

An Analysis of the Efficiency of Insurance and Takaful Firms Using the DEA Approach: A Study of Pakistan

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This study aims to examine the efficiency of Pakistani insurance companies that engaged in Takaful and those that engaged in regular insurance between 2006 and 2010. Evaluating technical, allocative, and cost-effectiveness is done using the Data Envelopment method. Due to the high level of allocative inefficiency, the results show that the insurance sector is inefficient. But when it comes to technical efficiency, there are rising tendencies. Results also demonstrate that Takaful businesses outperform more conventional insurance providers. The Malmquist productivity index clearly indicates that scale efficiency has greatly increased. However, we do not discover that technological advancements substantially boost total output. Particularly for Takaful companies, the research suggests that Pakistan's insurance industry give more creative and diverse coverage.

Keywords: Insurance, DAE Model, Efficiency, Takaful Insurance, Conventional Insurance.

Introduction

The insurance industry plays a major role in the development of an economy's social and economic sectors by allocating long-term financial resources and lowering the total risk of all economic activities. An effective 139 by directing people's savings into investment possibilities via financial intermediaries, an effective insurance sector may contribute to the growth of a nation's economy (Cao et al., 2021). Insurance companies provide a wide range of services to protect families and businesses. To protect people, businesses, and property from financial loss in the event of an accident is the main goal of insurance companies. Insurance companies capitalise on this by encouraging entrepreneurs and risk-averse individuals to pursue high-return sectors, even if it involves taking on more risk than they would normally.

Given the sector's distinctive contribution to the nation's social and economic growth and the presence of a dual insurance system that permits cooperation between Takaful and conventional insurance businesses, evaluating the insurance industry's performance makes sense. Before the introduction of Takaful laws in 2005, conventional insurance businesses controlled the insurance market in Pakistan. Since the start of the market in 2005, there have been five Takaful firms providing a variety of Shariah compatible goods. Three of these enterprises are general businesses, and two of them are family businesses. There are five operational Takaful

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enterprises in Pakistan as of 2021. The first one opened into business in 2017. The asset structure and net and gross premiums of the Takaful industry have increased consistently since 2017.

Efficiency has become as a major problem for Takaful businesses because to fierce competition from established conventional insurers. The efforts of takaful operators, who have a huge potential to reach individuals who did not have conventional insurance earlier owing to its noncompliance with Shariah law, may boost both the customer base and the insurance penetration rate in Pakistan.

The development of Takaful firms has played a major role in the fast rise of the insurance market in Pakistan in recent years. We shall be evaluating the effectiveness and productivity of insurance and Takaful firms only for this purpose.

Literature Review

The efficiency and effectiveness of the insurance sector in both developed and developing countries has been the subject of a great deal of study, with methods ranging from the purely quantitative to more qualitative analyses (Cheng et al., 2015). Nevertheless, there is a dearth of studies examining the Takaful industry's effectiveness. Insurance efficiency studies have mainly focused on Western and industrialized countries' businesses (Tang et al., 2017).

To understand how well Pakistani Takaful and insurance businesses run their operations, efficiency analysis is a must. The Data Envelopment Analysis (DEA) method is very useful for this purpose. There is a growing body of empirical research in Pakistan that utilizes DEA, a robust framework for assessing input-output links to determine relative efficiency (Shafique et al., 2015). A number of variables, including as legal frameworks, market positioning, and management tactics, contribute to the observed disparities in the efficiency levels of different types of corporations. Even though there are still problems with data availability and quality, new data analytics and computational methods could solve these problems. In order to enhance academic understanding and business practices in Pakistan's insurance and Takaful sectors, it is advised that future studies investigate the impact of technological innovation, market dynamics, and regulatory reforms (Khan & Noreen, 2014b).

Insurance and Takaful companies in Pakistan must do efficiency analyses utilising the Data Envelopment Analysis (DEA) method if they want to keep up with the rest of the modern financial services industry. Research has recently begun to explore further into the complex elements determining efficiency in this scenario, notwithstanding DEA's usefulness for comparing input-output correlations and evaluating relative efficiency (Janjua & Akmal, 2015). Along with more traditional metrics like company size and capitalization, newer research suggests that product innovation, consumer segmentation strategies, and digital transformation projects significantly affect an organization's operational efficiency. In addition, the importance of ESG factors in fostering sustainability and efficiency in the Takaful and insurance industries is being more and more recognized. Research in Pakistan's insurance and Takaful industries needs to use a multi-faceted strategy that includes financial and non-financial metrics if it wants to provide a complete assessment of their efficacy and value creation (Faruk & Rahaman, 2015). Implementation of risk-based supervisory frameworks and Shariah-compliance standards for

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Takaful activities are examples of how the regulatory landscape is changing, creating both opportunities and challenges for the industry to become more efficient and competitive. In order to help the Takaful and insurance sectors in Pakistan grow and develop in the long run, academics, practitioners, and policymakers should look into how market forces, technology innovation, regulatory dynamics, and strategic management practices interact with one another (Keong, 2013).

A large body of research examines the effectiveness and efficiency of the insurance sector in both industrialized and developing countries, employing both nonparametric and parametric methodologies. However, research evaluating the Takaful sector's efficacy is scarce. Keong, (2013); M. A. Rahman, (2013) are among the many studies that have focused on industrialized nations and their insurance sectors in relation to efficiency. Several studies evaluated the efficiency of the European insurance market. KHAN & NOREEN, (2014a) examines the impact of organizational structure on the productivity of insurance companies in Spain, whereas research by Kader et al., (2014) examines the effectiveness of insurance production in Austria. According to this research, insurance company efficiency and production took a major hit throughout the deregulatory process in these countries. The discovery of new goods and the adoption of new technologies have significantly improved the performance of these economies' insurance sectors, it is also decided.

Recent studies have investigated the efficiency and productivity of the insurance business in Asian economies, in contrast to the vast majority of literature that concentrates on the US and other industrialized nations. A few of studies have examined South Asian countries, although the majority of these studies have concentrated on the economies of East Asia (Afza & Asghar, 2012). Rahman et al., (2014) are just a few of the research that have looked at the effectiveness of Takaful businesses in different countries. Traditional insurance's efficacy has been the focus of most research efforts. Rahman et al., (2014) looked at the efficiency of Takaful businesses in 17 Islamic countries. Their findings indicate that, on average, Takaful firms are just as efficient as more established well-funded insurance organizations. They continue by saying that effective allocation of resources is greatly affected by having a board of directors that is both skilled and competent. From 2004–2009, Shafique et al., (2015) examined the efficiency of traditional and Takaful insurers in Malaysia. They find that conventional organizations have an efficiency score of 87%, while Takaful firms only manage 64%. Additionally, the paper suggests that Takaful companies support worthwhile projects, reduce management and agency expenses, and enhance investment returns. Additionally, Khan & Noreen, (2014b) investigate the efficacy of the life insurance market in Malaysia by analyzing data from Takaful and conventional insurance providers. In terms of performance, the study found that traditional firms were more successful than Takaful businesses. Additionally, they suggest that Takaful firms reach their optimal size for increased productivity. While there is an increasing amount of literature on the topic of insurance and Takaful firms' efficacy on a global scale, we were unable to find a single study that compared the two industries in Pakistan. M. A. Rahman, (2013) research that has compared the efficiency of Islamic banks with conventional banks. Researching the effectiveness and efficiency of two unique organizational forms traditional businesses and Takaful with contrasting risk management strategies will be an intriguing endeavour.

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Zhao et al., (2023) investigates how organizational structure affects the productivity of insurance companies in Spain, while (Ouenniche and Carrales, 2018) investigates the efficacy of insurance production in Austria. Several studies have assessed the efficiency of the European insurance market (Sarah et al., 2019, Abidi et al., 2020). European researchers continue to study how to evaluate productivity with the Malmquist index and stochastic frontier analysis (Liu et al., 2017). They found that as a result of deregulatory efforts in these countries, insurance company output and efficiency plummeted. The insurance industries of these countries have also profited greatly from the development of new products and the use of new technologies (Liu et al., 2017).

Although most studies have looked at the insurance market in developed countries like the US, we have discovered that further investigation of the effectiveness and efficiency of this sector in Asian nations. Although most studies have focused on East Asian economies, a number of studies have examined South Asian countries as well (Zhanget al., 2017).

There have been a few of studies that have looked into how well Takaful businesses work; for instance (Chenget al., 2016) all do so in different countries. Traditional insurance's efficacy has been the focus of most research efforts. Song and Li,(2019) looked at the efficiency of Takaful businesses in 17 Islamic countries. Their research shows that conventional insurers with more advanced systems have lower average cost efficiency scores than Takaful businesses. They continue by stating that an informed and capable board of directors might have a major influence on how well resources are distributed (Sarahet al., 2019).

From 2017–2021, Ibrahimet al., (2023) studied the efficiency of conventional and Takaful insurers in Malaysia. They find that conventional organizations have an efficiency score of 87% while Takaful firms only manage 64%. In addition to recommending that Takaful businesses sponsor worthy programmes, the paper suggests that they reduce agency and management expenses and boost investment returns. Zhanget al., (2015) also investigate the efficacy of the life insurance market in Malaysia by using data from Takaful and conventional insurance providers (Abidiet al., 2020). The results of the research demonstrate that conventional companies are doing better than Takaful companies. Furthermore, they advise Takaful businesses to reach its optimal size for maximum productivity (Alhassan and Asare, 2016).

We could not find a single study that compared the Takaful and insurance industries in Pakistan, despite the increasing amount of literature on the topic of global Takaful and insurance business efficacy (RENI, 2016). Indeed, a few of studies have compared the effectiveness of conventional banks with Islamic ones (Guoet al., 2020). So, it will be interesting to compare and contrast the effectiveness of two organizational types with different risk management strategies: conventional companies and Takaful (Guddad and Terdal, 2020).

Methodology

The efficiency principle may primarily be used to evaluate a company's performance. Conventional financial metrics to assess its effectiveness include return on assets (ROA), return on equity (ROE), cost to premium ratios, and so forth. The old methods of evaluating the

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efficacy of research have been mostly superseded by new frontier techniques that provide more accurate and relevant indications (Sabiti et al., 2017).

Primayanti and Arfianto (2016) list two primary frontier-based methods for determining efficiency: the parametric approach and the non-parametric approach. Assumptions about the distribution of the error term and the functional shape of the production, cost, and profit frontier are necessary for applying the parametric technique. On the other hand, non-parametric methods disregard the error factor when assessing efficiency since they do not presume a specific functional form (Mugera et al., 2016).

Zhang et al., (2020), Data Envelopment Analysis (DEA) became a reality. The strategy's primary goal was to establish a comparison between the best practices firm's efficiency and that of each Decision Making Unit (DMU). There are two parts to cost efficiency (CE) according to DEA. One method to describe technical efficiency is by looking at the degree to which output is maximized or lowered relative to inputs. Taking into consideration the quantities and prices of inputs, the optimal allocation of resources is the utilization of inputs relative to outputs. Two subcategories of technical efficiency are scale efficiency and pure technical efficiency. While SE happens when a corporation works at Constant Returns to Scale (CRS), PTE happens when a company uses Variable Returns to Scale (VRS) to maximise output. The resulting efficiency measure shows the distance from each unit to the boundary and ranges from zero (least efficient) to one (most efficient).

This investigation makes use of DEA in a non-parametric fashion. This technique was selected due to its numerous benefits. This method is suitable for small sample sizes because it requires less data, which is its main advantage. Furthermore, DEA3 may readily detect variations in efficiency and production across the organisations by evaluating each company independently (Cummins).

The Malmquist Index Approach, a derivative of the DEA, is used to quantify the technological and efficiency gains. Caves et al. expanded upon the concept initially proposed by Malmquist (1953) (1982). The Malmquist productivity index can be calculated in a variety of ways. This paper determined the output-oriented Malmquist index based on DEA. With the DEAP software package, Malmquist indices may also be calculated. To estimate the Malmquist Productivity Index, balanced panel data are required. For this reason, we restrict our analysis to only 16 businesses that were active between 2007 and 2010.

Data and Variables

Data

Five Takaful and twelve conventional insurance businesses in Pakistan make up the data sample for this inquiry. You can see a list of these firms in Appendix B. As a whole, the sample is typical of Pakistan's insurance and takaful industries, hence it accounts for over 80% of the

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premium market share. Unbalanced panel data for the years 2017–2021, culled from the annual reports of Takaful and insurance firms, is used to assess the cost-effectiveness.

Variable Description

Determining the output, inputs, and prices of the financial sector is the main goal of the efficiency study. Selecting the appropriate output-input variables increases the complexity and difficulty of work in the insurance sector.

The reliability of the efficiency results is affected by the input quantities, their associated costs, and the way outputs are defined. Much debate has surrounded the criterion for choosing input-output variables in the banking and insurance industries (Kohl et al., 2019).

Table-1: Descriptive Statistics

Description	Mean	Median	Standard Deviation
Output Variables			
Invested assets	12.27 x10 ⁸	11.11 x10 ⁷	38.7x10 ⁸
Net Premium	4.13x10 ⁸	5.39x10 ⁷	6.31x10 ⁸
Input Variables			
Labor	642	241	982
Total Fixed Assets	1.86x10 ⁷	1.12x10 ⁷	2.34x10 ⁷
Business Services	9.79x10 ⁷	8.79x10 ⁶	2.39x10 ⁸
Equity capital	3.23x10 ⁸	9.69x10 ⁷	4.49x10 ⁸
Input Prices			
Labor	484517	324175	346478
Total Fixed Assets	0.2317	0.2637	0.2134
Business Services	0.1264	0.1252	0.3276
Equity capital	0.3265	0.3427	0.1321

A number of output measures have been developed by various studies to assess the effectiveness and efficiency of the insurance industry. According to Kaya Samut and Cafri (2016), the insurance market primarily offers risk pooling, which is also known as risk carrying, and intermediation services. Given that policyholders effectively purchase protection against risk via insurance policies, a large body of research supports using premium income as a standard measure of risk pooling. As an alternative to the intermediation function, we used invested assets (Abbott and Fisher, 2015). Investment assets are considered an output (Jeanet al., 2015). They contend that general insurance's intermediation function—which comprises borrowing money from policyholders and investing it in marketable securities—contributes far more to their net profit

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than premium revenue. The selection of input factors is somewhat more decided in insurance analysis compared to that of outcome variables. According to Benyoussef and Hemrit,(2019), there are three types of input variables that are often used to quantify efficiency: labour, capital, and business services. Saneiet al., (2022) studies that used equity capital as an input. Having sufficient equity capital to pay out claims to policyholders is crucial for insurers, especially if losses end up being higher than expected. Four are in our possession.

Results and Discussions

We break down the DEA's cost efficiency findings into technical and allocative efficiency and talk about them here. Alterations to technical efficiency and changes to technical processes may be used as components in a total factor productivity assessment.

Efficiency Result

We begin by determining the cost efficiency of individual insurance and Takaful firms for each year from 2017 to 2021. We do this by considering their size, allocative efficiency, and pure technology components. The average efficiency statistics for traditional insurers and Takaful from 2017 to 2021 are shown in Table 2.

Table-2: Yearwise Efficiency Results Takaful and Insurance Firms

Year	Pure Technical Efficiency	Scale Efficiency	Allocative Efficiency	Cost Efficiency
2017	<u>0.87</u>	<u>0.76</u>	<u>0.62</u>	<u>0.62</u>
2018	<u>0.85</u>	<u>0.86</u>	<u>0.61</u>	<u>0.49</u>
2019	<u>0.85</u>	<u>0.82</u>	<u>0.49</u>	<u>0.48</u>
2020	<u>0.89</u>	<u>0.49</u>	<u>0.39</u>	<u>0.31</u>
2021	<u>0.87</u>	<u>0.79</u>	<u>0.51</u>	<u>0.51</u>
Mean	0.79	<u>0.81</u>	0.49	0.39

Both the insurance and Takaful sectors in Pakistan remain technically competent, according to the results. However, cost-effectiveness is paramount in the insurance market due to lower average allocative efficiency.

We find a mixed trend for pure technological efficiency over time. The data show that the insurance and Takaful industries are technologically efficient to the tune of 89% on average. The efficiency of internal management and the distribution of resources is shown by this indicator.

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For companies to achieve maximum efficiency while maintaining output levels, current input levels must be reduced by an average of 11%.

Similarly, scale efficiency in the insurance business remains at 74%, indicating that Pakistan's insurance market is expected to experience substantial growth from 2017 to 2021. This indicator displays if the business is operating at its optimal size. When the scale efficiency of a company is one or when the returns to scale remain constant, it is operating at its ideal scale. In contrast, if there is a deviation from unity, it indicates that the company is not performing up to par.

A second source of cost efficiency for the firm is its allocative efficiency. When the ratio of marginal products to input prices is equal, it means that the company is making the most efficient use of its resources to produce a certain amount of output. It is worth mentioning that Pakistan's insurance market remains approximately 49% allocatively inefficient as of the study's completion, which could have significantly influenced the industry's cost inefficiency. With an average cost efficiency of barely 45% for the relevant time period, insurance and Takful businesses would have needed to slash their spending by over 55% compared to where they are now just to attain the same level of output.

The largest company in the sample also happens to be the only one with a fully efficient operation, according to the firm-wise efficiency score. To my surprise, the most technologically efficient companies nonetheless show lower cost efficiency due to their persistence in allocativity, proving that allocative efficiency is more important than cost efficiency. Considering how few players there are in Pakistan's insurance sector, these results should not come as a surprise. Insurance businesses may have been reckless and underutilize their resources due to the industry's high concentration and product differentiation. But, these businesses may be able to better use their resources in the future years thanks to the present wave of competition and deregulatory process, which should put them on an equal footing in the insurance market.

As compared to their conventional counterparts, Takaful firms tend to be more cost-effective when it comes to insurance. Notably, allocative efficiency is more important than cost efficiency. Traditional companies, although technically more efficient, had low allocative efficiency (43%). In contrast, takaful businesses have high allocative efficiency (68%).

Companies in the takaful industry seem to be picking the optimal combination of inputs, given their high allocative efficiency. The lower scale efficiency of Takaful firms suggests that operators should expand in order to take advantage of economies of scale.

Productivity Results

Here you may discover the results and details of total factor productivity. Estimates of the DEA-based output-oriented Malmquist index are presented here. Annual increases in technical efficiency, total factor productivity, and technological breakthroughs make up the Malmquist index, as seen in Table 4.

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Table-4: Malmquist Index Results

YEAR	EFFCH*	TECHCH	PECH	SECH	TFPCH
2019	<u>0.867</u>	<u>1.172</u>	<u>0.843</u>	<u>1.175</u>	<u>1.184</u>
2020	<u>1.314</u>	<u>0.87</u>	<u>0.756</u>	<u>1.216</u>	<u>0.675</u>
2021	1.127	1.012	0.845	1.286	1.647
Mean	1.124	0.786	0.856	1.324	1.163

*EFFCH = Efficiency Change, TECHCH = Technological Change, PECH = Pure Efficiency Change, SECH =Scale Efficiency Change and TFPCH=Total Factor Productivity Change.

For Malmquist index and all of its components, a number larger than one signifies improved performance, a value less than one implies deterioration, and a value of one signifies no change in performance. According to the results, technical innovation in the insurance industry appeared to be on the wane, although total factor productivity rose, mostly due to changes in scale efficiency.

We find that total factor productivity grows at a rate of 1.9% per year on average. Also consistent with our previous results about cost efficiency generated from DEA is the fact that the measure has grown by an average of 3.3%, indicating a considerable gain in technological efficiency. However, we have noticed a slowdown in technological progress.

According to Table 4, productivity fell in 2021. A number of factors, including the state of domestic security, extreme inflation, natural disasters like floods, the worldwide economic downturn, and the global financial crisis, could have contributed to this. For these reasons, productivity might have dropped. Overall, Malmquist productivity results show that the insurance business has become more productive, mostly as a result of increases in scale efficiency.

In addition, while not every organization is the same, there are several efficiency metrics that are significantly affected by the company's size.

\bar{a}

Table-5: Productivity Comparison of Takaful and Conventional Firms

Firms	EFFCH	TECHCH	PECH	SECH	TFPCH
Conventional Firms	<u>1.107</u>	<u>1.152</u>	<u>1.132</u>	<u>0.867</u>	<u>1.174</u>
Takaful Firms	<u>1.287</u>	<u>0.856</u>	<u>0.867</u>	<u>1.365</u>	<u>1.347</u>

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Table 5 shows that compared to other companies, Takaful saw a significant 12% boost in productivity, mostly as a result of changes in scale efficiency. Total factor productivity increased by a meager 1.9% for conventional insurers. On the one hand, conventional businesses often show growth because to technical improvements, while Takaful organizations show a loss in technology. In light of this, it appears that Takaful companies could benefit from introducing a wider range of novel goods in order to boost output.

Conclusion

There is a lack of information comparing the two primary forms of insurance, conventional and Islamic, despite the growing body of study on the issue of insurance sector productivity and efficiency—a topic that is critical to the growth of the world economy. The goal of this study is to provide fresh standards for assessing insurance and Takaful businesses in Pakistan. Between 2006 and 2010, we assessed the effectiveness of regular insurance and Takaful using the DEA model.

The analysis's findings imply that insurance companies' technological efficiency during the reference period was almost 89%. Between 2006 and 2010, Pakistan's insurance industry had significant expansion, and the results demonstrate that scale efficiency (i.e., 74%), was also present. However, the insurance sector has issues with allocative inefficiency, which eliminates cost effectiveness.

Takaful firms outperform their conventional rivals because to their high allocative efficiency, according to empirical data on cost efficiency. Consequently, this to the conclusion that their choice of input is perfect. We also examined the economies of scale between conventional insurers and Takaful. The results show that all Takaful businesses are operating at IRS, as contrast to 44% of conventional organizations that use this model. Consequently, a lot of Takaful organizations are seizing the chance to grow, which will enable them to get over scale inefficiencies and improve performance. The bulk of conventional businesses (51%) are operating at CRS, which indicates that they are at their most efficient size, with the exception of 5% that are operating at DRS.

Takaful Malmquist index shows high productivity results for these enterprises as well, mostly due to the change in scale efficiency. Nevertheless, we fail to see any advantage of technical improvement for any of the two kinds of organizations. To increase efficiency, both conventional and Takaful firms should provide new and innovative items. The comparative analysis demonstrates that Takaful small firms are effectively competing with their more established rivals despite their relative newness to the market. If Takaful firms want to outperform their competitors, they must step up their game in terms of efficiency, service quality, and product marketability. The report concludes that the key drivers of the notable performance improvement in Pakistan's insurance sector have been size and technical efficiency. Sadly, businesses were unable to allocate resources optimally, which could have been due to flaws in the insurance industry.

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One may argue that our approach opens up new avenues for future studies on the Takaful industry in other parts of the Islamic world, where variables like macroeconomic conditions, business governance, and consumer preferences are taken into consideration.

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