurance companies, evaluating aspects like board composition, director incentives, independence, audit committee functions, CEO remuneration, age, and turnover across 35 listed insurers.

In Malaysia, Bank Negara Malaysia oversees corporate governance in the insurance industry. Initially, guidelines issued in 1990 outlined duties for CEOs and directors, emphasizing supervision, asset adequacy, and audit committee ownership. Subsequent enhancements in 1995 restricted outside directorships and emphasized internal audit functions. Further refinements in 1999 focused on transparency in related-party transactions, with approvals mandated for significant transactions. The year 2000 witnessed the introduction of a prudential framework emphasizing board effectiveness and transparency. Subsequent standards in 2003 emphasized committee structures, director training, remuneration disclosures, and fit and

proper assessments. By 2004, fit and proper requirements ensured the suitability of those managing insurance entities, reinforcing transparency and integrity in the sector.

Financial Services Act 2013 (FSA) and the Islamic Financial Services Act 2013 (IFSA) were introduced in June 2013, serve as crucial guidelines for corporate governance in Malaysia's insurance industry (Bank Negara Malaysia, 2013a, 2013b). These acts provide a robust legal framework emphasising the roles and responsibilities of the board of directors, robust risk management, transparency, and effective internal controls. Additionally, the IFSA mandates Shariah compliance for Takaful operators (Bank Negara Malaysia, 2013b) . By aligning with global best practices, these regulations enhance operational efficiency, protect consumer interests, and contribute to the financial system's stability and integrity, underscoring their importance in promoting sound corporate governance within the industry.

This evolving framework of corporate governance in Malaysia's insurance landscape reflects a concerted effort to enhance accountability, transparency, and ethical practices within the industry, ultimately benefiting policyholders and fostering market stability. However, there are several differences in corporate governance between conventional insurers and Takaful operators, including Shariah compliance, Listed or non-listed, and board composition. Firstly, the obligation for Takaful operators to comply with Shariah principles significantly shapes their corporate governance. Shariah compliance requires Takaful operators to align their operations and product offerings with Islamic principles, necessitating the establishment of a Shariah Supervisory Board (SSB). This board, comprising Shariah scholars, provides oversight and ensures that all activities, contracts, and investments adhere to Shariah guidelines. In contrast, conventional insurers operate under secular regulatory frameworks that do not mandate Shariah compliance or the establishment of an SSB.

Secondly, the composition of the board of directors reflects another notable difference. Takaful companies are required to have at least one Shariah expert on the board to offer guidance on

Shariah compliance, product development, and operational decisions. This inclusion ensures the company's activities remain aligned with Islamic principles and addresses any Shariah-related concerns. Conversely, conventional insurers do not require Shariah experts on their boards, as their operations do not revolve around Islamic finance principles.

Lastly, the ownership structure sets Takaful operators apart from conventional insurers. Takaful companies typically adopt a cooperative or mutual entity structure, wherein participants who contribute to the Takaful pool also become co-owners of the company. This participatory ownership model grants participants the right to share in the company's profits and losses based on their contributions and claims. In contrast, conventional insurance companies operate under a shareholder ownership structure, where shareholders who invest in the company's stocks are the sole owners entitled to profits and dividends. This distinction in ownership reflects the underlying principles of cooperation and mutual benefit in Takaful operations, whereas conventional insurers operate based on shareholder interests and returns.

These differences underscore the unique regulatory frameworks, ethical considerations, and operational practices that shape corporate governance in the Malaysian insurance industry, distinguishing between Shariah-compliant Takaful operators and conventional insurers operating under secular principles.

1.2 Problem Statements

1.2.1 Problem Statement 1

The conventional and Takaful insurance industries in Malaysia are currently experiencing significant and accelerated expansion, with the growth trajectory of the Takaful industry surpassing that of conventional insurance. In 2022, the gross direct premium of the general Takaful industry increased by a commendable 10%, reaching RM19.4 billion. Concurrently, the overall gross direct contribution of the general Takaful industry grew by 21.1%, reaching an impressive RM4.6 billion (ISM Insurance Services Malaysia Berhad, 2022). The family

Takaful industry also saw a remarkable increase of 18.3% in its aggregate gross direct contribution, from RM8.5 billion to RM10.1 billion. In contrast, the gross premium of the life Takaful industry decreased by a significant 6.9%, reaching RM12 billion in 2022 (ISM Insurance Services Malaysia Berhad, 2022).

Simultaneously, the Malaysian general insurance industry experienced significant financial changes that underscore the importance of efficiency among insurers. While gross direct premiums saw a 10% increase, reaching RM19.4 billion, underwriting profits for general insurance companies contracted by 23%, dropping to RM1.56 billion (ISM Insurance Services Malaysia Berhad, 2022). The contrasting trends of rising premiums but falling underwriting profits highlight the urgent need for insurers to improve efficiencies and risk management strategies to maintain profitability amidst changing market conditions.

Besides, there are several issues motivating the study of efficiency in Malaysia insurance industry. Firstly, with the escalating expansion of the insurance business, the expeditious handling of insurance claims, increased competition, and a lack of skilled workforce might emerge as formidable concerns. Managers of insurance companies in Malaysia have elucidated that contemporary insurance claims processes are encumbered by conventional standard operating procedures characterised by voluminous paperwork (Gomez, 2018). Consequently, delayed claims processing can prompt policyholders to reconsider their insurance consumption. Prolonged claim adjudication delays also act as visible signs of inefficiency within insurance organisations, highlighting significant operational efficiency flaws.

Secondly, intense competition may lead insurers to engage in aggressive pricing strategies to attract customers. This can result in under pricing policies, which might not adequately cover potential losses. Underpriced policies can lead to adverse selection, where high-risk individuals are more likely to purchase coverage, increasing the frequency and severity of claims and negatively impacting the efficiency of insurers (Kong et al., 2024).

Thirdly, a lack of a skilled workforce could make it more difficult for insurers to adjust to changing consumer demands and market developments. Skilled professionals with expertise in various domains, such as data analysis, technology, and risk assessment, are essential for conceiving and developing innovative insurance products. A shortage of such professionals can lead to a lack of creative ideas and hinder the development of new, competitive, and tailored insurance offerings that cater to evolving customer needs. Therefore, the Central Bank of Malaysia emphasises the importance of the insurance industry continually streamlining its internal management processes to enhance operational efficiency (Bank Negara Malaysia, 2020).

1.2.2 Problem Statement 2

The rapid evolution of digital financial services motivated the study of productivity of the insurers in Malaysia as a whole, since it has significantly reshaped the landscape of the financial industry worldwide, with both banking and insurance sectors experiencing transformative changes. Malaysia too is not spared from this transformative wave. The first digital bank – GXBank was launched recently on 30 November 2023 and Bank Negara Malaysia (BNM) is slated to release the Licensing Framework for Digital Insurers and Takaful Operators (DITO) by the early second half of 2024, potentially introducing disruptions to the insurance industry in the country. This regulatory framework aims to facilitate the entry of digital insurers and Takaful operators, fostering a competitive environment that encourages innovation and efficiency. The DITO framework is anticipated to be a game changer as it provides a structured pathway for digital entities to operate alongside traditional insurers and Takaful operators.

The DITO framework, first mooted in 2022, reflects a broader trend in financial regulation aimed at integrating digital advancements into the financial system while ensuring stability and consumer protection. By enabling the establishment of digital insurers and Takaful operators, BNM aims to enhance the inclusiveness, efficiency, competitiveness and resilience of the

Malaysian insurance sector. The framework is designed to address various aspects of digital insurance operations, including licensing, prudential requirements, and conduct standards, ensuring that these new entrants can compete fairly and contribute to the overall stability of the financial system and better serve the underserved market segments (Hayatun, 2024).

Conventional insurance sector has long been characterised by extensive physical branch networks and labour-intensive processes. Such characteristics have rendered them vulnerable to the entrance of digital players into the insurance market as these digital financial service providers generally operate with a leaner cost structure, primarily due to the absence of physical infrastructure and the automation of many administrative tasks. Additionally, these digital players also have an edge over their conventional counterparts due to reduced operational costs, enhanced customer engagement and streamlined service delivery as a result of technological innovations. This efficiency allows digital insurers to offer competitive pricing and improved customer experiences, thereby pressuring conventional insurers to innovate and enhance their productivity to maintain their market position.

Analysing productivity of an insurance firm is imperative as it is an indicator of the activity and performance of an insurance firm during the financial year (Abdulmunem & Alrikabi, 2022; Kaydos, 2020). Ensuring that the Malaysian insurance sector performs well and remain stable is crucial as the insurance sector is found to be significantly related to the stability of the financial system (Diallo & Al-Mansour, 2017; Gregory, 2013). Therefore, understanding the productivity dynamics of conventional insurers and Takaful operators is crucial for policymakers, industry stakeholders, and consumers.

1.2.3 Problem Statement 3

Additionally, Persatuan Insurans Am Malaysia (PIAM) and 22 Malaysian general insurers were fined 173.66 million Ringgit Malaysia due to a violation of Section 4 of the Competition Act 2010 (Bank Negara Malaysia, 2020). This violation involved an agreement between PIAM

and the Federation of Automobile Workshop Owners' Association of Malaysia, concerning the minimum hourly labour rates and spare part prices for vehicles from Proton, Naza, Perodua, Nissan, Honda and Toyota (Hafiz Yatim, 2022). Such anti-competitive practices not only impact customers but also have adverse effects on insurance companies. They can tarnish the company's image and erode confidence among consumers, regulators, and other stakeholders, leading to significant legal and financial consequences.

Therefore, effective corporate governance is crucial for insurance companies to operate transparently and ethically, including compliance with the rules and regulations set by Bank Negara Malaysia. According to Bank Negara Malaysia (2016), corporate governance is "a fundamental component of financial institution supervisory assessments and a key determinant of the level of supervisory scrutiny applied to a financial institution." Effective corporate governance involves setting clear guidelines and procedures to ensure adherence to Bank Negara Malaysia's regulations, along with providing staff training. Insurance companies should also implement monitoring mechanisms, such as an independent board of directors or an audit committee, to oversee compliance with ethical and legal standards.

Moreover, corporate governance plays a vital role in ensuring the efficiency and productivity of both conventional insurers and Takaful operators (Elamer et al., 2018; Karbhari et al., 2018; Tan, 2014). Robust corporate governance within an insurance company, characterized by an appropriate board size and a sufficient representation of non-executive directors, can help ensure that managers act in the best interests of shareholders while balancing the interests of all stakeholders (Lee, Cheng, Nassir, et al., 2019). Bank Negara Malaysia initiated key corporate governance guidelines in the insurance industry in 1990, beginning with guidelines on the responsibilities and duties of chief executive officers and directors of insurance companies (Bank Negara Malaysia, 2004). Strong corporate governance in an insurance company is crucial to avoid agency problems that arise when managerial incentives conflict

with shareholders' interests (Karbhari et al., 2018). For example, American International Group (AIG), once one of the largest insurance companies globally, engaged in improper accounting practices to exaggerate its financial results and inflate its stock price." The risk of financial scandals in the Malaysian insurance industry can be reduced or eliminated with strong corporate governance (Rodini, 2023).

Furthermore, a robust and reliable corporate governance system is essential for improving firm efficiency and productivity (Lee, Cheng, Nassir, et al., 2019). A solid corporate governance framework guarantees that decision-making is transparent, accountable, and aligned with the company's best interests. Corporate governance helps firms identify and manage risks, reducing the likelihood of unexpected losses and disruptions to operations. A strong corporate governance structure also ensures efficient allocation of the company's resources, especially financial and human capital. This can lead to increased trust, loyalty, and confidence among stakeholders, resulting in better business opportunities, higher efficiency and productivity, and improved financial performance. Therefore, there is a need to investigate the relationship between corporate governance attributes and the efficiency and productivity of the insurance industry in Malaysia.

The rationale for comparing the corporate governance of Takaful operators and conventional insurers arises from the distinct regulatory frameworks governing these entities in Malaysia. While both operate under the Financial Services Act 2014, Takaful operators have an additional layer of governance governed by Shariah law (Bank Negara Malaysia, 2004). This includes the establishment of a Shariah advisory board to ensure compliance with Shariah regulations in all aspects of operations, particularly in investment activities restricted to Shariah-compliant instruments (Bank Negara Malaysia, 2004).

This comparison aims to investigate the impact of this additional layer of governance on the efficiency and productivity of both conventional insurers and Takaful operators within the

Malaysian insurance industry. The analysis will shed light on how differing governance structures influence operational effectiveness, decision-making processes, accountability, and transparency. By evaluating these factors, the study seeks to provide insights into the effectiveness of regulatory practices and governance frameworks in the insurance sector, particularly within the context of a dual-insurance system in Malaysia.

1.3 Research Questions

1) Are there differences in efficiency between conventional insurers and Takaful operators?
2) Are there differences in productivity between conventional insurers and Takaful operators?
3) What is the relationship between corporate governance attributes and the performance of insurance industry in Malaysia?
    i) What is the relationship between corporate governance attributes and efficiency of insurance industry in Malaysia?
    ii) What is the relationship between corporate governance attributes on the productivity of insurance industry in Malaysia?

1.4 Research Objectives

There are three general objectives in this study which is:

1) To examine and compare the levels of efficiency between conventional and Takaful operators in Malaysia.
2) To examine and compare the levels of productivity between conventional and Takaful operators in Malaysia.
3) To analyse the relationship between corporate governance attributes and performance of insurance industry in Malaysia.

I. To examine the relationship between corporate governance attributes on the efficiency of insurance industry in Malaysia

II. To examine the relationship between corporate governance attributes on the productivity of insurance industry in Malaysia

1.5 Justification and Significance

The contribution of this study lies in its systematic examination of efficiency within the Malaysian insurance industry. The co-existence of a dual insurance system in Malaysia creates a distinct scenario that warrants a thorough assessment of the operational efficiency of both conventional insurers and Takaful operators. This study serves as an innovative empirical inquiry, marking a pioneering investigation to analyse the efficiency of Takaful operators in relation to their conventional counterparts. Malaysia's unique position as one of the limited global regions practising a dual insurance system further emphasises the exceptional nature of this research. By empirically analysing the efficiency of both Takaful and conventional insurers using Data Envelopment Analysis, the study provides insights into the relative strengths of different efficiency components and their implications for the industry. The findings offer valuable evidence to guide industry stakeholders, regulators, and policymakers in understanding the dynamics between these insurance models.

However, most of the studies regarding the productivity of the insurance industry are conducted in developed countries such as European countries (Dionne, 2023; Eling & Schaper, 2017; Lanfranchi & Grassi, 2021). The limited study on the efficiency and productivity of Malaysian insurance firms presents challenges for these operators, as they lack insights into how their efficiency and productivity evolve over time. By examining the productivity and efficiency within the Malaysian insurance sector, this study offers insurers a comprehensive understanding of their performance relative to competitors, motivating them to enhance their

operational efficiency and productivity. Consequently, this will foster a more competitive insurance industry and increase demand for insurance products in Malaysia, leading to the development of more valuable offerings.

Furthermore, the findings of this study provide crucial insights that can help traditional insurers in Malaysia remain competitive following the introduction of Digital Insurance and Takaful Operators (DITO). Firstly, the analysis of efficiency levels highlights that traditional insurers can gain significant advantages by benchmarking best practices from insurers. By identifying areas where insurers excel, such as cost management and process optimisation, traditional insurers can streamline their operations to reduce costs and enhance service delivery. The study also underscores the importance of adopting advanced technologies, such as automation and data analytics, which can further boost operational efficiency by improving underwriting processes, claims management, and customer service.

Secondly, the comparison of productivity levels emphasises the critical role of leveraging data analytics and customer-centric strategies. Traditional insurers can enhance productivity by adopting similar analytics tools used by digital operators to gain deeper insights into customer behaviour, optimise product offerings, and tailor marketing strategies. Additionally, the study suggests the need for strategic diversification and innovation in product lines and service delivery, enabling traditional insurers to meet evolving customer expectations and increase market share.

Furthermore, the findings of this study offer valuable insights to stakeholders by exploring different aspects of corporate governance aimed at improving the performance of both Takaful operators and conventional insurers in Malaysia. The research examines the influence of factors such as the size of the Shariah committee, board size, gender composition on both the board and the Shariah committee, the presence of non-executive directors, listed or non-listed, as well

as control variables like firm size, macroeconomic factors, and international diversification through foreign participation on the performance of these insurers.

Moreover, our findings provide a deeper understanding of the corporate governance differences between Takaful operators and conventional insurers, offering valuable insights for insurers, regulators, investors, and researchers. While many studies have examined the relationship between efficiency, productivity, and corporate governance in the Malaysian insurance and Takaful industries, this study addresses a gap by specifically investigating the impact of the Shariah committee and the proportion of men on the Shariah committee on the performance of the insurance industry in Malaysia.

1.6 Organization of the Thesis

This study is organised into five chapters. Chapter 1 introduces the study, outlining its objectives, scope, and significance. Chapter 2 describes the theoretical background of efficiency, productivity, and agency theory. It also summarises the literature on productivity and efficiency in the insurance industry, encompassing both Takaful and conventional insurance. This chapter includes the development of hypotheses.

Chapter 3 outlines the methodologies used to assess the efficiency and productivity of insurance companies in Malaysia, specifically highlighting Data Envelopment Analysis (DEA) and the Malmquist Productivity Index (MPI). The chapter also explores the approaches taken to compare the efficiency and productivity levels of Takaful operators and conventional insurers. Furthermore, it details the selection of independent variables incorporated into the regression models and the sources of data employed in the study.

Chapter 4 presents the study's results. It first discusses the efficiency and its components within the Malaysian insurance industry, followed by the productivity and its components among insurers in Malaysia. The chapter further investigates the impact of corporate governance

attributes on each aspect of efficiency and productivity using multivariate regression analysis. Chapter 5 provides a summary of the study and emphasises the key findings. It discusses the implications of these results and concludes with the limitations of the study and recommendations for future research.

1.7 Summary

The objective of this study	Problem Statement	Contribution of this study
To examine the different levels of efficiency between conventional and Takaful operators in Malaysia.	The study of efficiency in Malaysia's insurance industry is motivated by the need to address issues such as delayed claims processing due to outdated procedures, intense competition leading to potentially underpriced policies, and a shortage of skilled professionals essential for innovation and adaptation to market changes.	It helps the Takaful operators and insurance operators to identify the part where the output is under production, or the inputs are over utilization.
To examine the different levels of productivity between conventional and Takaful operators in Malaysia.	The study of productivity in Malaysia's insurance industry is driven by the rapid evolution of digital financial services, which has reshaped the global financial landscape, with initiatives such as the launch of GXBank and the upcoming Licensing Framework for Digital Insurers and Takaful Operators (DITO) by Bank	provide a whole picture for the insurers to know their efficiency change over time against their competitors, and it can encourage the insurance firms to keep improving their efficiency in technology and managerial part.

	Negara Malaysia poised to introduce significant changes, foster competition, and drive innovation and efficiency within the sector.	
To analyse the impacts of corporate governance on the efficiency and productivity of conventional and Takaful operators in Malaysia.	The significant fine imposed on Persatuan Insurans Am Malaysia (PIAM) and 22 general insurers for anti-competitive practices, along with the downfall of American International Group (AIG) due to poor governance, underscores the crucial need for effective corporate governance in Malaysian insurance companies	This study contributes to the performance of the Takaful operators and conventional insurers in Malaysia by helping them to improve their corporate governance system in their companies.

CHAPTER 2

THEORETICAL FRAMEWORK & LITERATURE REVIEW

2.0 Introduction

Chapter 2 encompasses the theories of efficiency, productivity, and the characteristics of insurer firms regarding their corporate governance. Following this, the chapter delves into an extensive literature review on the efficiency and productivity of insurers. Lastly, the chapter discusses the development of hypotheses concerning the firm characteristics that impact efficiency and productivity.

2.1 Theoretical Framework

Section 2.1 explores the two approaches used to gauge the performance of insurance firms: i) Frontier efficiency and ii) productivity changes. Furthermore, this section delves into the theories related to these studies.

2.1.1 Efficiency

The concept of efficiency originated from productivity theory, as proposed by Cobb and Douglas (2007), which aimed to examine the relationship between inputs such as capital and labour and the output of products. In this theory, Cobb and Douglas (2007) assumed that the firm is economically efficient. The Cobb-Douglas production function is as follows:

$$Y = A\,L^{\beta}K^{\alpha} \qquad (2.1.1)$$

Where total factor productivity is represented by A, the input for labour is L, the input for capital is K, the output elasticities for labour is β and the output elasticities for capital is α.

Technical efficiency is described using the Cobb-Douglas production function, which explains how variations in input levels and their combinations may impact output. The efficiency score is scaled between 0 and 1, with 1 representing the highest efficiency. Scale efficiency and pure technical efficiency are two subgroups of technical efficiency. Pure technical efficiency is defined as how effectively management reduces inputs to produce equal or greater output. A company is considered pure technically efficient if it operates on its production frontier, reflecting the greatest feasible output from a given set of inputs and existing technology. A pure technically efficient company minimises input waste and utilises inputs optimally to achieve the desired level of output. Any deviations from the production frontier indicate resource inefficiency. On the other hand, scale efficiency refers to whether a company operates at an appropriate scale relative to its production capabilities and desired output level (Taib et al., 2018). Scale efficiency depends on managerial ability to select an appropriate input size and production scale to achieve the desired output (Linn & Maenhout, 2019). Scale inefficiency mainly results from increasing returns to scale (IRS) and decreasing returns to scale (DRS) (Castro et al., 2023). Increasing returns to scale (IRS) refer to improved efficiency as the insurance firm's size increases, while decreasing returns to scale (DRS) refer to a decrease in efficiency as the firm's size grows. A firm achieves scale efficiency when it reaches constant

returns to scale (CRS) or a scale efficiency score of 1, indicating that changes in the insurance firm's size do not affect its efficiency (Castro et al., 2023). The decomposition of efficiency can refer to in Figure 2.1.

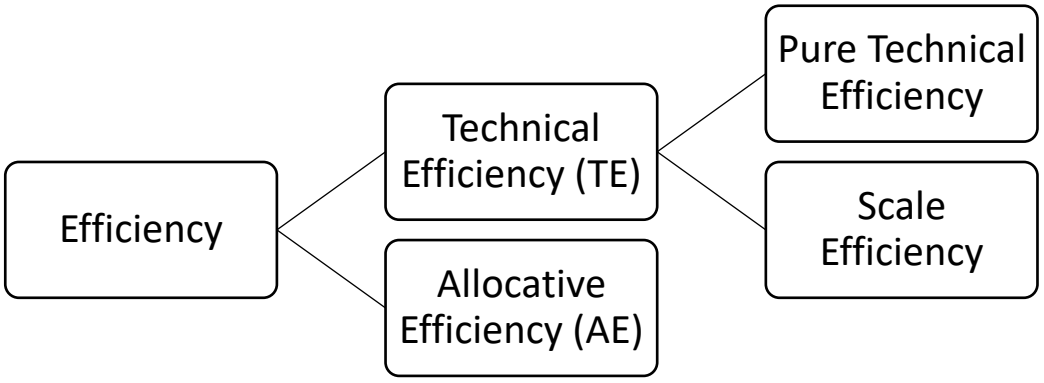

Figure 2.1 Decomposition of Efficiency

Source: author's own compilation

Efficiency measurement has gained a lot of interest from international researchers to provide important insight regarding the competitiveness of insurers (Eling & Luhnen, 2010b). Those efficiency studies are conducted in two different approaches which are parametric and non-parametric. Through efficiency studies, the reader can know how well a firm minimizes its input and maximizes its output using the given technology.

2.1.2 Productivity

Productivity refers to a firm's ability to maximise its output with a given input (Lee, Cheng, Nassir, et al., 2019). There are several ways for a firm to increase productivity: i) Increase output with a constant input, ii) Maintain output but decrease the use of input, iii) Decrease input while increasing output to achieve greater efficiency, iv) Increase the rate of producing output faster than the input, and v) Decrease input more than the decrease in output (Ruch, 1982).

Total factor productivity is a firm productivity measurement indicator that measures how much output a firm can produce with a constant input. Total factor productivity can be decomposed into technical efficiency change (EFFCH) and technological change (TECHCH) (Soltane Bassem, 2014). Technical efficiency change (EFFCH) refers to a firm's capacity to produce a specified output with the least amount of input, while technological change (TECHCH) pertains to the firm's capability to adopt superior technology to reduce input and enhance output (Masud et al., 2019). Technical efficiency change can be further broken down into pure technical efficiency change (PECH) and scale efficiency change (SECH). The decomposition of total factor productivity is illustrated in Figure 2.2.

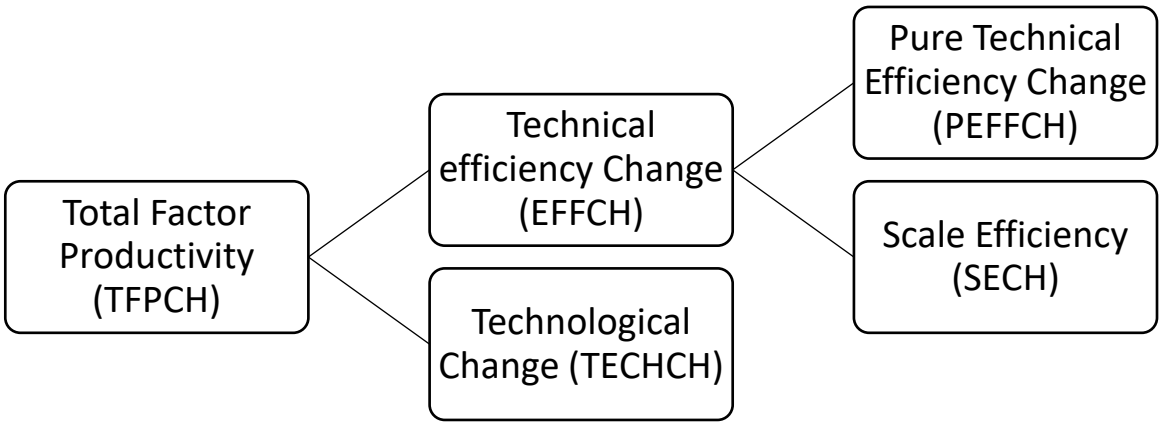

Figure 2.2 Decomposition of Total Factor Productivity

Source: author's own compilation

2.1.3 Agency Theory

The agency theory, first developed by, Jensen and Meckling (1976) was widely spread by the business school, practitioner journals, literature, business press and also the corporate proxy statements (Shapiro, 2005). This theory assumes that humans are self-interested and individualistic. The agency theory argues that the shareholder's wealth cannot be maximized if the incentive or the benefit for managers is not efficient for them to encourage them to do the

best decision for the firm (Tan, 2014). In a firm, the firm ownership and control are separated where the investors own the firm and the manager control and make the decision for the firm's operation. This may raise a problem that the manager makes the decision that is best for their interest but not shareholders' wealth maximisation. Therefore, the interests of the shareholders and the manager should be matched to overcome this problem to happened (Tan, 2014).

Agency theory plays an important role in the investor's understanding of corporate governance (Tan, 2014). It helps the owner of the firm to know the threat of the firm with inefficient corporate governance and come up with an efficient solution. Jensen and Meckling (1976) argue that there are three ways to solve this agency problem which are monitoring costs, residual losses and binding the management to the shareholders.

Insurance is a risk hedging contract that binds the managers to operate the insurance firm and invest the fund with the principle of protecting the interests of both the contracting parties including shareholders and policyholders (Jia et al., 2011). Besides, the agency theory also proposed that a large board of directors, the presence of independent directors and the implementation of an audit committee in an insurance firm, can encourage them to monitor each other and hence maximize the shareholder's wealth (Elamer et al., 2018).

2.1.4 Stewardship theory

Stewardship theory posits that managers function as stewards of the company (Goel et al., 2022). According to this theory, managers and senior executives bear a greater responsibility for which they are appointed; rather than pursuing self-serving interests, they work towards the best interests of the business and its shareholders (Athar et al., 2023; Jasir et al., 2023; Putra, 2023). This theory assumes that executives are motivated to fully commit themselves to the success of the business (Jasir et al., 2023). Independent board members may not offer significant benefits as they often lack access to critical information about insurance companies,

hindering their ability to react and respond effectively (Tarighi et al., 2023). Therefore, stewardship theory advocates for a smaller board with a majority of executive directors.

2.1.5 Resource dependency theory

Resource dependency theory underscores the importance of executives in linking firms to vital external resources. Diverse boards are generally more effective than homogeneous ones at securing access to these crucial resources for company operations (Sanad & Al Lawati, 2023). The theory advocates for larger board sizes, more executive directors, and gender diversity to build stronger corporate relationships in the external business environment (Nduati Kariuki, 2023). Larger boards support business growth through their enhanced expertise, skills, and wider networks with consumers and stakeholders (Tarighi et al., 2023). Additionally, women, known for traits like risk aversion and ethical awareness, can enhance the quality of information provided to insurance firms when they are more prominently represented on boards (Tarighi et al., 2023).

2.2 Literature Review

2.2.1 Efficiency

The resilience of the insurance industry in the market has encouraged researchers to study its performance (Ayinaddis et al., 2024; Che Mohd Salleh et al., 2022; Muhamat et al., 2023; Tayebi et al., 2024). In recent years, a series of studies have explored insurer performance assessment using diverse financial metrics. Notably, Ahmeti et al. (2022) investigated insurers' performance in Kosovo, utilising the return on assets (ROA) metric. Similarly, Osman and Samontaray (2022) and Upadhyaya et al. (2023) analysed insurers' performance in Nepal, employing both the return on assets (ROA) and return on equity (ROE) metrics. Goswami (2022), Pjanić et al. (2023) and Tsvetkova et al. (2021) also used the return on assets (ROA)

metric to scrutinise the performance of insurance companies. The use of metrics like return on equity, return on investment, and return on sales is widespread in the literature for evaluating firm performance. However, the conventional use of performance indicators, such as return on equity, return on investment, and return on sales, within the financial sector has faced criticism in academic discourse. Alshehadeh et al. (2022) argued that these methods, which rely on unidirectional performance metrics, are inadequate for comprehensively assessing multiple inputs and outputs essential for capturing a holistic view of performance metrics. Insurance companies utilise various inputs, including labour and capital, to generate diverse outputs such as claims settlements and investment returns. Therefore, assessing efficiency serves as a more suitable metric for evaluating the operational performance of insurance enterprises.

Efficiency refers to how well a firm minimises its inputs (resources) to produce the same output (Abdin et al., 2022). By focusing on improving efficiency, a firm can reduce inputs while maintaining output levels. For instance, an insurance firm enhancing its efficiency can cut costs, such as labour or capital, while achieving the same outputs. Numerous studies have delved into investigating efficiency paradigms within the insurance sector (Anandarao et al., 2019; Che Mohd Salleh et al., 2022; Kaffash et al., 2020; Karbhari et al., 2018).

To assess the efficiency of entities within an industry, two primary approaches are employed: parametric and non-parametric methods. The non-parametric approach, particularly Data Envelopment Analysis (DEA), is the most commonly used method for measuring efficiency in the financial sector (Kaffash et al., 2020). For instance, Ashiagbor et al. (2023) investigated the improvements in efficiency and productivity within Ghana's life insurance sector and found that the industry did not gain from pure scale efficiency. Furthermore, Omrani et al. (2022) evaluated insurance providers while taking uncertainty into account and conducted a comparative study to identify benchmarks and inefficient organisations. Lastly, after analysing the efficiency of Indian health insurance businesses, Siddiqui (2022) concluded that managers

of ineffective health insurers should promptly implement strategies to increase efficiency by making better use of existing resources and advancing technology.

While a substantial body of research has utilised data envelopment analysis (DEA) to assess the efficiency of the insurance industry, there remains a notable gap in the comparative evaluation of efficiency between conventional insurers and Takaful operators in Malaysia. Prior studies, such as those conducted by Ali et al. (2021), Eldaia and Hanefah (2023), Kholis and Rakhmawati (2022), Lee et al. (2019) and Sallemi and Zouari (2023) have primarily focused on the efficiency of the Takaful sector. Similarly, Muhamat et al. (2023) exclusively assessed the efficiency of Takaful operators in Malaysia after the introduction of the Islamic Financial Act 2013. Therefore, it is imperative to undertake a comprehensive study encompassing the entirety of the Malaysian insurance landscape, including both conventional and Takaful operators, to offer a comprehensive understanding of industry efficiency.

It is also noteworthy that much of the research comparing the efficiency of Takaful operators and conventional insurance companies has been conducted outside Malaysia. For example, Alshammari et al. (2019), Harun et al. (2020) and Sallemi et al. (2021) assessed insurer efficiency in the Gulf Cooperation Council countries. Likewise, Naushad et al. (2020) examined insurer efficiency in Saudi Arabia, while Abu Al-Haija and Houcine (2023) carried out a comparative analysis of Takaful operators and conventional insurers in Saudi Arabia and the United Arab Emirates. These studies highlight the necessity of evaluating the performance of Takaful operators and conventional insurers, especially in countries with Islamic financial systems like Malaysia, to drive enhancements in the insurance sector (Lim et al., 2021).

2.2.2 Productivity

Before this research, Sukmaningrum et al. (2022) investigated the productivity of Family Takaful in Indonesia and Malaysia, while Muhamat et al. (2023) focused on the productivity

of general Takaful in Malaysia. Sukmaningrum et al. (2022) also explored factors influencing Family Takaful insurers' productivity in Indonesia from 2014 to 2020. Additionally, Lee et al. (2019) examined the impact of risk-based capital regulations on Family Takaful insurers' productivity.

Given Malaysia's dual insurance system, research on the productivity of the conventional insurance sector is also available. For instance, Masud et al. (2019) studied the productivity of life insurers, and Chen et al. (2014) analyzed the productivity of general insurers in Malaysia, extending their research to explore the connection between intellectual capital and general insurers' productivity. Therefore, a comprehensive study that encompasses the entire Malaysian insurance landscape, including both conventional and Takaful insurers, is essential for a complete understanding of industry productivity.

While there are studies on the productivity of the insurance sector in Malaysia, most typically focus on life and general insurers separately. For example, Chen et al. (2014) investigated the relationship between intellectual capital and general insurers' productivity, Saad and Idris (2011) compared the efficiency of life insurers in Malaysia and Brunei, and Mansor and Radam (2000) evaluated both productivity and efficiency in the Malaysian life insurance sector. Among studies that compare both conventional insurers and Takaful operators, Saad et al. (2006) primarily focused on efficiency using Data Envelopment Analysis, while the work of Abduh and Omar (2012) is most similar to this study, examining the performance of Takaful operators and conventional insurers. However, their sample period (2008 to 2010) may not accurately reflect current performance or assist policymakers in addressing upcoming challenges from digital insurers.

Moreover, considerable research has been conducted outside Malaysia on the comparative productivity of Takaful operators and conventional insurers. For instance, Bakhouche (2023) studied insurers in the Arab Gulf countries and Jordan. Similarly, Taib et al. (2018a) assessed productivity in Pakistan, while Akhtar (2018) examined Takaful operators and conventional insurers' productivity in Saudi Arabia. These efforts emphasise the need to analyze and compare the productivity of both conventional insurers and Takaful operators, especially in countries like Malaysia with dual insurance markets, to foster innovation within the industry.

2.2.3 Corporate Governance

Corporate governance is defined in various ways. Bank Negara Malaysia (2016) defines it as "a fundamental component of the Bank's supervisory assessments and a key factor in determining the level of supervisory intensity applied to a financial institution". Aguilera et al. (2021) define corporate governance as the "distribution of rights and responsibilities within the firm, which entails allocating power and resources to different corporate actors and managing the inevitable tensions among these factors".

The study of insurance firm performance has been approached using various performance metrics, such as accounting metrics like ROA (Return on Assets) and ROE (Return on Equity), and market-based metrics like Tobin-Q. Researchers including Abebe Zelalem et al. (2022) Alhassan et al. (2021), Bailey (2022), Kiptoo et al. (2021) and Sanad et al. (2023) have employed ROA to investigate the connection between corporate governance attributes and their performance. Besides, Al-Matari et al. (2022) and Alhassan et al. (2021) have focused on ROE in their studies of the same relationship. Moreover, Bailey (2022), Hezabr et al. (2023) and Sanad et al. (2023) have utilised the Tobin Q metric to explore its association with corporate governance attributes. Additionally, Hemrit (2020) explored the connection between corporate governance attributes and their performance, utilising indicators such as expense ratios, net

premiums written and profit margins. This body of research demonstrates the varied approaches in assessing insurance firm performance and highlights the significance of using various performance metrics to comprehend how corporate governance affects firm outcomes. In recent years, various studies have delved into the realm of corporate governance within conventional insurers, investigating various facets of this complex domain (Abebe Zelalem et al., 2022; Bhuyan et al., 2022; Ullah et al., 2019). For example, Abebe Zelalem et al. (2022) carried out an thorough examination of the relationship between corporate governance practices and firm performance, highlighting significant connections within this context. Building on this foundation, Bhuyan et al. (2022) delved into the intricate dynamics of CEO compensation and its impact on insurance firm performance, contributing valuable insights to the field. Concurrently, Ullah et al. (2019) explored the correlation between corporate governance structures and corporate social responsibility disclosure, uncovering significant implications for organisational transparency and accountability. Moreover, Alade et al. (2022) extended this discourse by investigating the effect of corporate governance on audit quality, revealing compelling correlations that underscore the significance of strong governance frameworks in ensuring financial integrity and accountability.

Shifting focus to the unique landscape of Takaful operators, governed by Shariah principles, it is evident that research in this domain remains comparatively sparse yet essential (Eldaia & Hanefah, 2023; Hemrit, 2020; Karbhari et al., 2018; Sallemi & Zouari, 2023). Hemrit (2020) Lee et al. (2019) and Sallemi et al. (2021) undertook pioneering studies that explored the intricate connection between governance mechanisms and the performance of insurance providers across diverse global contexts. These studies provide a nuanced insight into the interaction between governance structures and operational outcomes in Takaful operators, highlighting critical areas for further exploration. Further contributing to this discourse, Eldaia and Hanefah (2023) focused on the effectiveness of audit committees in shaping Takaful

operators' performance, while Eldaia et al. (2023) delved into the impact of the Board of Directors' effectiveness on Takaful companies' performance. These studies underscore the multifaceted nature of governance dynamics in Takaful operators, emphasising the need for tailored governance strategies to optimise operational efficiency and performance outcomes.

In summary, the collective body of research reviewed here provides a comprehensive overview of the evolving landscape of corporate governance in insurance firms, shedding light on critical relationships, challenges, and opportunities that shape organisational performance and accountability. Despite the existing studies on corporate governance within Takaful operators and conventional insurance industries, there remains a noticeable gap in comparative research on corporate governance practices. First, comparing the corporate governance between Takaful operators and conventional insurers, particularly within the Malaysian context. Furthermore, this paper bridges the gap to study the impact of the Shariah committee and the proportion of men in the Shariah committee towards the performance of the insurance industry in Malaysia.

2.2.4 Hypotheses Development

This research develops eight hypotheses. The first two hypotheses concern the efficiency and productivity of Takaful operators and conventional insurers in Malaysia. The next five hypotheses relate to corporate governance factors: Shariah committee size, the ratio of men on the Shariah committee, board size, the ratio of men on the board of directors, the ratio of non-executive directors on the board of directors and listed or non-listed.

2.2.4.1 Efficiency and Productivity

Return on equity (ROE), return on investment (ROI), and return on sales (ROS) are widely utilised by researchers to evaluate the performance of insurance firms. For instance, Ahmeti et al. (2022) employed return on assets (ROA) to assess insurers' performance in Kosovo; Činčalová (2021) utilised ROA and ROE to evaluate insurers' performance in the Czech

Republic; and Tsvetkova et al. (2021) used ROA as an indicator to study the performance of insurance companies in Russia.

However, the use of traditional performance indicators such as ROE, ROI, and ROS to analyse performance within the financial industry has drawn criticism from some researchers. Alshehadeh et al. (2022) remarked that traditional performance indicators possess numerous drawbacks due to variations in accounting methods, including depreciation methods, inventory valuation, goodwill amortisation, and accrual-based accounting. Furthermore, accounting indicators like residual income and accounting-based returns, developed for measuring financial companies' performance, have also faced criticism for their failure to consider the total cost of capital utilised and their inability to estimate real economic returns (Alshehadeh et al., 2022; Alzoubi et al., 2021).

Therefore, there is an increasing recognition of the necessity for a more comprehensive method to measure the performance of financial firms, such as econometric models. This study advocates for efficiency and productivity as performance indicators, as they can accommodate multidimensional inputs and outputs, unlike traditional indicators that typically rely on single-input, single-output measures. Consequently, the following hypotheses are proposed:

H1: There is a significant difference in efficiency between Takaful operators and conventional insurers in Malaysia.

H2: There is a significant difference in productivity between Takaful operators and conventional insurers in Malaysia.

2.2.4.2 Shariah Committee Size

The Shariah committee plays a pivotal role in advising and supervising the operations of Takaful operators, encompassing crucial areas such as product development, investment strategies, and distribution channels. Their appointment by the board of directors is

underscored by the necessity of possessing profound knowledge in business operations and the Takaful industry (Mohamad Yusof & Ab. Rashid, 2021). According to Karbhari et al. (2018), the Shariah committee holds significant importance in fostering public trust and offering legitimacy to ongoing business practices. Furthermore, resource dependency theory posits that larger Shariah committees bring a diverse range of perspectives, knowledge, competence, and abilities, which can be instrumental in supporting Takaful operators.

However, a larger Shariah committee may present notable challenges, particularly in navigating Islamic regulations and decision-making processes. Among these challenges is the considerable cost associated with establishing and maintaining the Shariah committee (Albalawi, 2019). For instance, the expanded operational costs incurred by Takaful operators due to additional resources and funding required for oversight and review activities are ultimately passed on to customers, resulting in higher premiums. Moreover, the stringent Shariah governance imposed by the committee may impede the innovation and development of new Takaful products (Parveen et al., 2019), placing Takaful operators at a competitive disadvantage vis-à-vis conventional insurer.

Considering these dynamics, the alternative hypothesis posits:

H3a: The size of the Shariah committee significantly influences the efficiency of insurance firms.

H3b: The size of the Shariah committee significantly influences the productivity of insurance firms.

2.2.4.3 Board Size.

The impact of board size on the efficiency of insurance firms has been a widely discussed issue in the current literature (Karbhari et al., 2018; Kusmayadi et al., 2022). The board of directors plays a crucial role in overseeing the firm's management team, with the goal of maximising shareholder wealth. According to resource dependency theory, larger board sizes offer a wider

range of expertise and competencies, facilitating enhanced compliance monitoring and reducing the likelihood of inefficiency and financial fraud within insurance firms (Lee et al., 2019). These assertions find support in the studiess of Abebe Zelalem et al. (2022) and Alhassan et al. (2021), which indicate a positive correlation between board size and firm performance.

However, the potential drawbacks associated with larger boards warrant attention (Karbhari et al., 2018). The presence of free riders within a greater board may lead to diminished insurer performance (Karbhari et al., 2018b). Moreover, larger boards may face challenges in making timely and efficient decisions (Ardianto & Sukmaningrum, 2020). As the number of board members increases, the coordination of ideas and goals becomes more complex, potentially resulting in decision-making delays that hinder the firm's ability to respond effectively to market or regulatory shifts. In line with this, Kiptoo et al. (2021) suggest that smaller firms demonstrate superior performance compared to larger ones.

Therefore, the alternative hypothesis posited is:

H4a: Board size significantly impacts the efficiency of insurance firms.

H4b: Board size significantly impacts the productivity of insurance firms.

2.2.4.4 Ratio of men in the Board of directors & Ratio of men in the Shariah committee

Research conducted by Sanad and Al Lawati (2023) underscored the importance of women's presence on boards for firm performance, citing psychological, physiological, and behavioural differences between genders. This inclusion of women is believed to reduce risk-taking tendencies within the insurance sector, prompting a more vigilant oversight role in protecting stakeholders' interests (Nduati Kariuki, 2023). This finding resonates with resource dependency theory, advocating for gender diversity on boards to enrich perspectives, knowledge, competence, and capabilities within firms.

However, contrary evidence from Pavić Kramarić et al. (2018) suggests a potential negative impact of women on insurance firm performance when represented on the board of directors. Given the divergence in findings, the hypothesis formulated is:

H5a: The ratio of men on the board of directors significantly influences the efficiency of insurance firms.

H5b: The ratio of men on the board of directors significantly influences the productivity of insurance firms.

Besides, resource dependency theory suggests that the involvement of women in the Shariah committee provides diverse perspectives on knowledge, competence, and abilities to the firm, stemming from psychological, physiological, and behavioural differences between genders. This diversity fosters comprehensive discussions and enhances decision-making within the firm. The hypothesis formulated is as follows:

H6a: The ratio of men on the Shariah committee significantly influences the efficiency of insurance firms.

H6b: The ratio of men on the Shariah committee significantly influences the productivity of insurance firms.

2.2.4.5 Ratio of non-executive directors on the board of directors

Karbhari et al. (2018) argued that a higher proportion of non-executive directors on the board can reduce conflicts of interest between managers and shareholders, thereby alleviating agency problems. This heightened oversight is believed to enhance managerial accountability and reputation in the corporate sphere, potentially leading to increased future compensation. Consequently, the formulated hypothesis is as follows:

However, Alhassan et al. (2020) and Lee et al. (2019) identified a inverse relationship between the proportion of non-executive directors on the board and insurer efficiency. This is attributed to non-executive directors potentially demonstrating excessive risk aversion in making company decisions, ultimately leading to a deterioration in firm efficiency. Therefore, an alternative hypothesis is proposed:

H7a: The ratio of non-executive directors significantly influences the efficiency of insurance firms.

H7b: The ratio of non-executive directors significantly influences the productivity of insurance firms.

2.2.4.6 Listed or non-listed

Being listed on Bursa Malaysia enhances insurers' visibility, public and investor relations, and access to external funding, thereby reducing their cost of capital and increasing the liquidity of their securities. These benefits are align with the findings of Le et al. (2020), who demonstrated that listing positively impacts firm performance.

However, Claessens and Tzioumis (2006) found contrasting results, indicating that non-listed companies exhibit better performance compared to listed ones. This disparity may be attributed to the potential negative impact of stringent listing rules and regulations on the performance of financial institutions.

H8a: Listing on Bursa Malaysia significantly influences the efficiency of insurance firms.

H8b: Listing on Bursa Malaysia significantly influences the productivity of insurance firms.

2.2.4.7 Other control variables

There are numerous firm-specific factors that can influence firm efficiency. To refine our analysis, we control for the effects of firm size, macroeconomic factors, and international diversification through foreign participation.

Studies by researchers such as Karbhari et al. (2018) indicate that larger firm sizes tend to exhibit higher efficiency levels. This can be attributed to larger firms being able to reduce their average costs due to economies of scale arising from fixed costs (Lee, Cheng, Nassir, et al., 2019).

Macroeconomic factors, such as GDP, play a crucial role in impacting firm efficiency. A higher GDP indicates a robust economy in Malaysia, resulting in increased ownership of insurance policies. However, elevated inflation rates can lead to decreased underwriting profit due to a surge in claims (Karbhari et al., 2018b), consequently affecting the efficiency of insurance firms.

Foreign participation is often linked to enhanced efficiency owing to substantial capital and experience in superior markets (Lee, Cheng, Nassir, et al., 2019). However, it is worth considering that their efficiency may diminish as they navigate local regulatory frameworks, presenting challenges compared to local insurance firms. As a result, local insurers have a level playing field to compete with their foreign counterparts.

2.3 Conceptual Framework

presents the research framework for this study, which focuses on assessing the efficiency differences between conventional insurers and Takaful operators in Malaysia. Efficiency is categorized into technical efficiency, scale efficiency, and pure technical efficiency. DEA is employed as the primary methodology for evaluating firm efficiency and comparing the two types of insurers. The second objective is to investigate the productivity variations between Takaful operators and conventional insurers, with a focus on metrics such as changes in pure technical efficiency, scale efficiency, and technological efficiency. To achieve this, the MPI is used to assess and compare productivity levels.

The third objective of this research explores the relationship between corporate governance features and the performance of Malaysia's insurance sector, using panel data regression analysis. The governance attributes analyzed include SHARIAH, R_SMEN, BOARD, R_BMEN, NON_EX, and LISTED. Additional control variables include LNSIZE, GDP, and FOREIGN.

This objective is divided into two key sub-objectives. The first aims to investigate the connection between corporate governance characteristics and the efficiency of conventional insurers in Malaysia. The second focuses on exploring how corporate governance attributes influence the productivity of Takaful operators in Malaysia.

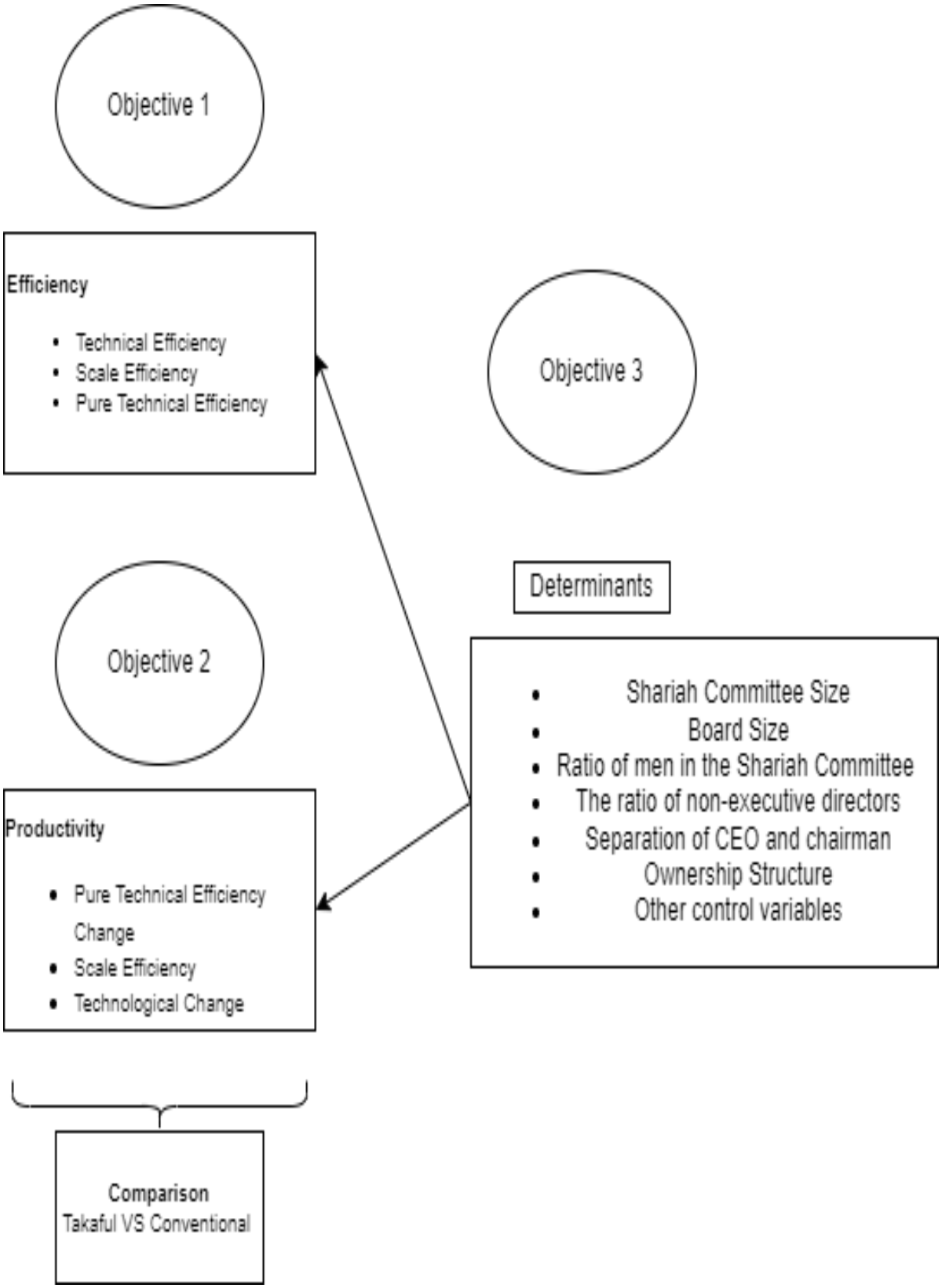

Figure 2.3 Research Framework (Author's summarization)

2.4 Summary

Variables	Hypothesis
Efficiency	H1: Efficiency is significantly different between Takaful operators and conventional insurers in Malaysia.
Productivity	H2: Productivity is significantly different between Takaful operators and conventional insurers in Malaysia.
Shariah Committee Size	H3a: The size of the Shariah committee significantly influences the efficiency of insurance firms. H3b: The size of the Shariah committee significantly influences the efficiency of insurance firms.
Board Size	H4a: Board size significantly impacts the efficiency of insurance firms. H4b: Board size significantly impacts the productivity of insurance firms.

Ratio of men in the Board of directors	H5a: The ratio of men on the board of directors significantly influences the efficiency of insurance firms. H5b: The ratio of men on the board of directors significantly influences the productivity of insurance firms.
Ratio of men in the Shariah committee	H6a: The ratio of men on the Shariah committee significantly influences the efficiency of insurance firms. H6b: The ratio of men on the Shariah committee significantly influences the productivity of insurance firms.
The ratio of non-executive directors	H7a: The ratio of non-executive directors significantly influences the efficiency of insurance firms. H7b: The ratio of non-executive directors significantly influences the productivity of insurance firms.
Listed or non-listed	H8a: Listing on Bursa Malaysia significantly influences the efficiency of insurance firms.

	H8a: Listing on Bursa Malaysia significantly influences the productivity of insurance firms.
Other control variables	For this analysis, we control the effect of the firm size, macroeconomic factors, and international diversification with foreign participation

CHAPTER 3

METHODOLOGY

3.0 Introduction

This chapter outlines the data collection process and the computation of efficiency and productivity measures using Data Envelopment Analysis (DEA) and the Malmquist Productivity Index (MPI). Additionally, it explores the second-stage analysis, which involves Multivariate Panel Regression using Ordinary Least Squares (OLS), the Random Effects (RE) model, and the Fixed Effects (FE) model.

3.1 Efficiency

3.1.1 Data Envelopment Analysis (DEA)

Two prominent frontier efficiency methods commonly employed by researchers and practitioners to assess the efficiency of insurance firms are stochastic frontier analysis (SFA) and data envelopment analysis(DEA) (Kaffash et al., 2020). Eling and Luhnen (2010b) study and summarize the frontier efficiency methodologies used by other academics and practitioners to study the performance of the insurance industry. They find that 55 studies out of 95 studies use the DEA whereas 22 out of 95 studies use the stochastic frontier analysis.

This research adopts a non-parametric approach, specifically employing DEA, to investigate the operational efficiency of both conventional and Takaful insurance entities, which constitutes the first objective of this study. This choice is grounded in the manifold advantages offered by DEA. Firstly, DEA yields a singular efficiency score for each Decision-Making Unit (DMU), facilitating the rank ordering of DMUs within the sample. Furthermore, it directs attention towards precise areas wherein individual DMUs have the potential for enhancement.

For instance, when evaluating a DMU in relation to a cluster of proficient DMUs with similar input-output structures, the evaluated DMU can discern whether it has engaged inputs disproportionately or if its output generation has been suboptimal. Lastly, the approach empowers the derivation of insights pertaining to the overarching profile of the DMUs.

DEA is a non-parametric approach that assesses DMUs by benchmarking them against the most efficient producers. It employs linear programming techniques to transform inputs into outputs. There are two fundamental types of DEA: CCR model, which assumes constant returns to scale, and the BCC model, which operates under the assumption of variable returns to scale. Assuming there are N firms each producing K outputs while using M inputs. The input technical efficiency measure for the jth firm, referred to as a Decision-Making Unit (DMU; j = 1, 2, ..., N), is formulated as follows:

$$Eff_j = \min \theta_j \qquad (3.1.1)$$

In the condition that: $X\lambda_j \geq \theta_j x_j$ (3.1.2)

$$Y\lambda_j \geq y_j \qquad (3.1.3)$$

$\lambda_\alpha \geq 0$ (j = 1, 2, 3, …., N) (3.1.4)

Y represents a K×N output matrix, and X denotes an M×N input matrix for all firms in the sample. The variable yj is a K×1 output vector, while xj is an M×1 input vector for the jth firm, and kj is an N×1 intensity vector for the jth DMU.

3.1.1.1 Input and Output

This study uses the thumb rule introduced by William et al. (2007) to select the number of inputs and outputs. The thumb rule is as below:

$$n \geq max\{m \times s, 3(m + s)\}$$

where n is the number of decision-making units, m is the total inputs and s is the total outputs.

The definition and quantification of inputs and outputs within the insurance function are topics of ongoing debate among scholars. This study adopts a comprehensive framework involving three distinct inputs and three corresponding outputs to assess efficiency. The inputs selected encompass labour, business services, materials, equity capital, and capital debt. Notably, Kaffash et al. (2020) highlight that labour was utilised as an input in 60.72% of insurance-related studies, while capital debt was employed in 49.18% of the cases, and equity capital constituted an input in 37.7% of the studies. As a result, this investigation aligns with this prevailing trend by incorporating three specific input variables: (i) Labour, business services, and materials, (ii) Equity capital, and (iii) Capital debt. The proxies for these three input variables are as follows: operating expenses (X1), total equity (X2), and total liabilities (X3).

In the literature on the insurance industry, three widely used output approaches are the value-added approach, financial intermediary approach, and production approach. Kaffash et al. (2020) reported that 68% of studies on insurance efficiency utilised the value-added approach, while 10% employed the financial intermediary approach. Additionally, 2.5% of the studies applied both the value-added and financial intermediary approaches, and the production approach was used in 3% of the cases. For the output variables, this study adopts the value-added approach, which involves risk pooling and risk transfer mechanisms. This approach provides a more realistic assessment of how successfully insurers manage and disperse risks, considering the total value provided by insurance coverage. Based on the value-added approach, insurers provide three key services: (i) risk pooling for Takaful operators and risk-bearing for conventional insurers, (ii) intermediation, and (iii) financial services associated with insured losses (Kaffash et al., 2020). For the risk-pooling or risk-bearing service, customers pay a premium to the insurers in exchange for the services. If any defined losses happened, the fund is used to compensate the policyholders. Under the intermediation services, insurers used the premium collected as a fund to invest in a reliable investment product. Conventional insurers

are free to choose any type of investment instrument, but the Takaful operators can only invest in Shariah-compliant investment instruments. The insurers provide financial services to the policyholders or participants including life planning or design of coverage programme. Hence, the output variables in this study are premium collected (Y1), total investment (Y2), and claims by policyholders (Y3). Table 3.1 summarises the inputs and outputs selected for this study.

Table 3.1 Summary of Inputs and Outputs

Inputs	**Proxy**
Labours, Materials and Business Services	Operating Expenses
Debt	Total Liabilities
Equity	Total Asset
Outputs	**Proxy**
Risk Pooling/Risk Bearing	Premium/ Contributions collected
Intermediation	Total Investment
Financial Service	Total claim or life benefits

3.1.2 Efficiency Comparison

The following steps are performed to compare the efficiency between conventional insurers and Takaful operators.

1) Compute the efficiency score of conventional insurers and Takaful operators separately from 2013, 2014, …, and 2021, respectively.

In this step, we compute the efficiency score for each year for both conventional insurers and Takaful operators. We need to calculate the efficiency score for each year for both conventional insurers and Takaful operators, starting from 2013 and ending in 2021. This will give us a time series of efficiency scores for both types of insurers.

2) Compute the overall efficiency score from 2013 to 2021 for conventional and Takaful operators. The Takaful and conventional insurers chosen for comparison are those that survive from 2013 to 2021.

3) Interpret and compare the efficiency score for conventional and Takaful operators.

3.2 Productivity

3.2.1 Malmquist Productivity Index (MPI)

There are various methods available to assess the productivity scores of insurance firms in Malaysia, including the Malmquist Productivity Index, the Tornqvist-Theil Productivity Index, and the Fare-Primont Index (FPI). However, this study selects the Malmquist Productivity Index for several reasons. Firstly, it does not necessitate the assumptions of cost minimization and profit maximization. Secondly, the approach does not require data on input and output prices. Lastly, it allows for the decomposition of productivity changes into EFFCH and TECHCH.

The MPI is a non-parametric approach for comparing a set of firms' efficiency over time by measuring the distance between their production frontiers. The MPI is based on the DEA approach and can be applied to estimate and identify the causes of productivity change between two periods.

The Malmquist productivity index is a metric that assesses changes in productivity over time. The formula for the output-oriented MPI, assuming constant returns to scale between time t and time t+i, is given below:

$$MPI_0\left(x^t, y^t, x^{t+i}, y^{t+i}\right) = \left(\frac{\theta_0^t\left(x^{t+i}, y^{t+i}\right)}{\theta_0^t\left(x^t, y^t\right)} \times \frac{\theta_0^{t+i}\left(x^{t+i}, y^{t+i}\right)}{\theta_0^{t+i}\left(x^t, y^t\right)}\right)^{\frac{1}{2}} \qquad (3.2.1)$$

where x^t and y^t are input vector and output vector, $\theta_0^t(x^t, y^t)$ means that the distance between time t and time t+1. If the value of $MPI_0\left(x^t, y^t, x^{t+i}, y^{t+i}\right)$ is more than one, it implies that the

TFP increases over the period. If the value of $MPI_0(x^t, y^t, x^{t+i}, y^{t+i})$ is less than one, it suggests that the TFP decreases over the period.

The formula can be further decomposed to

$$MPI_0(x^t, y^t, x^{t+i}, y^{t+i}) = \frac{\theta_0^t(x^t,y^t)}{\theta_0^{t+i}(x^{t+i},y^{t+i})} \times \left(\frac{\theta_0^{t+i}(x^{t+i},y^{t+i})}{\theta_0^t(x^{t+i},y^{t+i})} \times \frac{\theta_0^{t+i}(x^t,y^t)}{\theta_0^t(x^t,y^t)}\right)^{\frac{1}{2}} \quad (3.2.2)$$

Where

$\frac{\theta_0^t(x^t,y^t)}{\theta_0^{t+i}(x^{t+i},y^{t+i})}$ refer to technical efficiency change (TEC)

$\left(\frac{\theta_0^{t+i}(x^{t+i},y^{t+i})}{\theta_0^t(x^{t+i},y^{t+i})} \times \frac{\theta_0^{t+i}(x^t,y^t)}{\theta_0^t(x^t,y^t)}\right)$ refer to technological change (TC)

3.2.2 Productivity Comparison

To compare the productivity between conventional insurers and Takaful operators, the following steps are undertaken:

1. Compute the Productivity Scores Annually:
    - Calculate the productivity scores for conventional insurers and Takaful operators for each year from 2013-2014, 2014-2015, ..., and 2020-2021.
    - This involves determining the productivity score for each year for both conventional and Takaful operators, starting from 2004-2005 and ending in 2020-2021. This will provide a time series of productivity scores for both types of insurers.
    - If the number of conventional and Takaful operators differs between years, select the insurers that exist in both years. For instance, if there are 53 conventional insurers and 4 Takaful operators in 2006, and 54 conventional insurers and 8 Takaful operators in 2007, then for comparing the productivity scores between 2006-2007, use the 53 conventional and 4 Takaful operators that existed in both years.

2. Compute the Overall Productivity Scores from 2004 to 2021:
    - Calculate the overall productivity scores for conventional and Takaful operators from 2004 to 2021.
3. Interpret and Compare the Productivity Scores:
    - Use both parametric tests (t-test) and non-parametric tests (Mann-Whitney test and Kruskal-Wallis test) to interpret and compare the productivity scores for conventional and Takaful operators.

3.3 Tests for the Difference in Efficiency and Productivity Between Conventional Insurance and Takaful

The efficiency and productivity of Takaful operators and conventional insurers are compared using both parametric (t-test) and non-parametric tests (Mann-Whitney and Kruskal-Wallis tests). Utilising both parametric and non-parametric tests addresses the concern of constructing common frontiers for small and large insurers. According to Sufian (2011), both parametric t-tests and non-parametric tests (Mann-Whitney and Kruskal-Wallis tests) are effective in addressing the issue of common frontier construction for small and large banks. Similarly, Lee et al. (2018) employed these three tests, as proposed by Sufian (2011), to study the efficiency differences between family Takaful and general Takaful insurance. Consistent with the methodologies of Sufian (2011) and Lee et al. (2018), this study employs all three significant tests to ensure robust results.

The t-test used in this study is an independent two-sample t-test. An independent two-sample t-test compares the means of the two samples. There are six assumptions for this test (Verma & Abdel-Salam, 2019). First, the dataset collected must be free from outliers. Second, the data collected from dependent variables must be continuous. Third, the data must be collected randomly. Fourth, the data on dependent variables in each group must be normally distributed

or approximately normally distributed. Fifth, the variability of the data must be the same and lastly, the data in each group must be independent.

The equation for the two-sample t-test is presented below:

$$t = \frac{\overline{x_1} - \bar{x}_2}{\sqrt{(s^2(\frac{1}{n_1} + \frac{1}{n_2})}} \quad (3.3.1)$$

In this equation, t signifies the t-value, while x_1 and epresent the means of the two groups under comparison. The term s^2 indicates the pooled standard error for the groups, and n_1 and n_2 refer to the number of observations in each group. A higher t-value implies that the difference between the group means is greater than the pooled standard error, suggesting a significant difference between the groups.

Meanwhile, the Mann-Whitney test is the alternative to the parametric two-independent samples t-test. It is based on the mean ranks or median of the two samples (Verma & Abdel-Salam, 2019). To use the Mann-Whitney test, the data must be collected from two independent random variables. This test helps to differentiate the difference between the two distributions of the random variables. The location of the distribution is different between the groups, but the shape of the distribution is assumed to be the same. As for the dependent variables, they cannot be normally distributed but ordinal or continuous is allowed.

To evaluate the difference between the rank sums associated with the first sample, the test statistic U can be calculated as follows:

$$U = N_1 . N_2 + N_1 (N_1+1) – R_1 \quad (3.3.2)$$

Where, N_1 and N_2 denote the sizes of the two samples, while R_1 denotes the sum of ranks assigned to the values of the first sample. For convenience in calculations, N_1 is designated as the first sample when the sizes of the samples are unequal, specifically when $N_1 \leq N_2$. The sampling distribution of the U test statistic can be closely approximated by a normal distribution, with the mean (μU) calculated as $N_1.N_2/2$ and a standard deviation (ϭU) given by

[$N_1.N_2$ (N_1 + N_2 + 1)/12]1/2. The z-value is then computed using the formula: Z = (U - µU)/ ϭU, , which can be compared to the relevant z-table to draw conclusions based on the hypothesised assumptions.

Likewise, to determine the difference between the rank sums of the second sample, the U test statistic can be computed using the sum of ranks for that sample as shown below:

$$U = N_1.\ N_2 + N_2\ (N_2+1) - R_2 \qquad (3.3.3)$$

Where, N1 and N2 refer to the sizes of the samples, and R2 indicates the sum of the ranks assigned to the values of the second sample.

The Kruskal-Wallis test is an alternative test to the parametric one-way analysis of variance (ANOVA) used to compare one variable in two or more groups. It is an extension of the Mann-Whitney test, which is used to test the differences in the group distribution of each independent group. Similar to one-way ANOVA (Verma & Abdel-Salam, 2019), to use this test, there are three requirements. First, the data must be obtained from more than two independent random samples. Second, the dependent variables should be ordinal or continuous. Third, the observation is not allowed to overlap between groups, it must be independent.

The test statistic H is calculated using the following method:

$$H = \frac{12}{N\ (N+1)} \sum_{j=1}^{k} \frac{R_j^2}{N_j} - 3\ (N + 1) \qquad (3.3.4)$$

where, N signifies the total size of all ‘k’ samples combined, expressed as N = N_1 + N_2 +…….+ N_k, while R_j represents the sum of the ranks allocated to the ‘k’ samples, expressed as R_j = R_1 + R_2 + ….. + R_k. The sample sizes are indicated by N_j. The sampling distribution of H can be approximated by a chi-square distribution with (k-1) degrees of freedom, given that the total sample size is at least 5 and there are no tied ranks. In cases where ties are present among the

observations, the H value must be adjusted accordingly; however, these corrections are typically too minor to influence the decision-making process.

If the computed H-value is within the chi-square critical value for (k-1) degrees of freedom at a designated significance level, the null hypothesis is accepted. In contrast, if the computed H-value surpasses the tabulated chi-square value at that significance level, the null hypothesis is rejected.

3.4 Effect of Corporate Governance on Efficiency and Productivity of conventional and Takaful operators

To investigate the impact of corporate governance characteristics on the efficiency and productivity of insurers in Malaysia (Objective 3), this study employs regression analysis to assess the relationship between these attributes and the performance of the insurance sector in Malaysia. Initially, a multivariate panel model is estimated using Ordinary Least Squares (OLS), followed by Random Effects (RE) and Fixed Effects (FE) regressions in the second stage. If the Breusch-Pagan (BP) test and the Lagrangian Multiplier (LM) test are rejected, the FE or RE model is preferred. Furthermore, if the Hausman test is rejected, FE is favored over RE. Backward stepwise regression and adjusted R-squared are also utilized to determine the best-fitting model. For robustness, sensitivity analysis is conducted by substituting technical efficiency with accounting indicators, such as Return on Assets (ROA). This analysis seeks to reinforce the findings by highlighting the importance of profitability for investors in insurance firms.

The independent variables examined in this research include the existence of the Shariah Committee Size (SHARIAH), the ratio of men in the Shariah Committee (R_SMEN), board size (BOARD), the ratio of men in the board of directors (R_BMEN), the ratio of non-executive directors (NON_EX), and Listed or non-listed (LISTED). Additionally, other control variables

included firm size (LNSIZE), gross domestic product (GDP), and foreign participation (FOREIGN). The model for the regression analysis is as follows.

$$TE_{it} = \beta_0 + \beta_1 \ln \text{SHARIAH}_{it} + \beta_2 \ln \text{R\_SMEN}_{it} + \beta_3 \ln \text{BOARD}_{it} + \beta_4 \ln \text{R\_BMEN}_{it} + \beta_5 \ln \text{NON\_EX}_{it} + \beta_6 \ln \text{LISTED}_{it} + \beta_7 \ln \text{LNSIZE}_{it} + \beta_8 \ln \text{GDP}_{it} + \beta_9 \ln \text{FOREIGN}_{it} + \varepsilon_{it} \quad (3.4.1)$$

$$TFP_{it} = \beta_0 + \beta_1 \ln \text{SHARIAH}_{it} + \beta_2 \ln \text{R\_SMEN}_{it} + \beta_3 \ln \text{BOARD}_{it} + \beta_4 \ln \text{R\_BMEN}_{it} + \beta_5 \ln \text{NON\_EX}_{it} + \beta_6 \ln \text{LISTED}_{it} + \beta_7 \ln \text{LNSIZE}_{it} + \beta_8 \ln \text{GDP}_{it} + \beta_9 \ln \text{FOREIGN}_{it} + \varepsilon_{it} \quad (3.4.2)$$

where i refers to insurers, t refers to years, and ε refers to the error term.

As overall efficiency can be divided into scale efficiency (SE) and pure technical efficiency (PTE), this study examines the impact of corporate governance variables and other control variables on both types of efficiency. This differentiation is essential, as not all insurers attain both forms of efficiency; some may face challenges in operating at an optimal scale. The regression analysis model is detailed in the following section.

$$PTE_{it} = \beta_0 + \beta_1 \ln \text{SHARIAH}_{it} + \beta_2 \ln \text{R\_SMEN}_{it} + \beta_3 \ln \text{BOARD}_{it} + \beta_4 \ln \text{R\_BMEN}_{it} + \beta_5 \ln \text{NON\_EX}_{it} + \beta_6 \ln \text{LISTED}_{it} + \beta_7 \ln \text{LNSIZE}_{it} + \beta_8 \ln \text{GDP}_{it} + \beta_9 \ln \text{FOREIGN}_{it} + \varepsilon_{it} \quad (3.4.3)$$

$$SE_{it} = \beta_0 + \beta_1 \ln \text{SHARIAH}_{it} + \beta_2 \ln \text{R\_SMEN}_{it} + \beta_3 \ln \text{BOARD}_{it} + \beta_4 \ln \text{R\_BMEN}_{it} + \beta_5 \ln \text{NON\_EX}_{it} + \beta_6 \ln \text{LISTED}_{it} + \beta_7 \ln \text{LNSIZE}_{it} + \beta_8 \ln \text{GDP}_{it} + \beta_9 \ln \text{FOREIGN}_{it} + \varepsilon_{it} \quad (3.4.4)$$

where i refers to insurers, t refers to years, and ε refers to the error term.

Moreover, total factor productivity can be broken down into technical efficiency change (TEC) and technological change (TC). This study further investigates the impact of corporate governance variables and other control variables on both TEC and TC. The subsequent section presents the regression analysis model.

$$TEC_{it} = \beta_0 + \beta_1 \ln \text{SHARIAH}_{it} + \beta_2 \ln \text{R\_SMEN}_{it} + \beta_3 \ln \text{BOARD}_{it} + \beta_4 \ln \text{R\_BMEN}_{it} + \beta_5 \ln \text{NON\_EX}_{it} + \beta_6 \ln \text{LISTED}_{it} + \beta_7 \ln \text{LNSIZE}_{it} + \beta_8 \ln \text{GDP}_{it} + \beta_9 \ln \text{FOREIGN}_{it} + \varepsilon_{it} \quad (3.4.5)$$

$$TC_{it} = \beta_0 + \beta_1 \ln \text{SHARIAH}_{it} + \beta_2 \ln \text{R\_SMEN}_{it} + \beta_3 \ln \text{BOARD}_{it} + \beta_4 \ln \text{R\_BMEN}_{it} + \beta_5 \ln \text{NON\_EX}_{it} + \beta_6 \ln \text{LISTED}_{it} + \beta_7 \ln \text{LNSIZE}_{it} + \beta_8 \ln \text{GDP}_{it} + \beta_9 \ln \text{FOREIGN}_{it} + \varepsilon_{it} \quad (3.4.6)$$

where i refers to insurers, t refers to years, and ε refers to the error term.

Additionally, technical efficiency change can be categorized into PTC and SEC. This study also examines how corporate governance variables, along with other control variables, impact both PTC and SEC. The following outlines the regression analysis model used.

$$PTC_{it} = \beta_0 + \beta_1 \ln \text{SHARIAH}_{it} + \beta_2 \ln \text{R\_SMEN}_{it} + \beta_3 \ln \text{BOARD}_{it} + \beta_4 \ln \text{R\_BMEN}_{it} + \beta_5 \ln \text{NON\_EX}_{it} + \beta_6 \ln \text{LISTED}_{it} + \beta_7 \ln \text{LNSIZE}_{it} + \beta_8 \ln \text{GDP}_{it} + \beta_9 \ln \text{FOREIGN}_{it} + \varepsilon_{it} \quad (3.4.7)$$

$$SEC_{it} = \beta_0 + \beta_1 \ln \text{SHARIAH}_{it} + \beta_2 \ln \text{R\_SMEN}_{it} + \beta_3 \ln \text{BOARD}_{it} + \beta_4 \ln \text{R\_BMEN}_{it} + \beta_5 \ln \text{NON\_EX}_{it} + \beta_6 \ln \text{LISTED}_{it} + \beta_7 \ln \text{LNSIZE}_{it} + \beta_8 \ln \text{GDP}_{it} + \beta_9 \ln \text{FOREIGN}_{it} + \varepsilon_{it} \quad (3.4.8)$$

where i refers to insurers, t refers to years, and ε refers to the error term.

3.4.1 Shariah Committee Size (SHARIAH)

SHARIAH denotes the total number of members within the Shariah committee of an Islamic financial institution (BenSaid, 2023). This committee plays a crucial role in guaranteeing that the institution's operations, products, and services align with Islamic law (Shariah). This includes reviewing and approving financial transactions, advising on the development of new products, and providing guidance on Shariah-related matters.

3.4.2 Board Size (BOARD)

The variable BOARD denotes the overall number of directors on an insurance firm's board (Sallemi, 2023). The board of directors comprises individuals elected to asist shareholders and oversee the management and governance of the organisation.

3.4.3 Ratio of Male Directors on the Board of Directors. (R_BMEN)

The formula for R_BMEN is as below (Sallemi, 2023):

$$\text{Ratio of Male Directors} = \frac{Total \text{ Male Directors on the Board of Directors}}{Total\ directors\ in\ board} \quad (3.4.9)$$

3.4.4 Ratio of Male members in Shariah Committee (R_SMEN)

The formula for the variable R_SMEN is as below:

$$\text{Ratio of Male Shariah Committee} = \frac{Total \text{ Male members in Shariah Committee}}{Total\ member\ in\ Shariah\ Committee} \quad (3.4.10)$$

3.4.5 The Ratio of Non-Executive Directors (NON_EX)

The formula for NON_EX is as below (Sallemi, 2023):

$$\text{Ratio of non} - \text{executive director} = \frac{Total\ non{-}executive\ directors\ in\ board}{Total\ directors\ in\ board} \quad (3.4.11)$$

Where an executive director is a company employee who is actively involved in the day-to-day operations of the organisation, while a non-executive director is not an employee and does not participate in the company's operational activities.

3.4.6 Listed or non-listed (LISTED)

LISTED is represented by a dummy variable indicating whether an insurance company is publicly listed on Bursa Malaysia, the country's stock exchange (Doidge et al., 2004). This variable is binary, taking the value of one if the company is listed and zero if it is not.

3.4.7 Other control variables

Some other variables that are found to affect the firm performance other than corporate governance need to be included in the model to avoid model misspecification. For this analysis, we control the effect of firm size, macroeconomic factors, and international diversification on foreign participation. Firm size is determined by the total assets of the insurance companies (Onsongo et al., 2020). As or the macroeconomic factors, Malaysia's GDP and consumer price index are included in the model (Meher & Zewudu, 2020). For foreign participation, the dummy value for insurers with foreign participation is one and vice versa (Lee et al., 2019). Table 3.2 summarizes definitions of the proxies of the variables.

Table 3.2 Proxies of the variables

Variables	Proxy
LNSIZE	Total Asset of the insurers (RM)
GDP	Malaysia GDP (RM)
FOREIGN	Dummy (Foreign Participation = 1, Non-Foreign Participation = 0)

Table 3.3 summarizes definitions of the variables for the proposed regression analysis.

Table 3.3 Proxies of the other variables

Variables	Proxy
SHARIAH	Number of members in the Shariah Committee
BOARD	Number of Directors on the Board
R_BMEN	Number of male directors / Total directors on the Board
R_SMEN	Number of male Shariah committee members / Total Shariah committee members
NON_EX	Non-Executive Directors divided by Total Directors on the Board
LISTED	Dummy (Listed in Bursa Malaysia = 1, Non-listed in Bursa Malaysia = 0)

3.5 Data Sources

This study uses data from 59 conventional insurers and 29 Takaful operators in Malaysia from 2013 to 2021. The study takes into account all the insurance companies that were operational at any point during the study period, including those that merged or exited the market and new entrants. The data collected including the input (operating expenses, total assets and total liabilities), output (premium collected, total investment, total claim or life benefit) and the determinant for the third objective (Shariah committee size, the ratio of men on the Shariah committee, board size, the ratio of men on the board of directors, the ratio of non-executive directors on the board of directors, and Listed or non-listed and data for other variables). The

data start from 2013 because it is extended period post the implementation of digital transformation, artificial intelligence, and regulatory compliance. The data from Takaful operators and conventional insurers are analysed separately to compare the efficiency and productivity of the from Takaful operators and conventional insurers. This study excludes the banking industry and reinsurance companies to maintain the study's homogeneity. This study utilises secondary data sourced from the annual reports of Bank Negara Malaysia (BNM) and Insurance Service Malaysia statistical yearbook.

Table 3.4 summarises the total number of Takaful operators and conventional in Malaysia from 2013 to 2021. A consolidation trend is evident in the conventional insurance sector, with the number of insurers decreasing from 38 in 2013 to 35 in 2021. Similarly, the number of Takaful operators has decreased from 20 in 2013 to 15 in 2021. According to the international rating agency Fitch, this consolidation may be attributed to local players needing to enhance their efficiency and resilience (Olano, 2017).

Table 3.4 Summary of Conventional Insurers and Takaful operators in Malaysia

Year	Total Conventional Insurer	Total Takaful operators	Total
2013	38	20	58
2014	37	20	57
2015	37	19	56
2016	36	19	55
2017	35	19	54
2018	36	21	57
2019	35	18	53
2020	35	15	50
2021	35	15	50

Source: Insurance Service Malaysia statistical yearbook

Table 3.5 Summary of Insurers sampled

Company	Type
CIMB Aviva Takaful Berhad	General Takaful
Etiqa Takaful Berhad	General Takaful
Hong Leong MSIG Takaful berhad	General Takaful
HSBC Amanah Takaful (Malaysia) Sdn Bhd	General Takaful
MAA Takaful Berhad	General Takaful
Prudential BSN Takaful Berhad	General Takaful
Sun Life Malaysia Takaful Berhad	General Takaful
STMAB	General Takaful
Syarikat Takaful Malaysia Berhad	General Takaful
Takaful Ikhlas General Bhd	General Takaful
Takaful Ikhlas Sdn Bhd	General Takaful
Zurich Takaful	General Takaful
Zurich GT	General Takaful
AIA AFG Takaful Bhd	Family Takaful
AIA PUBLIC Takaful Bhd	Family Takaful
AmFamily Takaful Berhad	Family Takaful
CIMB Aviva Takaful Berhad	Family Takaful
Etiqa Takaful Berhad	Family Takaful
FWD Takaful	Family Takaful
Great EaStern Takaful Sdn Bhd	Family Takaful
Hong Leong MSIG Takaful berhad	Family Takaful
HSBC Amanah Takaful (Malaysia) Sdn Bhd	Family Takaful
ING PUBLIC Takaful Ehsan Bhd	Family Takaful
MAA Takaful Berhad	Family Takaful
Prudential BSN Takaful Berhad	Family Takaful
Sun Life Malaysia Takaful Berhad	Family Takaful
Syarikat Takaful Malaysia Berhad	Family Takaful
Takaful Ikhlas Sdn Bhd	Family Takaful
Zurich Takaful	Family Takaful
AIA Bh+A30:A81d	General conventional
AIA General Berhad	General conventional
AIG Malaysia Insurance Berhad	General conventional
ACE Synergy Insurance Berhad	General conventional
Aviva Insurance Berhad	General conventional
Asia Insurance (Malaysia) Berhad	General conventional
Allianz General Insurance Company (M) Berhad	General conventional
American International Assurance Bhd	General conventional
AmGeneral Insurance Berhad	General conventional
AXA Affin General Insurance Berhad	General conventional
Berjaya Sompo Insurance Berhad	General conventional
Chubb Insurance Malaysia Berhad	General conventional
Chartis Malaysia Insurance Berhad	General conventional
Etiqa Insurance Berhad	General conventional
Great Eastern General Insurance (Malaysia) Berhad	General conventional
Liberty Insurance Berhad	General conventional

ING Inxurance Berhad	General conventional
Jerneh Insurance Berhad	General conventional
Kurnia Insurans (Malaysa) Berhad	General conventional
Lonpac Insurance Bhd	General conventional
Malaysian Assurance Alliance Berhad	General conventional
MCIS Zurich Insurance Berhad	General conventional
Mitsui Sumitomo Insurance (Malaysia) Bhd	General conventional
MPI General Insurans Berhad	General conventional
MSIG Insurance (Malaysia) Bhd	General conventional
MUI Continental Insurance Berhad	General conventional
Multi-Purpose Insurans Bhd	General conventional
Oriental Capital Assurance Corporation (Malaysia) Berhad	General conventional
Overseas Assurance Corporation (Malaysia) Berhad	General conventional
Pacific & Orient Insurance Co. Berhad	General conventional
Pacific Insurance Berhad (The)	General conventional
PanGlobal Insurance Berhad	General conventional
Progressive Insurance Berhad	General conventional
Prudential Assurance Malaysia Berhad	General conventional
QBE Insurance (Malaysia) Berhad	General conventional
RHB Insurance Berhad	General conventional
Tokio Marine Insurans (M) Berhad	General conventional
TUNE Insurance Malaysia Berhad	General conventional
Uni.Asia General insurance Berhad	General conventional
Zurich General Insurance Malaysia Berhad	General conventional
AIA Bhd	Life Conventional
Allianz Life Insurance Malaysia Berhad	Life Conventional
AmLife Insurance Berhad	Life Conventional
AmMetLife Insurance Berhad	Life Conventional
AXA Affin Life Insurance Berhad	Life Conventional
CIMB Aviva Assurance Berhad	Life Conventional
Etiqa Insurance Berhad	Life Conventional
Gibraltar BSN Life Berhad	Life Conventional
Great Eastern Life Assurance (Malaysia) Berhad	Life Conventional
Hong Leong Assurance Berhad	Life Conventional
Manulife Insurance Berhad	Life Conventional
MCIS Insurance Berhad	Life Conventional
Prudential Assurance Malaysia Berhad	Life Conventional
Sun Life Malaysia Assurance Berhad	Life Conventional
Tokio Marine Life Insurance Malaysia Bhd	Life Conventional
Uni.Asia Marine Life insurance Berhad	Life Conventional
Zurich Insurance Malaysia Berhad	Life Conventional
Asia Life (M) Berhad	Life Conventional
Commerce Life Assurance Bhd	Life Conventional

3.6 Summary

Data			
This study uses data from 59 conventional insurers and 29 Takaful operators in Malaysia from 2013 to 2021.			
Methodology			
	Objective 1	Objective 2	Objective 3
Method	• Data Envelopment Analysis (DEA)	• Malmquist Productivity Index(MPI)	• Panel Regression (Ordinary Least Square, Random Effect, Fixed Effect)
Variables	• Inputs: Labours, Materials and Business Services, Debt, Equity • Outputs: Risk Pooling/Risk Bearing, Intermediation, Financial Service	• Inputs: Labours, Materials and Business Services, Debt, Equity • Outputs: Risk Pooling/Risk Bearing, Intermediation, Financial Service	• Shariah Committee Size (SHARIAH) • The ratio of men in the Shariah Committee (R_SMEN) • Board Size (BOARD) • The ratio of men in the board of directors (R_BMEN)

			• The ratio of non-executive directors (NON_EX) • Listed or non-listed (LISTED) • Other variables
Test	Parametric Test • t-test Non-parametric Test • Mann-Whitney (Wilcoxon) test • Kruskal-Wallis test	Parametric Test • t-test Non-parametric Test • Mann-Whitney (Wilcoxon) test Kruskal-Wallis test	Preliminary Test • Breush Pagan (BP) test • Lagrangian Multiplier (LM) test • Hausman test Robustness Check • Sensitivity Analysis (ROA)

CHAPTER 4

RESULT

4.0 Introduction

This chapter commences by computing the efficiency of 74 insurers in Malaysia using DEA (Objective 1). Following this, it delves into the productivity scores of these insurers in Malaysia using MPI (Objective 2). Subsequently, the chapter presents the results from parametric and non-parametric tests conducted to compare the efficiency and productivity scores of conventional insurers and Takaful operators. A correlation analysis is included to confirm the absence of multicollinearity issues within the model. Additionally, this chapter includes the results from panel regression tests that analyse the relationship between corporate governance attributes and efficiency/productivity. It investigates the connection between corporate governance and the various components of efficiency and productivity. Lastly, a robustness check is performed to confirm the consistency and stability of the findings.

4.1 Descriptive analysis

The descriptive statistics for the inputs and outputs of the Malaysian insurance industry are presented in Table 4.1. Firstly, the total assets of the Malaysian insurance industry increased from RM2.75 billion in 2013 to RM7.24 billion in 2021, representing nearly a 263% increase. Secondly, the premium collected from the Malaysian public throughout this period indicates increasing public awareness of the importance of insurance. Between 2013 and 2021, total premiums collected, and claims increased by about 238% and around 194%, respectively. The significant increase in total premiums received implies that the Malaysian insurance market is expanding significantly. This expansion could be fuelled by a variety of factors, including an

expanding economy, greater disposable income, and heightened public awareness of the significance of insurance. The surge in claims, a 194% increase, can be attributed to the heightened severity and urgency of illnesses being treated and claimed, along with the added expenses incurred due to COVID-19 pandemic-related measures, including COVID-19 testing in laboratories and increased utilisation of disposable medical supplies (Bank Negara Malaysia, 2021). This development may reflect a rising appreciation for the importance that insurance provides in protecting against financial losses caused by unexpected catastrophes.

Thirdly, the Malaysian insurance sector has witnessed a substantial increase in its investments during this period. Over the past nine years, its total investments have surged by almost 238%. This trend may imply that insurers are using investments to secure enduring expansion and fulfil extended financial objectives, ultimately serving the interests of policyholders and shareholders. Lastly, the average operating expenses of Malaysian insurers rose by over 232% throughout the research period, climbing from RM 128.41 million in 2013 to RM 298.73 million in 2021. The substantial rise in operating expenses suggests that the cost of doing business for Malaysian insurers has significantly increased over the research period.

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4.2 Pearson Correlation

Table 4.2 displays the Pearson correlation matrix for these variables. The correlations presented in Table 4.2 are generally low, with the highest correlation of 0.37 found between FOREIGN and R_SMEN. As all correlation coefficients are below 0.8, there is no indication of significant multicollinearity in this model (Kennedy, 2003). To further confirm this, we assessed the variance inflation factors (VIF) for each variable, with all values below 10 (Ayyangar, 2007). This provides additional support for our conclusion regarding the absence of significant multicollinearity issues based on the correlation values.

Table 4.1 Descriptive Statistics for Inputs and Outputs

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Output									
Premium Collected									
Min (million)	5.16	7.39	7.39	7.17	6.24	.00	.00	49.45	49.47
Mean (million)	560.23	647.34	875.47	935.80	1000.73	1023.79	1207.65	1257.80	1335.13
Max (million)	6378.33	6655.73	7006.66	7567.25	7598.13	8617.73	8631.75	9020.24	9450.18
S.D (million)	929.67	997.47	1456.89	1557.33	1613.62	1730.16	1878.57	1957.54	1989.99
Total Investment									
Min (million)	.00	.00	.00	.00	.00	.00	.00	16.82	21.72
Mean (million)	2241.07	2586.55	3479.59	3727.72	4214.16	4125.00	4868.54	5460.28	5680.74
Max (billion)	61.53	64.83	54.43	55.94	62.78	63.27	66.48	69.51	69.58
S.D (billion)	8.56	9.11	8.98	9.38	10.48	10.37	11.45	12.31	12.37
Total claim or life benefits									
Min (million)	.00	.00	.16	.00	.00	.00	.00	20.78	17.84
Mean (million)	384.47	460.08	541.37	581.14	626.14	749.61	763.83	758.14	745.36
Max (million)	5959.04	7446.71	5224.87	5947.16	6211.34	6911.33	7156.40	7103.38	6195.57
S.D (million)	858.56	1072.93	998.38	1085.96	1156.19	1231.62	1361.95	1356.62	1265.13
Inputs									
Operating									
Expenses									
Min (million)	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mean (million)	128.41	144.92	205.95	225.53	257.64	236.58	266.55	278.05	298.72
Max (million)	1298.04	1336.14	1431.60	1529.28	1643.67	1738.92	1720.99	1768.11	2236.53
S.D (million)	200.73	212.40	318.31	342.22	368.45	377.87	391.31	399.19	460.99
Total									
Liabilities									
Min (million)	18.26	21.45	.00	24.38	27.14	7.12	.00	280.71	380.90
Mean (million)	2745.07	3083.36	4541.27	4855.01	5336.91	5263.73	6231.46	6989.47	7244.74
Max (billion)	63.47	66.86	69.35	72.28	78.65	80.32	86.11	88.98	89.48
S.D (billion)	8.84	9.40	11.22	11.80	12.91	12.89	14.46	15.51	15.72
Total Asset									
Min (million)	18.26	21.45	0.00	24.38	27.14	7.12	0.00	280.71	380.90
Mean (million)	2745.07	3083.36	4541.27	4855.01	5336.91	5263.73	6231.46	6989.47	7244.74
Max (billion)	63.47	66.86	69.35	72.28	78.65	80.32	86.11	88.98	89.48
S.D (billion)	8.84	9.40	11.22	11.80	12.91	12.89	14.46	15.51	15.72

Table 4.2 Pearson Correlation Matrix

	SHARIAH	R_SMEN	BOARD	R_BMEN	NON_EX	LISTED	LNSIZE	GDP	FOREIGN	VIF
SHARIAH	1.00									1.17
R_SMEN	0.10	1.00								1.65
BOARD	-0.1	0.14*	1.00							1.51
R_BMEN	0.08*	0.18*	0.28	1.00						1.26
NON_EX	0.03*	0.10*	0.14	0.07	1.00					1.26
LIST	0.23	0.25*	0.03	-0.01	0.14	1.00				1.76
LNSIZE	0.26*	0.12*	-0.03	-0.17	0.00	0.05*	1.00			1.44
GDP	0.08*	-0.14	-0.30	-0.28	-0.19	-0.03	0.23*	1.00		1.77
FOREIGN	0.02*	0.37*	-0.27	-0.08	-0.13	-0.30	0.12*	-0.01	1.00	1.90

Note: Symbols ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

4.3 Efficiency

The efficiency results of both conventional insurers and Takaful operators operating in Malaysia, obtained through the application of the DEA approach, are presented in Table 4.3. Panels A to I show the results for the respective years from 2013 to 2021. Moreover, the scope of the study is broadened to include the efficiency evaluation of solely conventional insurers (Panel J), exclusively Takaful operators (Panel K), and a unified common frontier for all insurers—both Takaful and conventional (Panel L). Based on the findings related to the main objective of this study, which is to assess operational efficiency within the insurance industry, Malaysian insurers achieved an average overall efficiency score of 81.04% in 2013 (Panel A). This score decreased to 75.69% in 2014 (Panel B) and further declined to 72.94% in 2015 (Panel C). Subsequently, a gradual increase was observed, resulting in an overall efficiency of 81.50% in 2016 (Panel D) and an even higher 85.60% in 2017 (Panel E). This trend fluctuated, with a decrease to 80.62% in 2018 (Panel F), followed by a peak of 86.42% in 2019 (Panel G), but then saw declines to 84.63% and 84.56% in 2020 (Panel H) and 2021 (Panel I), respectively.

Table 4.3 Summary Statistics of Efficiency Measure

Efficiency measures	(Panel A) 2013	(Panel B) 2014	(Panel C) 2015	(Panel D) 2016	(Panel E) 2017	(Panel F) 2018	(Panel G) 2019	(Panel H) 2020	(Panel I) 2021	(Panel J) Conventi-onal	(Panel K) Takaful	(Panel L) Overall Sample Period
TE												
Mean	0.810	0.756	0.729	0.815	0.856	0.806	0.864	0.846	0.845	0.788	0.865	0.814
Minimum	0.508	0.408	0.286	0.183	0.420	0.312	0.538	0.484	0.503	0.183	0.299	0.183
Maximum	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Std. Dev.	0.156	0.180	0.204	0.179	0.136	0.169	0.133	0.123	0.129	0.159	0.165	0.164
PTE												
Mean	0.862	0.823	0.850	0.872	0.899	0.865	0.919	0.909	0.908	0.851	0.937	0.878
Minimum	0.513	0.469	0.295	0.389	0.438	0.312	0.570	0.604	0.633	0.295	0.469	0.295
Maximum	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Std. Dev.	0.155	0.180	0.165	0.160	0.135	0.151	0.110	0.113	0.108	0.148	0.123	0.147
SE												
Mean	0.943	0.924	0.856	0.933	0.953	0.930	0.939	0.931	0.931	0.924	0.925	0.926
Minimum	0.626	0.408	0.299	0.341	0.587	0.560	0.688	0.585	0.522	0.471	0.299	0.299
Maximum	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Std. Dev.	0.083	0.105	0.156	0.123	0.070	0.106	0.082	0.080	0.092	0.095	0.131	0.106

Note: TE represents overall efficiency, PTE represent pure technical efficiency and SE represent the scale efficiency.

Efficiency scores of the Malaysian insurance industry from 2013 to 2021, overall efficiency scores for both conventional insurers and takaful operators as well as the average efficiency score over the sample period are presented in Table 4.3. The mean scores for Total Efficiency (TE), Pure Technical Efficiency (PTE), and Scale Efficiency (SE) among conventional insurers in Malaysia stand at 78.8%, 85.1%, and 92.4%, respectively. In contrast, Takaful operators exhibit scores of 86.5%, 93.7%, and 92.5% for TE, PTE, and SE, respectively. The study showed that the average overall technical efficiency for conventional insurers in Malaysia was 78.8 %, while Takaful operators demonstrated a higher efficiency of 86.5%. In alternative terms, it can be stated that within the study timeframe, conventional insurers could have achieved equivalent levels of output by utilising only 78.8% of their current inputs. In a similar vein, it is plausible that Takaful operators could have achieved a reduction of 13.5% in the number of inputs they currently utilise while maintaining the current level of outputs they produce. This divergence underscores that Takaful operators in Malaysia achieve greater efficiency compared to their conventional counterparts. In light of the inclusion of administrative and compliance costs within our input variable, operating expenses, our study underscores a notable disparity in efficiency among insurers. The main reason behind this difference is the substantial non-productive expenses incurred by conventional insurance companies, particularly administrative and compliance costs, which have negatively affected their overall technical efficiency. Takaful operators, conversely, place a heightened emphasis on risk-sharing principles among their participants, fostering a more transparent and collaborative framework for risk management. Such a framework can reduce the need for extensive compliance mechanisms aimed at ensuring fair practices, as the inherent structure promotes ethical behaviour and mutual trust. As a result, this orientation may lead to a reduction in specific administrative and compliance costs. This finding broadly supports the

work of Mohamed and Elgammal (2023) in their investigation of Islamic and conventional microfinance firms.

The findings for all insurance companies across all years generally support the view that scale efficiency is the primary determinant of efficiency of Malaysian insurers. From 2013 to 2021, Malaysian insurers have demonstrated an average overall (technical) efficiency of 81.4%. Deconstructing this overall efficiency score into its core components, specifically regarding pure technical efficiency and scale efficiency, reveals that the primary source of inefficiency is linked to pure technical efficiency (12.2%), rather than being rooted in scale-related efficiency (7.4%). Pure technical efficiency pertains to a company's capacity to optimise input utilisation through the adoption of cutting-edge technology. Hence, it is apparent that Malaysian insurers can enhance their operational efficiency by embracing technology-driven solutions in their insurance pricing and claims procedures. This proposition finds support in initiatives like the peer-to-peer insurance model proposed by the Chief Executive of the Malaysian Insurance Institute, which holds promise for integration within the realm of insurance technology (Lee et al., 2019). By leveraging community-based risk pooling and digital platforms, P2P insurance can achieve more accurate risk assessments, lower operational costs, and consequently, reduced premiums for policyholders. Additionally, the use of AI, blockchain, and peer verification mechanisms streamlines claims procedures, enhancing efficiency, transparency, and reducing fraud. This innovative model promises to revolutionise traditional insurance practices, aligning with the broader trend of digitisation in financial services and delivering substantial benefits to both insurers and insureds.

4.4 Productivity

Table 4.4 presents the annual means of TFPCH, TECHCH, EFFCH, PECH and SECH for the years 2013 through 2021. Since 2013 serves as the reference year, the Malmquist TFPCH index

and all of its constituent parts begin with a score of 1. Consequently, Any rating above (below) 1 in subsequent years signifies an improvement (decline) in the corresponding measure.

The results shown in Panel 1 of Table 4.4, reveal that Malaysia insurer's productivity grew in the years 2014 before experiencing a decline starting 2015 to 2016. Compared to the year 2013, the improvement in productivity of conventional insurers was 8.0% in 2014, then decreasing gradually each year by 5% until 2016 but increased by 2% in 2017, remained constant in 2018 and declined by 9% productivity in 2019. However, the productivity change improved by 91% in 2020 and remained unchanged in 2021. The breakdown of the productivity change index into technological change and efficiency change indicates that the improvement of insurers' productivity in our study period is mainly due to the technological efficiency increased by 13%. In contrast, the efficiency changes of the conventional insurers in Malaysia slightly declined by 1% in the overall study period.

The breakdown of the efficiency change index into the scale efficiency and pure technical efficiency shows that the decline in efficiency change of Takaful operators in our study period is scale related. The results reveal that scale efficiency change over the study period decreased by 1%, but the pure technical efficiency remained unchanged over the study period.

The results shown in Panel 2 of Table 4.4, suggest that Malaysia's conventional insurer's productivity grew between the years 2013 and 2014 before experiencing a decline starting 2015 to 2018. Compared to the year 2013, the improvement in productivity of conventional insurers was 2.0% in 2014, then decreasing gradually each year by 10%, 2%, 2% and 3% to 2018 but increased by 2% in 2019, remains constant in 2020 and drop 1% productivity in 2021. The breakdown of the productivity change index into technological change and efficiency change indicates that the decline in productivity among conventional insurers during our study period is primarily attributed to a 3% drop in efficiency. In contrast, the technological change of the

conventional insurers in Malaysia still shows the 2% increments in the overall study period, since it shows a positive impact every year in our study period except in 2016 and 2019.

The breakdown of the efficiency change index into the scale efficiency and pure technical efficiency shows that the decline in efficiency change of conventional insurers in our study period is scale related. The results indicate that pure technical efficiency change over the study period remains unchanged even though the score of pure technical efficiency remains unchanged in 2016 and 2021. In contrast, the decline of scale efficiency from 2013 to 2016 by 7%, 10% and 1% respectively, mainly contributed to the 2% drop in scale efficiency over the study period. The scale efficiency shows a positive increment of 1% each year from 2017 to 2019 but dropped from 2020 to 2021 by 3% and 1% respectively.

The results shown in Panel 3 of Table 4.4, suggest that Malaysia's Takaful operator's productivity experienced a positive growth between the years 2013 and 2021 except the years 2016 and 2019. Even though the productivity change of Takaful operators declined in 2016 and 2019 by 9% and 34%, the productivity change for the Takaful operators still experienced a 35% growth. The breakdown of the productivity change index into technological change and efficiency change indicates that the growth of Takaful operators' productivity in our study period is mainly due to the technological improvement of 38%. In contrast, the efficiency change of Takaful operators in Malaysia had a limited impact on the productivity change of these operators during the study period since there is only a 1% decrement in the overall study period.

The breakdown of the efficiency change index into the scale efficiency and pure technical efficiency shows that the decline in efficiency change of Takaful operators in our study period is in contrast with all insurers in Malaysia, which is pure technical related. The results show that pure technical efficiency change over the study period decreased by 1%, but the scale efficiency remained unchanged over the study period.

Table 4.4 Decomposition of Total Factor Productivity Change (TFPCH) in Malaysian Insurance Industry, 2014-2021

	Indices				
	Productivity Change (TFPCH)	**Technological Change (TECHCH)**	**Efficiency Change (EFFCH)**	**Pure Technical Efficiency Change (PEFFCH)**	**Scale Efficiency Change (SECH)**
			Panel 1: All Insurers		
2013-2014	1.08	1.19	0.91	0.94	0.97
2014-2015	0.95	1.04	0.95	1.04	0.93
2015-2016	0.95	0.97	0.99	1.00	0.98
2016-2017	1.02	1.00	1.04	1.02	1.02
2017-2018	1.00	1.03	0.97	0.97	1.00
2018-2019	0.91	0.86	1.07	1.05	1.01
2019-2020	1.91	1.94	0.96	0.98	0.97
2020-2021	1.00	1.00	1.00	1.00	1.00
Mean	**1.10**	**1.13**	**0.99**	**1.00**	**0.99**
			Panel 2: Conventional Insurers		
2013-2014	1.02	1.21	0.85	0.91	0.93
2014-2015	0.90	1.01	0.93	1.04	0.90
2015-2016	0.97	0.97	1.00	1.00	0.99
2016-2017	0.98	1.00	0.98	0.98	1.01
2017-2018	0.98	1.00	0.98	0.98	1.01
2018-2019	1.02	0.94	1.09	1.08	1.01
2019-2020	1.00	1.03	0.96	0.98	0.97
2020-2021	0.99	1.00	0.99	1.00	0.99
Mean	**0.98**	**1.02**	**0.97**	**1.00**	**0.98**
			Panel 3: Takaful Operators		

2013-2014	1.15	1.17	1.00	0.97	1.03
2014-2015	1.04	1.09	0.99	1.04	0.97
2015-2016	0.91	0.97	0.96	1.01	0.96
2016-2017	1.00	0.96	1.05	1.01	1.04
2017-2018	1.03	1.09	0.94	0.95	0.99
2018-2019	0.66	0.66	1.01	1.00	1.01
2019-2020	4.02	4.09	0.95	0.98	0.97
2020-2021	1.01	0.99	1.02	0.99	1.03
Mean	**1.35**	**1.38**	**0.99**	**0.99**	**1.00**

Note: The average scores of the TFPCH index and its components, including TECCH and EFFCH, are further classified into PEFFCH and SECH for all insurers and for various types of insurers (conventional and Takaful).

4.5 Comparison of Efficiency

The second aim of this research delves into a comparative analysis of efficiency between conventional insurers and Takaful operators operating in the Malaysian insurance landscape. To scrutinise this hypothesis, we deploy a combination of statistical tests, including a parametric t-test and two non-parametric assessments, specifically the Kolmogorov-Smirnov and Mann-Whitney tests. The null hypothesis tested is that the conventional insurers and Takaful operators have the same level of efficiency. The outcomes, meticulously detailed in Table 4.5, lead us to reject the null hypothesis at a 0.05 level of significance. Consequently, our findings assert the presence of a substantial disparity in efficiency between conventional insurers and Takaful operators. This observation aligns harmoniously with the insights gleaned from ,where Takaful operators displayed a technical efficiency (TE) of 86.5%, while their conventional counterparts registered a TE of 78.8%. Collectively, our research findings unveil a higher level of efficiency among Takaful operators when compared to their conventional counterparts within the Malaysian insurance domain. Our findings diverge from those of Abu

Al-Haija and Houcine (2023), who reported that there is no notable difference in risk management performance between Takaful operators and conventional insurance companies in Saudi Arabia and the United Arab Emirates.

Table 4.5 Summary of Parametric and Non-parametric Tests

	Parametric test	Non-parametric test	
Individual tests	t-test	Kolmogorov-Smirnov test	Mann-Whitney test
Hypotheses	$Mean_T = Mean_C$	$distribution_T = distribution_C$	$Median_T = Median_C$
Test statistics	t (Prb > t)	K-S (Prb > K-S)	z (Prb > z)
Overall Efficiency	4.577 (-0.072)	3.660 (0.001)	-5.733 (0.001)
Pure Technical Efficiency	6.238 (0.085)	4.732 (0.001)	-8.018 (0.001)
Scale Efficiency	-0.451(-0.005)	3.456 (0.001)	-3.596 (0.001)

Note: Both parametric (t-test) and non-parametric (Kolmogorov-Smirnov and Mann-Whitney) tests are used to examine the null hypothesis that the efficiency of Takaful and conventional insurers is similar. The numbers in brackets represent the p-values of the relative test.

The higher efficiency of Takaful operators suggests that they may have a competitive advantage over conventional insurers in the Malaysian market. This advantage can be attributed to the unique characteristics and Shariah principles of Takaful, which align with the ethical and religious beliefs of a significant portion of the Malaysian population. Additionally, since Takaful operators are relatively new compared to conventional insurers, they have not yet grown too large, thereby avoiding resource wastage. Their smaller size compels Takaful operators to work within the resources available to them, leading to a better utilisation rate (Antonio et al., 2013). Thus, the focus on mutuality and risk-sharing in Takaful may contribute to this efficiency by encouraging a more conservative approach to insurance operations.

4.6 Comparison of Productivity

The second objective is tested by using a parametric (t-test) and two non-parametric (Kolmogorov-Smirnov and Mann-Whitney). According to the results shown in Table 4.6, the t-test and Kolmogorov-Smirnov test reject the null hypothesis at the 0.05 levels of significance,

but the Mann-Whitney test does not reject the null hypothesis. Since two out of three tests rejected the null hypotheses at the 0.05 levels of significance, the result of the study implies that there is significant difference between conventional insurers and Takaful operators in terms of productivity. Table 4.6 reveals that Takaful operators possess 1.35 total factor productivity, which is higher than the productivity level of conventional insurers (0.98). One of the possible reasons is that the conventional insurers "lack of a learning-by-doing effect". Conventional insurers in Malaysia more resources to possess the advanced technology, but they do not utilize the full benefit of the technology. Conventional insurers typically possess more financial and human resources compared to Takaful operators, enabling them to invest heavily in advanced technology. Anbar and Eker (2010) highlight that larger, more established firms often have the financial capacity to acquire sophisticated technological systems. However, these firms may suffer from organisational inertia, which impedes their ability to adapt swiftly to new technologies. Hannan and Freeman (1984) explain that established firms frequently resist change due to entrenched routines and processes, resulting in the underutilisation of new technological advancements.

Table 4.6 Summary of parametric and non-parametric tests

Test group			
	Parametric test	Non-parametric test	
Individuals Tests	T-test	Kolmogorov-Smirnov test	Mann-Whitney test
Hypotheses	MeanC = MeanT	distributionC= distributionT	MedianC = MedianT
Test Statistics	t (Prb > t)	K-S (Prb > K-S)	z (Prb > z)
TFPCH	-2.200 (0.028)	1.842 (0.002)	-1.83 (0.138)
TECHCH	-1.194 (0.235)	1.52 (0.02)	-0.876 (0.381)
EFFCH	-1.184 (0.239)	1.747 (0.004)	-0.931 (0.352)
PEFFCH	-0.454 (0.650)	1.883 (0.002)	-0.572 (0.568)
SECH	0.981 (0.327)	2.99 (0.00)	-1.923 (0.054)

Note: Both parametric (t-test) and non-parametric (Kolmogorov-Smirnov and Mann-Whitney) tests are used to examine the null hypothesis that the productivity of Takaful and conventional insurers are similar. The figures in parentheses indicate the p-values associated with the relative test.

4.7 Result of Breusch-Pagan (BP) test and the Lagrangian Multiplier (LM) test & Hausman Test

The interpretation of model diagnostics such as the Breusch-Pagan (BP) test, the Lagrangian Multiplier (LM) test, and the Hausman test guides the selection between pooled Ordinary Least Squares (OLS), Fixed Effects (FE), and Random Effects (RE) models. For Technical Efficiency, the BP and LM tests do not reject the null hypothesis, indicating that the pooled OLS model is sufficient, with no need to adopt panel data models. Similarly, for Scale Efficiency, Total Factor Productivity, Technical Efficiency Change, Technological Change, Scale Efficiency Change, and Pure Technical Change, the BP and LM tests consistently fail to reject the null hypothesis, suggesting that the pooled OLS model remains appropriate in these cases.

In contrast, for Pure Technical Efficiency, the BP and LM tests reject the null hypothesis, indicating that the pooled OLS model is inadequate, necessitating the use of a panel model. The Hausman test, however, does not reject the null hypothesis, favouring the RE model over the FE model due to its efficiency under these conditions. This nuanced approach to model

selection ensures that the most suitable econometric framework is chosen based on the statistical evidence, with the pooled OLS model being retained in most cases, and the RE model preferred where panel data models are required.

Table 4.7 BP LM TEST & HAUSMAN TEST

Model	Breusch-Pagan (BP) & Lagrangian Multiplier (LM) test	Hausman test
Technical Efficiency	Do not reject	*Not aplicable
Pure Technical Efficiency	Reject	Do not reject
Scale Efficiency	Do not reject	*Not aplicable
Total Factor Productivity	Do not reject	*Not aplicable
Technical Efficiency Change	Do not reject	*Not aplicable
Technological Change	Do not reject	*Not aplicable
Scale Efficiency Change	Do not reject	*Not aplicable
Pure Technical Change	Do not reject	*Not aplicable

4.8 Effect of Corporate Governance on Efficiency of conventional and Takaful operators

4.8.1 Regression results for Technical Efficiency

The second stage of our panel regression findings, tabulated in Table 4.8, provides insights into how corporate governance characteristics and control variables influence the overall efficiency of Malaysian insurers. We opted for OLS based on the results of the Breusch Pagan Lagrangian Multiplier test, affirming its suitability for our analysis. Model 6, distinguished by its higher adjusted R-squared value compared to other models, is considered more reliable for interpreting the results.

Our analysis will centre on Model 6 due to its superior adjusted R-squared value, indicating a better explanatory fit of the model to the data. Within Model 6, several notable findings shed light on the nuanced relationship between corporate governance factors and overall efficiency in the Malaysian insurance industry.

Firstly, the positive and significant coefficient of SIZE suggests that greater firm size contribute to enhanced overall efficiency. This finding consistent with previous study by Alhassan &

Boakye (2020), further substantiating the positive association between firm size and efficiency in the insurance sector. In the context of this analysis, the positive coefficient for SIZE indicates that larger insurers may leverage economies of scale, which allows them to allocate fixed costs over a larger volume of business and achieve greater operational efficiencies. Larger firms can leverage their scale to negotiate better terms with suppliers, invest in advanced technology, and improve their risk management capabilities. These firms are also better positioned to absorb the costs of regulatory compliance and invest in talent development, which can lead to better underwriting practices, claims management, and customer service. Furthermore, larger insurance firms may have more diversified portfolios, reducing their overall risk exposure and contributing to more stable performance.

Regarding foreign insurers' presence, the positive and significant coefficient indicates that their participation in the Malaysian insurance market positively impacts overall efficiency. This corroborates the findings of Abdul Razak et al. (2021), underscoring the value that foreign participants bring through their financial resources and risk management expertise, which contribute to overall sector efficiency. Foreign insurers often introduce innovative products and services, driven by their experiences in more competitive and mature markets. They may also bring advanced technologies and managerial practices, which local firms can adopt and adapt. Moreover, the competition introduced by foreign entrants can incentivize local insurers to improve their efficiency and service quality to maintain their market positions.

In contrast, the negative and significant impact of LISTED on overall efficiency is a noteworthy finding of our study. Our analysis suggests that insurance firms listed on Bursa Malaysia experience declines in efficiency, echoing the observations of Atuahene and Xusheng (2024). This decline may stem from increased regulatory scrutiny and reporting obligations associated with being listed, highlighting the complex dynamics between regulatory frameworks and operational efficiency. Listed companies are subject to stringent disclosure requirements,

which can be resource-intensive and divert management attention away from core operations. Additionally, the pressure to meet short-term performance targets set by analysts and investors can lead to suboptimal decision-making, such as underinvestment in long-term projects or excessive risk-taking. The increased visibility and scrutiny can also lead to conservative business strategies, potentially stifling innovation and agility.

Turning to R_SMEN, our analysis reveals a positive but statistically insignificant coefficient. While a higher proportion of males in the Shariah committee may be associated with higher technical efficiency. However, this finding invites further investigation into potential underlying mechanisms—such as the technical expertise and decision-making styles of males, which could enhance committee effectiveness.

One possible explanation for this positive but insignificant relationship is that male members might possess specific technical expertise or experience that contributes to more effective Shariah governance. Additionally, cultural and social dynamics might influence how gender composition affects committee performance. In some contexts, male dominance in leadership roles might lead to a more hierarchical and decisive decision-making process, which could impact the efficiency of Shariah compliance operations.

Table 4.8 Regression Results for Technical Efficiency

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)	(Model 6)	(Model 7)
VARIABLES	TE	TE	TE	TE	TE	TE	TE
GDP	0.000						
	(0.000)						
LNSIZE	0.038***	0.038***	0.039***	0.039***	0.039***	0.039***	0.029***
	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.005)
FOREIGN	0.047	0.046	0.056*	0.055*	0.055*	0.057**	0.019
	(0.031)	(0.030)	(0.030)	(0.030)	(0.030)	(0.028)	(0.016)
LISTED	-0.171***	-0.171***	-0.162***	-0.162***	-0.163***	-0.163***	-0.067***
	(0.033)	(0.032)	(0.031)	(0.031)	(0.030)	(0.030)	(0.019)
NON_EX	-0.020	-0.022					
	(0.121)	(0.117)					

R_BMEN	0.018	0.017	0.007				
	(0.079)	(0.077)	(0.078)				
BOARD	0.002	0.002	-0.002	-0.002	-0.002		
	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)		
R_SMEN	0.047	0.047	0.036	0.038	0.038	0.035	
	(0.069)	(0.069)	(0.070)	(0.068)	(0.068)	(0.065)	
SHARIAH	-0.004	-0.004	-0.003	-0.003			
	(0.017)	(0.017)	(0.017)	(0.017)			
Constant	0.083	0.093	0.079	0.085	0.076	0.061	0.194**
	(0.275)	(0.226)	(0.201)	(0.188)	(0.179)	(0.160)	(0.098)
Observations	142	142	144	144	144	144	473
R-squared	0.336	0.336	0.325	0.325	0.325	0.325	0.111
Adjusted R-squared	0.291	0.296	0.291	0.296	0.301	0.305	0.105

Note: Symbols ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

4.8.2 Regression results for Pure Technical Efficiency

In Table 4.9, the second stage of the panel regression results is presented, aiming to elucidate the impact of corporate governance factors and control variables on the pure technical efficiency of Malaysian insurers. The RE model is selected based on the results of the Hausman test, which indicated its appropriateness for the analysis. Among the models considered, Model 3 emerged as the most reliable, demonstrating consistently higher adjusted R-squared values compared to the other models.

The discussion in this section centres around Model 3 due to its superior adjusted R-squared value, indicating a stronger alignment of the model with the data. Within Model 3, several noteworthy findings regarding the relationship between corporate governance factors and pure technical efficiency are observed.

Firstly, the coefficient of SIZE is positive but statistically insignificant. This suggests that larger insurance firms do not necessarily exhibit better pure technical efficiency. This finding aligns with previous research by Alhassan and Boakye (2020). Possible explanations for this insignificance include the presence of diseconomies of scale, where increased bureaucratic inefficiencies and more complex operational challenges offset potential gains from economies

of scale. As insurance firms grow in size, the layers of management often increase, leading to slower decision-making processes and potentially reducing overall operational efficiency. Additionally, larger firms might have a more intricate organizational structure, which may lead to communication barriers and coordination issues among various departments. Moreover, while larger firms possess more resources, these resources might not always be allocated efficiently. There is a tendency for large organizations to experience resource wastage due to mismanagement or over-investment in non-essential areas. For example, a larger firm may invest heavily in marketing campaigns that do not yield proportional returns, or in technological systems that are underutilized. The challenge lies in the optimal allocation and the effective use of available resources to attain maximum operational efficiency. Furthermore, larger firms might become complacent, relying on their established market presence rather than striving for continuous improvement and innovation, which can adversely impact their technical efficiency.

Similarly, the coefficient associated with foreign insurers' participation is positive yet statistically insignificant. This corroborates the findings of Abdul Razak et al. (2021), indicating that foreign ownership does not have a significant impact on pure technical efficiency. The lack of significance might stem from differences in management practices or regulatory environments that foreign firms encounter in Malaysia, which do not necessarily translate into efficiency gains. Foreign insurers often bring advanced management practices and technologies from their home countries, but these may not be directly applicable or effective in the Malaysian context due to differing regulatory frameworks, market dynamics, and consumer behavior. Additionally, cultural and operational integration challenges might negate potential efficiency advantages brought by foreign ownership. Foreign firms may face difficulties in adapting to local business practices, managing a culturally diverse workforce, and understanding local consumer preferences. These integration challenges can lead to

inefficiencies and offset the potential benefits of foreign ownership. Moreover, the presence of foreign insurers might introduce competitive pressure, prompting local firms to improve their efficiency, but this effect may take time to materialize and may not be immediately reflected in the current analysis.

Interestingly, the gross domestic product (GDP) demonstrates a weak, insignificant positive correlation with pure technical efficiency. This finding aligns with the findings of Karbhari et al. (2018) and suggests that broader economic conditions do positive influence the technical efficiency of insurers. This could be because industry-specific factors, such as regulatory policies, competitive dynamics, and technological advancements, play a more critical role in determining efficiency levels within the insurance sector. For instance, regulatory policies can significantly impact operational processes, compliance costs, and overall efficiency. Competitive dynamics drive firms to innovate and improve their processes, while technological advancements enable firms to streamline operations, reduce costs, and enhance service quality. Furthermore, the insurance industry's performance might be more resilient to macroeconomic fluctuations compared to other sectors. Insurance firms typically operate with long-term perspectives, and their performance may be influenced more by long-term trends and developments within the industry rather than short-term macroeconomic conditions. The impact of GDP on technical efficiency might not be immediate, manifesting over a longer period that is not captured in the current analysis timeframe. Additionally, the nature of insurance products and services, which often involve long-term contracts and risk management strategies, might buffer the industry from immediate macroeconomic shocks.

A notable result emerges regarding the impact of being listed on Bursa Malaysia, which shows a significantly negative association with pure technical efficiency. This finding suggests that listing on Bursa Malaysia may degrade pure technical efficiency among insurers. Possible reasons for this could include the additional regulatory and compliance burdens associated with

being publicly listed, which may divert resources away from efficiency-enhancing activities. The pressure to meet short-term market expectations might also lead to suboptimal decision-making that negatively impacts operational efficiency. Publicly listed companies must comply with strict reporting standards and regulatory obligations, which can be resource-intensive and time-consuming. The need to regularly disclose financial and operational information can divert management's attention from core business activities and strategic initiatives aimed at improving efficiency. The pressure to meet short-term market expectations might also lead to suboptimal decision-making that negatively impacts operational efficiency. Listed firms often face pressure from shareholders and market analysts to deliver consistent quarterly results, which can result in an emphasis on short-term performance, potentially compromising long-term efficiency improvements. This short-termism might result in underinvestment in essential areas such as research and development, employee training, and process improvements. Additionally, the heightened scrutiny from investors and regulators can result in conservative management practices that may hinder innovative and efficiency-enhancing initiatives. Management may become risk-averse, avoiding potentially beneficial but uncertain projects that could enhance long-term efficiency.

Furthermore, the variable NON_EX reveals a negative but statistically insignificant correlation with pure technical efficiency. This aligns with the findings of Alhassan et al. (2020) and Lee et al. (2019), who identified a negative relationship between the ratio of non-executive directors on the board and insurer efficiency. This lack of significance suggests that an increased proportion of non-executive directors on the board does not significantly impact technical efficiency. Non-executive directors typically focus on oversight and governance rather than day-to-day operations, limiting their direct impact on technical efficiency. Their role is to provide strategic guidance, monitor executive management, and ensure that the firm adheres to governance standards, rather than to drive operational improvements. The limited

involvement of non-executive directors in operational matters might explain their minimal influence on operational efficiency improvements. While their oversight function is crucial for maintaining governance standards and ensuring accountability, it may not directly translate into efficiency gains. Moreover, non-executive directors might adopt a more risk-averse stance, prioritizing compliance and risk management over innovative and efficiency-enhancing initiatives. This conservative approach can sometimes stifle the implementation of new strategies and technologies that could improve operational efficiency.

The variable SHARIAH, which reflects the size of the Shariah committee, exhibits a positive yet statistically insignificant effect on pure technical efficiency. This is consistent with the findings of Karbhari et al. (2018) and the resource dependency theory. This suggests that while a larger Shariah committee might be expected to enhance efficiency, this relationship is not supported by significant evidence. The size of the committee alone may not be sufficient to influence efficiency, and other qualitative aspects of the committee's work, such as its effectiveness and the expertise of its members, are more important. The effectiveness of a Shariah committee in guiding and overseeing Shariah compliance relies on the knowledge, experience, and dedication of its members rather than just on their quantity.

Conversely, R_SMEN shows a negative but insignificant effect on pure technical efficiency. This is supported by Sanad and Al Lawati (2023), who underscored the importance of women's presence on boards for firm performance, citing psychological, physiological, and behavioral differences between genders. This suggests that the gender composition of the Shariah committee does not have a significant effect on the firm's pure technical efficiency. The efficiency impact of a Shariah committee is likely more dependent on the expertise and functional dynamics of its members rather than their gender. The overall governance framework and how different committees and boards interact might play a more significant role in influencing technical efficiency. The presence of diverse perspectives and effective

collaboration within the committee and with other governance bodies can enhance decision-making processes and contribute to operational improvements.

Table 4.9 Regression Results for Pure Technical Efficiency

VARIABLES	(1) PTE	(2) PTE	(3) PTE	(4) PTE	(5) PTE	(6) PTE
GDP	-0.000	-0.000	0.000	0.000	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LNSIZE	0.014	0.014	0.013	0.013	0.015	0.015*
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.009)
FOREIGN	0.044	0.046	0.050	0.057	0.059	0.023
	(0.043)	(0.042)	(0.041)	(0.040)	(0.039)	(0.036)
LISTED	-0.099***	-0.100***	-0.100***	-0.107***	-0.107***	-0.038
	(0.035)	(0.035)	(0.034)	(0.036)	(0.035)	(0.035)
NON_EX	-0.031	-0.032	-0.028			
	(0.070)	(0.070)	(0.070)			
R_BMEN	-0.018					
	(0.052)					
BOARD	-0.006	-0.006				
	(0.006)	(0.006)				
R_SMEN	0.002	-0.003	-0.005	0.001	-0.001	
	(0.050)	(0.048)	(0.048)	(0.054)	(0.054)	
SHARIAH	0.013	0.012	0.013	0.012		
	(0.009)	(0.009)	(0.009)	(0.011)		
Constant	0.692***	0.668***	0.598***	0.470**	0.492**	0.393**
	(0.240)	(0.228)	(0.215)	(0.204)	(0.200)	(0.171)
Observations	142	142	142	144	144	473
Number of id	25	25	25	25	25	73
Adjusted R-squared	0.437	0.442	0.446	0.409	0.410	0.123

Note: Symbols ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

4.8.3 Regression results for Scale Efficiency

In Table 4.10, the second stage of the panel regression analysis aims to understand the influence of corporate governance factors and control variables on the scale efficiency of insurers in Malaysia. The choice of using OLS was based on the results of the Breusch Pagan Lagrangian Multiplier test, which indicated its suitability for the analysis. Model 8 is identified as the most

reliable model, primarily due to its higher adjusted R-squared value, indicating that a considerable share of the variation in scale efficiency can be attributed to the variables included, making it a robust choice for the analysis.

Model 8 demonstrates a significant and positive coefficient for gross domestic product (GDP), indicating that as GDP increases, there is a corresponding improvement in scale efficiency among insurers in Malaysia. This finding is align with Karbhari et al. (2018) and suggests that broader economic conditions positively influence the technical efficiency of insurers. According to economic theory and resource dependency theory, a growing economy provides more resources and opportunities, which subsequently improves the operational performance of firms. Specifically, in the insurance sector, a higher GDP often results in increased demand for insurance products and services, enabling insurers to achieve economies of scale. This scenario allows them to distribute fixed costs across a greater volume of business, leading to greater efficiency. Furthermore, a robust economy facilitates investments in advanced technologies and processes that improve operational efficiency, such as sophisticated data analytics and AI. These investments enhance underwriting processes, reduce fraudulent claims, and optimize risk assessment, all contributing to improved scale efficiency. Additionally, a thriving economic environment may lead to more stringent regulatory frameworks and increased competitive pressures, further driving efficiency improvements within the industry.

R_SMEN has been found to have a positive and statistically significant impact on scale efficiency among Takaful operators. This result suggests that a higher representation of men in the Shariah committee is associated with enhanced efficiency. This finding contrasts with the work of Sanad and Al Lawati (2023), who highlighted the importance of women's presence on boards for improved firm performance, emphasizing psychological, physiological, and behavioral differences between genders. One possible explanation for the positive impact of male representation could be the the varied viewpoints and expertise that male members offer

to the committee., which may lead to more effective decision-making and governance practices within Takaful companies. Nevertheless, it is crucial to acknowledge that while the presence of male members may contribute positively, the overall effectiveness of governance structures often benefits from a balanced representation that includes both men and women, ensuring a more comprehensive approach to decision-making and governance.

Table 4.10 Regression Results for Scale Efficiency

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	SE	SE	SE	SE	SE	SE	SE	SE
GDP	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LNSIZE	0.008	0.008	0.008	0.008	0.007	0.007	0.006	
	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	
FOREIGN	0.011	0.013	0.011	0.009				
	(0.027)	(0.024)	(0.023)	(0.022)				
LISTED	0.000							
	(0.029)							
NON_EX	0.035	0.037	0.036					
	(0.107)	(0.103)	(0.102)					
R_BMEN	0.020	0.019						
	(0.069)	(0.068)						
BOARD	0.004	0.004	0.004	0.004	0.002			
	(0.009)	(0.009)	(0.009)	(0.008)	(0.008)			
R_SMEN	0.093	0.096*	0.099*	0.102*	0.112**	0.113**	0.110**	0.117**
	(0.061)	(0.056)	(0.054)	(0.053)	(0.048)	(0.047)	(0.047)	(0.046)
SHARIAH	-0.014	-0.013	-0.012	-0.012	-0.012	-0.013		
	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)		
Constant	0.514**	0.510**	0.535**	0.580***	0.598***	0.628***	0.593***	0.666***
	(0.242)	(0.237)	(0.220)	(0.182)	(0.176)	(0.148)	(0.143)	(0.110)
Observations	142	144	144	146	146	146	146	146
R-squared	0.067	0.068	0.067	0.066	0.065	0.065	0.059	0.055
Adjusted R-squared	0.004	0.013	0.019	0.026	0.032	0.038	0.039	0.041

Note: Symbols ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

4.9 Effect of Corporate Governance on Productivity of conventional and Takaful operators

4.9.1 Regression results for Total Factor Productivity

The second stage of the panel regression findings, as detailed in Table 4.11, provides crucial insights into how corporate governance characteristics and control variables influence the Total Factor Productivity (TFPCH) of Malaysian insurers. Ordinary Least Squares (OLS) was employed based on the results of the Breusch-Pagan Lagrangian Multiplier test, confirming its suitability for the analysis. Model 5, distinguished by its higher adjusted R-squared value compared to other models, is considered the most reliable for interpreting the results. Model 5's superior adjusted R-squared value indicates a better explanatory fit for the data. Several notable findings from Model 5 illuminate the nuanced relationship between corporate governance factors and TFP in the Malaysian insurance industry.

Table 4.11 Regression Results for Total Factor Productivity (TFPCH)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	TFPCH	TFPCH	TFPCH	TFPCH	TFPCH	TFPCH	TFPCH
GDP	-0.004	-0.004	-0.004	-0.002			
	(0.014)	(0.014)	(0.014)	(0.013)			
LNSIZE	0.352	0.352	0.353	0.351	0.332	0.084	0.052
	(0.242)	(0.233)	(0.231)	(0.230)	(0.208)	(0.071)	(0.069)
FOREIGN	-1.300	-1.300	-1.291	-1.239	-1.234	-0.424*	
	(0.839)	(0.828)	(0.794)	(0.750)	(0.747)	(0.236)	
LISTED	-2.086**	-2.087**	-2.081**	-2.075**	-2.046**	-0.444	-0.303
	(0.911)	(0.876)	(0.860)	(0.856)	(0.840)	(0.270)	(0.259)
NON_EX	5.197	5.198	5.199	5.333*	5.409*	2.066*	2.375**
	(3.263)	(3.242)	(3.227)	(3.150)	(3.114)	(1.195)	(1.186)
R_BMEN	-0.081	-0.083					
	(2.106)	(2.051)					
BOARD	-0.055	-0.055	-0.055				
	(0.268)	(0.266)	(0.264)				
R_SMEN	1.964	1.964	1.947	1.867	1.910		
	(1.812)	(1.802)	(1.741)	(1.691)	(1.670)		
SHARIAH	-0.002						
	(0.446)						
Constant	-9.002	-9.008	-9.123	-9.932*	-10.479**	-2.030	-1.918
	(7.585)	(7.420)	(6.828)	(5.602)	(4.855)	(1.732)	(1.737)

Observations	122	122	122	122	122	359	359
R-squared	0.083	0.083	0.083	0.083	0.083	0.024	0.015
Adjusted R-squared	0.010	0.019	0.027	0.035	0.043	0.013	0.007

Note: Symbols ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

Firstly, the positive yet statistically insignificant coefficient for SIZE indicates that larger insurance firms might have the potential to enhance their TFP, which is align with the theory of economies of scale. According to this theory, as firms grow in size, they are expected to achieve greater efficiencies as a result of spreading fixed costs over a larger output and the ability to negotiate better terms with suppliers. This observation consistent with the research findings of Karbhari et al. (2018), which suggest that bigger firms may benefit from economies of scale that contribute to improved technical efficiency.

Regarding the presence of foreign insurers, the negative and insignificant coefficient suggests that their participation in the Malaysian insurance market might negatively impact TFP, though this effect is not statistically significant. This may be attributed to the challenges foreign insurers face in adapting to local market conditions, regulatory environments, and cultural differences, which might offset the potential efficiency gains from their international expertise and advanced technologies. The lack of significance here indicates that while foreign insurers bring valuable practices and technologies, these benefits are not fully realized due to the complexities of operating in a foreign market.

In contrast, the negative and significant influence of LISTED on TFP is a noteworthy finding. This suggests that publicly listed insurance companies may face pressures that adversely affect their productivity. Being publicly listed often entails greater regulatory scrutiny, the need for transparency, and the pressure to meet short-term financial targets set by shareholders. These factors can lead to conservative decision-making, reduced risk-taking, and potentially underinvestment in innovation and efficiency-enhancing practices. This phenomenon can be

explained by agency theory, which highlights the conflicts between management and shareholders. The need to satisfy short-term investor demands can detract from the company's focus on long-term operational efficiency and productivity. Publicly listed companies might prioritize immediate financial performance over strategic investments in technology and process improvements that could yield long-term productivity gains.

NON_EX demonstrates a positive and significant effect on TFP. This is consistent with the findings of Karbhari et al. (2018), which indicated a positive relationship between the proportion of non-executive directors on the board and insurer efficiency. This finding underscores the importance of independent oversight in enhancing firm productivity. Non-executive directors can provide unbiased perspectives, challenge management decisions, and ensure that the company's strategies are aligned with the creation of long-term value. Their independent oversight can lead to better governance practices, reduced agency costs, and more efficient resource allocation, supporting stewardship theory. This theory emphasizes the importance of effective governance and oversight in promoting organizational efficiency and effectiveness. Non-executive directors can help mitigate agency problems by monitoring management actions, thereby ensuring that decisions align with the best interests of the company and its stakeholders. Their presence can also instil greater discipline within the management team, fostering a culture of accountability and continuous improvement.

Lastly, the analysis reveals that R_SMEN has a positive effect, although it is statistically insignificant, on TFP. This finding contrasts with the research by Sanad and Al Lawati (2023), who emphasized the importance of women's presence on boards for improved firm performance, citing psychological, physiological, and behavioral differences between genders. While a higher representation of men in the Shariah committee is associated with increased productivity among Takaful operators, this relationship does not achieve statistical significance. The lack of significance may be due to several factors, including the potential benefits of male

representation such as specific technical expertise and decision-making styles, which may not be fully captured in this analysis.

4.9.2 Regression results for Technical Efficiency Change

The second stage of the panel regression findings, depicted in Table 4.12, provides comprehensive insights into how corporate governance characteristics and control variables influence the technical efficiency change (EFFCH) of Malaysian insurers. OLS was employed based on the results of the Breusch-Pagan Lagrangian Multiplier test, affirming its suitability for the analysis. Model 5, distinguished by its higher adjusted R-squared value, is considered the most reliable for interpreting the results.

Several key findings from Model 5 shed light on the intricate relationship between corporate governance factors and EFFCH in the Malaysian insurance industry, supporting the conclusions of Abdul Razak et al. (2021). The presence of foreign insurers is linked to a positive and significant coefficient, indicating that foreign insurers make a beneficial contribution to EFFCH. This positive effect may stem from the introduction of advanced practices and technologies that improve operational efficiency. Foreign insurers often bring international experience and innovative methodologies that drive efficiency improvements. For instance, they may introduce sophisticated risk assessment tools, cutting-edge underwriting processes, and advanced data analytics capabilities, which can lead to more accurate pricing, better risk management, and overall improved operational efficiencies. These enhancements align with the resource dependency theory, which posits that external resources can significantly enhance organizational performance by providing access to capabilities that may not be readily available within domestic firms.

Table 4.12 Regression Results for Technical Efficiency Change (EFFCH)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	EFFCH	EFFCH	EFFCH	EFFCH	EFFCH	EFFCH	EFFCH	EFFCH	EFFCH

GDP	-0.000								
	(0.001)								
LNSIZE	0.005	0.005	0.004						
	(0.011)	(0.010)	(0.010)						
FOREIGN	-0.071*	-0.069*	-0.071*	-0.073*	-0.068*	-0.030*	-0.027*	-0.031*	-0.026*
	(0.039)	(0.038)	(0.037)	(0.037)	(0.036)	(0.017)	(0.016)	(0.016)	(0.015)
LISTED	-0.033	-0.032	-0.034	-0.032	-0.029	-0.010			
	(0.042)	(0.041)	(0.040)	(0.039)	(0.039)	(0.019)			
NON_EX	-0.148	-0.142	-0.140	-0.138	-0.141	-0.105	-0.110	-0.102	
	(0.152)	(0.148)	(0.147)	(0.147)	(0.146)	(0.086)	(0.085)	(0.084)	
R_BMEN	-0.040	-0.036	-0.041	-0.048					
	(0.098)	(0.096)	(0.093)	(0.091)					
BOARD	0.008	0.009	0.010	0.009	0.008	0.004	0.005		
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.006)	(0.006)		
R_SMEN	0.045	0.045	0.046	0.051	0.042				
	(0.084)	(0.084)	(0.083)	(0.082)	(0.080)				
SHARIAH	-0.005	-0.005							
	(0.021)	(0.021)							
Constant	1.066***	1.021***	1.008***	1.092***	1.066***	1.077***	1.076***	1.101***	1.003***
	(0.353)	(0.273)	(0.267)	(0.160)	(0.152)	(0.080)	(0.080)	(0.074)	(0.012)
Observations	123	123	123	123	123	361	362	362	403
R-squared	0.055	0.055	0.055	0.053	0.051	0.015	0.015	0.013	0.008
Adjusted R-squared	-0.020	-0.011	-0.003	0.004	0.011	0.004	0.006	0.007	0.005

Note: The symbols ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively.

In contrast, the negative and insignificant impact of LISTED on EFFCH indicates that public listing does not significantly negatively affect technical efficiency, echoing the observations of Atuahene and Xusheng (2024). This counterintuitive result could be attributed to the higher regulatory scrutiny and compliance costs associated with listing, which might offset potential efficiency gains. Publicly listed companies often face stringent reporting requirements and market pressures to meet short-term financial targets. These demands can lead to conservative decision-making, reduced risk-taking, and potentially underinvestment in long-term innovation and efficiency-enhancing practices. The heightened need for transparency and adherence to regulatory standards can divert resources from productive activities to compliance efforts. This result suggests that the anticipated benefits of public listing, such as increased capital access

and improved corporate governance, may not necessarily translate into enhanced technical efficiency. This finding reflects aspects of agency theory, where conflicts between management and shareholders, driven by the need to satisfy short-term market expectations, can hinder long-term operational efficiency and strategic decision-making.

NON_EX shows a negative and statistically insignificant effect on EFFCH. This is consistent with the findings of Alhassan et al. (2020) and Lee et al. (2019), which identified a negative correlation between the proportion of non-executive directors on the board and insurer efficiency. This implies that an increased presence of non-executive directors does not necessarily improve technical efficiency. Non-executive directors, while crucial for providing independent oversight and strategic guidance, may lack the day-to-day operational involvement required to drive efficiency. Their limited engagement in the company's daily operations might explain why their presence does not significantly influence EFFCH. Additionally, non-executive directors may focus more on compliance and governance issues rather than operational efficiencies, which can dilute their impact on productivity. This finding calls for a reevaluation of the role of non-executive directors in driving operational efficiencies, highlighting the importance of a balanced board composition that includes both independent oversight and active operational engagement. This resonates with stewardship theory, which emphasizes the role of governance in fostering long-term value creation through effective oversight and strategic direction.

BOARD shows a positive and insignificant impact on EFFCH. Although the effect is positive, its insignificance implies that merely increasing the board size does not substantially influence technical efficiency. This finding is consistent with the research of Karbhari et al. (2018). While larger boards can benefit from a diversity of perspectives and expertise, they might also suffer from coordination challenges and slower decision-making processes. Larger boards can lead to more comprehensive deliberations and diverse viewpoints, potentially enhancing strategic

decisions. However, they can also face difficulties in reaching consensus, leading to delays in decision-making and implementation. This result suggests that beyond a certain point, increasing the number of board members does not lead to significant efficiency improvements. It highlights the necessity of an optimal board size that strikes a balance between the advantages of diverse viewpoints and the potential drawbacks of greater complexity and slower decision-making processes.

Finally, the analysis shows that the R_SMEN has a positive but statistically insignificant effect on total factor productivity. Although the positive coefficient hints at a potentially beneficial influence, its lack of statistical significance suggests that the gender composition of the Shariah committee does not significantly determine changes in overall productivity. This finding contrasts with the research by Sanad and Al Lawati (2023), who emphasized the importance of women's presence on boards for improved firm performance, citing psychological, physiological, and behavioral differences between genders. The potential positive impact of male representation in the Shariah committee could be linked to specific technical expertise and decision-making styles that men might bring to the table. However, the lack of statistical significance implies that these potential benefits are not strong enough to be conclusively demonstrated in this study. This suggests that factors like the expertise and independence of Shariah committee members may significantly influence efficiency in Islamic finance. This observation is consistent with resource dependency theory, which emphasizes the significance of governance resource quality rather than just demographic characteristics. It suggests that while gender diversity is important, the specific skills and expertise of Shariah committee members are more crucial determinants of productivity and efficiency in Takaful operations.

4.9.3 Regression results for Technological Change

The second stage of the panel regression findings, depicted in Table 4.13, provides detailed insights into how corporate governance characteristics and control variables influence the

technological change (TECHCH) of Malaysian insurers. OLS was selected based on the results of the Breusch-Pagan Lagrangian Multiplier test, confirming its suitability for the analysis. Model 5, distinguished by its higher adjusted R-squared value compared to other models, is considered more reliable for interpreting the results.

Several key findings from Model 5 offer valuable insights into the intricate relationship between corporate governance variables and TECHCH within Malaysia's insurance sector. For instance, firm size (SIZE) has a significant but negative impact on TECHCH, which stands in contrast to the conclusions drawn by Karbhari et al. (2018). Karbhari et al. argued that larger firms should experience efficiency gains and accelerated technological change due to economies of scale, improved resource allocation, and increased investment potential. However, in this study, the negative relationship indicates that larger firms might face challenges in adapting to technological changes. This could be due to bureaucratic inertia, where the more complex and rigid structures of larger organizations slow down decision-making and implementation processes. Additionally, larger firms may have legacy systems and processes that are harder to modify or replace, making it difficult to integrate new technologies efficiently. This finding aligns with agency theory, which suggests that larger firms may experience inefficiencies due to more complex organizational structures and potential misalignment between management and shareholders. The increased layers of approval and coordination required in larger firms can hinder swift adaptation to technological advancements.

Table 4.13 Regression results for TECHCH

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	TECHCH	TECHCH	TECHCH	TECHCH	TECHCH	TECHCH	TECHCH
GDP	-0.004	-0.004	-0.004	-0.002			
	(0.014)	(0.014)	(0.014)	(0.012)			
LNSIZE	0.342	0.342	0.344	0.342	0.323	0.076	0.046
	(0.240)	(0.237)	(0.229)	(0.228)	(0.207)	(0.071)	(0.069)
FOREIGN	-1.277	-1.274	-1.272	-1.209	-1.205	-0.393*	
	(0.832)	(0.793)	(0.787)	(0.744)	(0.740)	(0.234)	

LISTED	-2.066**	-2.063**	-2.057**	-2.048**	-2.020**	-0.425	-0.294
	(0.903)	(0.879)	(0.853)	(0.849)	(0.833)	(0.267)	(0.256)
NON_EX	5.331	5.331	5.324*	5.485*	5.560*	2.207*	2.493**
	(3.235)	(3.220)	(3.200)	(3.123)	(3.087)	(1.185)	(1.176)
R_BMEN	-0.029						
	(2.087)						
BOARD	-0.065	-0.065	-0.066				
	(0.266)	(0.264)	(0.262)				
R_SMEN	2.022	2.016	2.016	1.920	1.963		
	(1.796)	(1.733)	(1.726)	(1.676)	(1.655)		
SHARIAH	0.015	0.014					
	(0.442)	(0.431)					
Constant	-8.980	-9.015	-8.951	-9.923*	-10.470**	-1.988	-1.884
	(7.519)	(7.070)	(6.769)	(5.554)	(4.814)	(1.718)	(1.722)
Observations	122	122	122	122	122	359	359
R-squared	0.084	0.084	0.084	0.084	0.083	0.024	0.016
Adjusted R-squared	0.010	0.019	0.028	0.036	0.044	0.013	0.008

Note: Symbols ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

FOREIGN is associated with a negative and insignificant coefficient, implying that while foreign insurers are present in the Malaysian market, their impact on TECHCH is not statistically significant. This could be attributed to differences in operational practices, market strategies, or adaptation challenges in a new regulatory environment. Foreign insurers might bring advanced technologies and methodologies, but these may not be effectively integrated into the local context due to differences in business practices and regulatory constraints. This aligns with resource dependency theory, indicating that foreign insurers may not always bring advantageous resources effectively into the local context, and their potential benefits might be neutralized by the adaptation challenges they face.

LISTED exhibit negative and significant impacts on TECHCH, echoing the observations of Atuahene and Xusheng (2024). This indicates that being publicly listed may hinder technological advancements, possibly due to higher regulatory scrutiny and compliance costs associated with listing. Publicly listed companies are often under intense scrutiny to comply

with numerous regulations, which can divert resources and attention from innovative activities. Additionally, market pressures and the need to meet shareholder expectations could lead to short-term decision-making that is not conducive to long-term technological improvements. Managers in publicly listed companies may focus on short-term financial results at the expense of long-term investments in technological advancements, reflecting agency theory where the pressures to satisfy shareholders might impede long-term technological investments.

The NON_EX exhibits a positive and significant impact on TECHCH, aligning with the findings of Karbhari et al. (2018). This suggests that a higher proportion of non-executive directors can facilitate technological change by providing more independent oversight and strategic guidance that supports innovation and technology adoption. Non-executive directors, by virtue of their independence from daily operations, can offer fresh perspectives and encourage the adoption of innovative practices. This supports stewardship theory, which posits those non-executive directors act as stewards of the company, promoting long-term success and innovation. Their role in challenging management decisions and ensuring that the company remains competitive through technological advancements is crucial for sustained technological progress.

Lastly, the R_SMEN has a positive but insignificant impact on TECHCH. This finding contrasts with the research by Sanad and Al Lawati (2023), who emphasized the importance of women's presence on boards for improved firm performance, citing psychological, physiological, and behavioral differences between genders. Despite the positive coefficient, the lack of statistical significance suggests that the gender composition of the Shariah committee does not significantly affect technological change. This may imply that other factors, such as the members' overall expertise and effectiveness, are more influential in driving technological change within the Shariah committee. The effectiveness of Shariah committees in driving technological change may depend more on the members' expertise in Islamic finance and their

ability to integrate technological innovations in a manner compliant with Shariah principles. This aligns with resource dependency theory, emphasizing the importance of the quality and relevance of resources over mere demographic attributes. The critical takeaway is that the expertise and strategic vision of the committee members are more pivotal in fostering technological advancements than their gender composition.

4.9.4 Regression results for Scale Efficiency Change

The second stage of the panel regression findings, depicted in Table 4.14, provides detailed insights into how corporate governance characteristics and control variables influence the scale efficiency change (SECH) of Malaysian insurers. OLS was selected based on the results of the Breusch-Pagan Lagrangian Multiplier test, confirming its suitability for the analysis. Model 7, distinguished by its higher adjusted R-squared value compared to other models, is considered more reliable for interpreting the results.

negative and insignificant coefficient, suggesting that while foreign insurers participate in the Malaysian market, their impact on SECH is not statistically significant. This could be due to differences in operational practices, market strategies, or adaptation challenges in a new regulatory environment. It highlights the possibility that foreign insurers might face difficulties in achieving scale efficiency comparable to local firms, possibly due to integration issues or differing market dynamics. This finding resonates with resource dependency theory, indicating that external resources may not always contribute significantly to operational efficiency.

Table 4.14 Regression Results for SECH

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	SECH	SECH	SECH	SECH	SECH	SECH	SECH	SECH	SECH
GDP	0.000	0.000	0.000	0.000	0.001	0.000			
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)			
LNSIZE	-0.001								
	(0.010)								

FOREIGN	-0.037	-0.036	-0.034	-0.029	-0.028	-0.032	-0.034		
	(0.034)	(0.034)	(0.033)	(0.028)	(0.028)	(0.027)	(0.027)		
LISTED	-0.044	-0.045	-0.043	-0.039	-0.043	-0.043	-0.048	-0.033	
	(0.037)	(0.037)	(0.036)	(0.033)	(0.032)	(0.032)	(0.031)	(0.029)	
NON_EX	-0.060	-0.061	-0.061	-0.058					
	(0.134)	(0.132)	(0.132)	(0.131)					
R_BMEN	-0.018	-0.017							
	(0.087)	(0.086)							
BOARD	0.005	0.005	0.005	0.006	0.006				
	(0.011)	(0.011)	(0.011)	(0.011)	(0.010)				
R_SMEN	0.026	0.025	0.022						
	(0.074)	(0.073)	(0.071)						
SHARIAH	-0.030	-0.031*	-0.031*	-0.031*	-0.031*	-0.032*	-0.031*	-0.034*	-0.039**
	(0.018)	(0.018)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.016)
Constant	1.062***	1.051***	1.033***	1.037***	0.968***	1.063***	1.189***	1.185***	1.205***
	(0.312)	(0.298)	(0.283)	(0.281)	(0.233)	(0.177)	(0.092)	(0.092)	(0.090)
Observations	123	123	123	123	123	123	123	123	124
R-squared	0.079	0.079	0.079	0.078	0.076	0.073	0.068	0.055	0.045
Adjusted R-squared	0.006	0.014	0.023	0.030	0.037	0.042	0.044	0.039	0.037

Note: Symbols ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

LISTED exhibit negative but insignificant impacts on SECH. Our analysis suggests that insurance firms listed on Bursa Malaysia experience declines in efficiency, echoing the observations of Atuahene and Xusheng (2024). The negative yet insignificant coefficient for listed companies may indicate that being publicly listed does not necessarily confer a scale efficiency advantage. This could be due to the higher regulatory scrutiny and compliance costs associated with being listed, which might offset potential efficiency gains. Additionally, market pressures and the need to meet shareholder expectations could lead to short-term decision-making that is not conducive to long-term efficiency improvements. This finding aligns with agency theory, highlighting the challenges listed companies face in balancing short-term shareholder interests with long-term operational efficiency.

The R_MEN has a negative but significant impact on SECH. The significant negative coefficient suggests that a larger Shariah committee size, particularly with a higher ratio of

men, may deteriorate SECH. This finding aligns with the work of Sanad and Al Lawati (2023), who highlighted the importance of women's presence on boards for improved firm performance, emphasizing psychological, physiological, and behavioral differences between genders. This could be due to more rigorous oversight and better adherence to ethical guidelines and operational standards, which are crucial in the Islamic finance context. The presence of a robust Shariah committee might ensure stricter compliance with Shariah principles, thereby enhancing operational efficiency and trust in the insurer's practices. This finding aligns with stewardship theory, which emphasizes the importance of effective oversight and adherence to ethical standards in promoting organizational efficiency and effectiveness.

4.9.5 Regression results for Pure Technical Change

The second stage of the panel regression findings, depicted in Table 4.15, provides detailed insights into how corporate governance characteristics and control variables influence the pure technical change (PECH) of Malaysian insurers. OLS was chosen based on the results of the Breusch-Pagan Lagrangian Multiplier test, confirming its suitability for the analysis. Model 8, distinguished by its higher adjusted R-squared value compared to other models, is considered more reliable for interpreting the results.

Several notable findings from Model 8 shed light on the nuanced relationship between corporate governance factors and PECH . Firstly, the presence of foreign insurers is associated with a negative and insignificant coefficient, suggesting that their participation in the Malaysian insurance market might negatively impact Pure Technical Efficiency Change. Although this effect is not statistically significant, it could indicate potential challenges foreign insurers face in achieving technical efficiency in a market that may have different regulatory, cultural, or operational contexts compared to their home countries. This finding aligns with resource dependency theory, which posits that external factors like market conditions can influence operational efficiency.

Table 4.15 Regression Results for PECH

VARIABLES	(1) PECH	(2) PECH	(3) PECH	(4) PECH	(5) PECH	(6) PECH	(7) PECH	(8) PECH	(9) PECH
GDP	-0.000	-0.000							
	(0.001)	(0.001)							
LNSIZE	-0.002	-0.002	-0.002	-0.003	-0.003				
	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)				
FOREIGN	-0.016	-0.016	-0.015	-0.017	-0.020	-0.019	-0.022	-0.023	
	(0.031)	(0.031)	(0.030)	(0.029)	(0.025)	(0.025)	(0.024)	(0.024)	
LISTED	0.008	0.008	0.009	0.008					
	(0.034)	(0.033)	(0.032)	(0.031)					
NON_EX	0.002								
	(0.121)								
R_BMEN	0.011	0.011	0.013						
	(0.078)	(0.078)	(0.076)						
BOARD	0.004	0.004	0.004	0.004	0.004	0.005			
	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)			
R_SMEN	0.050	0.050	0.050	0.053	0.059	0.056	0.064	0.068	0.045
	(0.067)	(0.066)	(0.066)	(0.064)	(0.059)	(0.058)	(0.056)	(0.055)	(0.052)
SHARIAH	0.008	0.008	0.008	0.009	0.010	0.009	0.008		0.008
	(0.017)	(0.016)	(0.016)	(0.016)	(0.015)	(0.015)	(0.015)		(0.015)
Constant	0.936***	0.937***	0.926***	0.936***	0.925***	0.880***	0.910***	0.951***	0.913***
	(0.281)	(0.248)	(0.193)	(0.182)	(0.176)	(0.102)	(0.086)	(0.042)	(0.086)
Observations	123	123	123	123	124	124	124	124	124
R-squared	0.022	0.022	0.022	0.021	0.021	0.020	0.017	0.015	0.010
Adjusted R-squared	-0.056	-0.047	-0.038	-0.029	-0.021	-0.013	-0.007	-0.001	-0.006

Note: Symbols ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

Additionally, our analysis reveals that the R_SMEN has a positive but insignificant impact on PECH. While this association is not statistically significant, the positive coefficient suggests that a higher representation of men in the Shariah committee could be linked to improved technical efficiency among Takaful operators. This finding contrasts with the work of Sanad and Al Lawati (2023), who highlighted the importance of women's presence on boards for improved firm performance, emphasizing psychological, physiological, and behavioral differences between genders. The positive, albeit insignificant, coefficient could be attributed

to gender dynamics within the Shariah committee potentially influencing decision-making processes or operational efficiencies. This might involve aspects such as technical expertise, decision-making styles, or adherence to Shariah principles. However, the insignificance of this result indicates that other factors might be at play, suggesting the need for further research to explore these dynamics comprehensively. This finding resonates with agency theory, which posits that governance structures and decision-making processes can impact operational efficiency.

4.10 Robustness check

Table 4.16 shows the regression result for the corporate governance attributes with ROA and Technical efficiency. Given the critical importance of the insurance sector's profitability to the stability of emerging markets such as Malaysia, we conducted a robustness check on our main results using profitability indicators, specifically the return on assets (ROA). We found no significant relationship between technical efficiency and ROA, even after considering all independent variables within the selected model, using ordinary least squares regression. Notably, under the ROA model, the variable representing foreign insurers' presence exhibited an insignificant influence on the ROA performance metric. However, our analysis revealed that LISTED variables had a negative impact on ROA while exerting a significant influence on TE.

Table 4.16 Regression Results for Return of Asset (ROA)

	(1)	(1)
VARIABLES	TE	ROA
LNSIZE	0.039***	0.006**
	(0.008)	(0.002)
FOREIGN	0.057**	0.003
	(0.028)	(0.009)
LISTED	-0.163***	0.016*
	(0.030)	(0.009)
R_SMEN	0.035	0.021

	(0.065)	(0.020)
Constant	0.061	-0.070
	(0.160)	(0.049)
Observations	144	143
R-squared	0.325	0.115

Note: Symbols ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

4.11 Summary

Efficiency of conventional and Takaful operators (Objective 1)	
Takaful operators displayed a technical efficiency (TE) of 86.5%, higher than conventional counterparts registered a TE of 78.8%.	
Productivity of conventional and Takaful operators (Objective 2)	
Takaful operators possess 1.35 total factor productivity, which is higher than the productivity level of conventional insurers (0.98).	
Corporate governance attributes that influence insurers' efficiency and productivity(Objective 3)	
	Findings
Technical Efficiency	Listed in Bursa Malaysia have negative and significant impact.
Pure Technical Efficiency	Listed in Bursa Malaysia have negative impact.
Scale Efficiency	-R_SMEN has been found to have a positive impact
Total Factor Productivity	-Listed in Bursa Malaysia have negative impact. NON_EX demonstrates a positive effect.
Technical Efficiency Change	N/A
Technological Change	-Listed in Bursa Malaysia have negative impact. -NON_EX demonstrates a positive effect.
Scale Efficiency Change	SHARIAH has a negative impact.
Pure Technical Change	N/A

CHAPTER 5

CONCLUSION

5.0 Introduction

This chapter presents the study's conclusions, explores its implications, highlights its limitations, and offers recommendations for future research.

5.1 Conclusion

Insurance plays a pivotal role in any economy, serving as a stabilising influence during periods of unpredictability and risk. Evaluating the efficiency of insurance service providers is of paramount importance in ensuring the longevity and competitiveness of the insurance sector in Malaysia. This research is motivated by the presence of a dual insurance system in Malaysia, a unique scenario that demands a comprehensive evaluation of the operational efficiency exhibited by both conventional insurance firms and Takaful operators. Furthermore, in contemporary times, the swiftness of insurance claim processing has emerged as a prominent concern within the insurance sector, primarily attributable to the prevalence of intricate standard operating procedures entailing substantial paperwork. Lengthy intervals for claim adjudication serve as an indicator of inefficiency within insurance companies, underscoring inadequacies in operational management. In light of this, The Central Bank of Malaysia has called upon the insurance industry to improve its efficiency.

The first goal of this research is to assess and compare the efficiency of Malaysian insurers from 2013 to 2021. The study distinguishes between technical efficiency, pure technical efficiency, and scale efficiency in the Malaysian insurance sector, applying Data Envelopment Analysis (DEA). The results suggest that scale efficiency has a greater impact than pure

technical efficiency on the overall technical efficiency of Malaysian insurers. Both parametric and non-parametric methods have been employed to evaluate significant differences in efficiency between Takaful operators and conventional insurers. The outcomes from these tests provide strong evidence to reject the null hypothesis, indicating no notable efficiency difference between conventional insurers and Takaful operators in Malaysia.

Furthermore, the rapid growth of digital financial services has significantly changed the global financial industry, impacting both banking and insurance. Malaysia is also undergoing this shift, demonstrated by the launch of its first digital bank, GXBank, and the anticipated release of the Licensing Framework for Digital Insurers and Takaful Operators (DITO) by Bank Negara Malaysia (BNM) in late 2024. This new framework could disrupt the insurance sector by allowing digital insurers and Takaful operators to enter the market. Its aim is to create a competitive environment that promotes innovation and efficiency, in line with the global trend of integrating digital advancements while ensuring stability and consumer protection. Overall, DITO is expected to improve inclusivity, efficiency, competitiveness, and resilience within Malaysia's insurance sector, prompting traditional insurers to innovate and increase productivity in response to digital changes.

This second objective focuses on evaluating the productivity of Malaysian insurers from 2013 to 2021, distinguishing factors such as total factor productivity, technological advancement, efficiency shifts, pure technical efficiency changes, and scale efficiency adjustments within the insurance sector in Malaysia, utilising the Malmquist Productivity Index (MPI). The findings from both parametric and non-parametric tests provide enough evidence to reject the null hypothesis, indicating there is significant productivity difference between conventional insurers and Takaful operators in Malaysia.

Moreover, the insurance industry plays a crucial role in supporting national economies, functioning as a foundation for financial stability and growth. A notable example highlighting

the importance of strong corporate governance in this sector is the downfall of American International Group (AIG), a globally significant insurance firm. AIG's collapse was primarily due to improper accounting methods, which led to inflated financial results. This case illustrates the essential role that robust corporate governance plays in upholding the integrity, transparency, and sustainability of insurance companies.

The third objective explores the effects of corporate governance on the technical and scale efficiencies of Malaysian insurers from 2013 to 2021. Several significant findings are found in this study. First, the size of insurance firms and foreign participation have a statistically significant positive relationship with the technical efficiency of Malaysian insurers. Second, we discover that insurance companies listed in Malaysia reduce both their technical and pure technical efficiency. Third, the GDP and the proportion of males in the Shariah committee are significantly positive with the scale efficiency of Malaysian insurers.

5.2 Implication of study

There are several implications drawn from this study. Firstly, our findings reveal that scale efficiency significantly impacts the overall efficiency of Malaysian insurers more than pure technical efficiency. The finding suggests that insurers benefit more from operating at an optimal scale rather than solely improving their technical operations. This implies that strategies focused on achieving the right scale, such as mergers, acquisitions, or scaling operations up or down to match market demand, might be more effective in enhancing overall efficiency. By aligning their size and capabilities with market conditions, companies can optimize resource allocation and streamline operations. Such strategic adjustments can lead to cost savings, improved competitive positioning, and better responsiveness to market changes. Additionally, these strategies can help companies achieve economies of scale and scope, further enhancing their operational efficiency.

Given the relatively small population size of Malaysia—estimated at around 33 million—compared to larger markets, there is a natural limitation to the market demand that insurance and Takaful companies can tap into. This limitation underscores the importance of achieving scale efficiency to sustain competitiveness. Merger and acquisition (M&A) activities among insurance and Takaful companies could be a viable strategy to address this challenge. Through M&A, smaller firms can combine resources, consolidate their market presence, and eliminate redundancies, enabling them to operate at a more optimal scale. Larger, more consolidated entities are better positioned to leverage economies of scale, negotiate better terms with service providers, and enhance product offerings to meet diverse customer needs. Moreover, M&A can facilitate the sharing of best practices, technology, and expertise between conventional and Takaful operators, leading to innovation and improved service delivery across the industry.

Furthermore, our study suggests that technological change has a greater influence on overall productivity change than efficiency change, underscores the importance of technological advancements in the insurance sector. Insurers that invest in technology, such as advanced data analytics, automated underwriting, and digital customer service platforms, are likely to experience significant productivity gains. Advanced data analytics can provide deeper insights into customer behavior and risk profiles, enabling more accurate pricing and better risk management. Automated underwriting can streamline the underwriting process, reducing processing time and costs while improving accuracy and consistency in decision-making. Digital customer service platforms can enhance customer satisfaction by providing efficient, accessible, and responsive service, thereby increasing customer retention and acquisition. These technological investments not only drive operational efficiencies but also foster innovation and competitiveness in the insurance market.This implies that continuous investment in technology is crucial for maintaining and enhancing productivity. Industry leaders should prioritize technological innovation and adoption to sustain productivity growth.

The higher efficiency productivity of Takaful insurers compared to conventional insurers suggests that the operational and business model of Takaful is more conducive to productivity improvements. This might be due to better alignment with customer expectations, more efficient risk-sharing mechanisms, or streamlined processes. Conventional insurers can learn from Takaful practices to enhance their productivity. Furthermore, this finding can inform customers, investors, and policymakers about the potential benefits of Takaful products, encouraging greater adoption and support.

For policymakers, understanding these differences can inform regulatory and policy decisions that promote a more efficient and productive insurance sector. By supporting Takaful practices, regulators can encourage innovation and competition, ultimately benefiting consumers with better products and services. Additionally, promoting Takaful insurance aligns with certain Sustainable Development Goals (SDGs), such as economic growth, industry innovation, and reduced inequalities, thereby contributing to broader socio-economic development.

Investors can also benefit from recognising the operational advantages of Takaful insurers, guiding better investment decisions and attracting more capital into the sector. Finally, the unique risk-sharing mechanisms of Takaful insurance can enhance financial stability and resilience, creating a more robust financial system. By integrating successful elements of Takaful into conventional models, the entire insurance sector can achieve significant improvements, benefiting consumers, investors, and the broader economy.

The negative impact of being listed on the efficiency and productivity of insurers in Malaysia implies that the regulatory and reporting requirements, as well as market pressures associated with being a publicly listed company, may hinder operational efficiency. This could be due to short-term profit pressures, increased compliance costs, or constraints on managerial flexibility. Insurers and policymakers need to address these challenges by finding a balance between transparency and operational efficiency. Measures could include reviewing regulatory

requirements or offering support to listed companies to help them manage the additional burdens more effectively. Regulatory reviews might focus on streamlining compliance processes, reducing redundant reporting requirements, or introducing more flexible regulatory frameworks that encourage innovation without compromising oversight. Support initiatives could include providing training and resources to help companies navigate regulatory complexities, offering tax incentives or subsidies for investments in compliance technologies, and facilitating dialogues between regulators and industry stakeholders to ensure that regulatory policies are practical and effective. By alleviating some of the regulatory pressures, policymakers can help listed companies focus more on long-term strategic goals and efficiency improvements.

Furthermore, the finding that a higher ratio of non-executive directors enhances total factor productivity suggests that non-executive directors provide valuable oversight, strategic guidance, and accountability, contributing to better governance and operational outcomes. This implies that having a diverse and independent board can significantly improve the performance of insurers. Insurers should therefore focus on strengthening their board composition by increasing the proportion of non-executive directors. Non-executive directors contribute independent judgment and varied perspectives, improving governance and strategic decision-making. Their independence allows them to provide unbiased oversight and challenge management decisions effectively, ensuring that the company's strategies are aligned with long-term value creation and risk management objectives. Moreover, non-executive directors can draw on their extensive experience and networks to offer valuable insights and advice on industry trends, regulatory changes, and best practices. By increasing the proportion of non-executive directors, insurers can improve board effectiveness, reduce agency costs, and foster a culture of accountability and continuous improvement. Additionally, governance frameworks

should emphasize the importance of non-executive directors in enhancing productivity and overall corporate governance.

These findings collectively highlight the importance of scale efficiency, technological advancements, and strong governance practices in enhancing the efficiency and productivity of Malaysian insurers. The comparative advantage of Takaful insurers suggests a potential shift in market dynamics that could influence future strategic decisions within the industry. Policymakers, industry leaders, and regulators should consider these implications to foster a more efficient and productive insurance market in Malaysia.

5.3 Limitations and Recommendations of Future Study

This research offers valuable insights into the efficiency and productivity of Malaysia's insurance sector and its connection to corporate governance. However, some areas may have been overlooked.

Firstly, the study could have examined the levels of life insurance and general insurance separately between Takaful and conventional insurers, rather than grouping them into conventional and Takaful. By analyzing these categories independently, the study could provide more nuanced insights into how different types of insurance and their respective governance structures impact efficiency and productivity. This separation would allow readers for a deeper understanding of the unique challenges and opportunities within life and general insurance.

Secondly, since this research focuses solely on the Malaysian insurance sector, its findings may not be entirely generalisable to other regions. The regulatory frameworks, market dynamics, and cultural influences specific to Malaysia may differ from those in insurance markets elsewhere. Future studies could expand the analysis to incorporate a cross-country comparison of insurance industries. In addition, exploring different performance metrics such as ROA

(return on assets), ROE (return on equity), and ROS (return on sales) could provide deeper insights into the factors affecting insurance company performance.

Thirdly, the findings of this study may stimulate additional research into the specific elements determining efficiency and productivity in the insurance market. A more detailed understanding of these drivers can lead to targeted recommendations for industry improvement. Moreover, the results may inspire further investigation into the specific factors causing performance discrepancies between conventional insurers and Takaful operators. Such research could uncover underlying issues related to management practices, market conditions, or regulatory frameworks that contribute to these differences.

Future studies could also consider using alternative approaches to selecting inputs and outputs. While this study employs the value-added approach, future research could adopt the financial intermediary approach or the production approach to provide different perspectives on efficiency and productivity measurement.

Overall, this study lays the groundwork for future research and policy development aimed at enhancing the efficiency and productivity of the insurance industry. By addressing the limitations identified, future research can build on these findings to provide more comprehensive and actionable insights for policymakers, industry practitioners, and researchers.

5.4 Summary

Conclusions
Objective 1: Computation of Efficiency
Objective 2: Computation of Productivity
Objective 3: Relationship between corporate governance attributes on the efficiency and productivity

Implications of the study

1. encouraging competition and allowing insurers to achieve the scale

2. Incentives supporting insurers to invest in technology

3. Promoting foreign participation and addressing challenges faced by listed companies

Limitations & recommendations for future research

1. Examined the levels of life insurance and general insurance

2. Exclusively on the insurance industry in Malaysia

3. Specific elements determining efficiency and productivity in the insurance market

Source: Author's own summarisation

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APPENDIX A– Publication (Journal Articles under Review / Accepted)

Journal Article Accepted

1. Is Takaful (Islamic Insurance) More Efficient Than Conventional Insurance? A Comparative Analysis of The Malaysian Insurance Industry (International Journal of Business and Society, Vol25, No2, August 2024)

Articles under Review

1. Comparative Analysis of Productivity Trends between Conventional Insurers and Takaful Operators in Malaysia (Malaysian Journal of Economic Studies)
2. Corporate governance and performance of the Insurance Industry in Malaysia: A comparison between conventional Insurance and Takaful