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Financial Management Efficiency Performance of Insurers and Takaful Operators in Malaysia

(Kecekapan Pengurusan Kewangan Penanggung Insurans dan Pengendali Takaful di Malaysia)

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ABSTRACT

This study is aimed to assess the financial management efficiency of each insurer/takaful operator in both conventional and takaful industry. We also identify the operating system that is more efficient among the conventional and takaful system which involves 20 firms. The results from the slack-based measure (SBM) - data envelopment analysis (DEA) implied that the average insurers/takaful operators have to improve about 20% if it were to perform the best financial management practice. Clearly, the inefficiency in both functions of financial management is caused by both the input and output dimensions. This study also revealed that takaful operators exhibit a relatively more efficient financial management in terms of risk management than conventional insurers. However, it cannot be confirmed whether one type of operating system is better than the other system in terms of investment management, as the result is mixed.

Keywords: Takaful operator; conventional insurer; financial management; efficiency; slack based measure – data envelopment analysis

ABSTRAK

Kajian ini bertujuan untuk menilai kecekapan pengurusan kewangan setiap penanggung insurans/ pengendali takaful dalam kedua-dua industri konvensional dan takaful. Kami juga mengenal pasti sistem operasi yang lebih cekap dalam kalangan sistem konvensional dan takaful yang melibatkan 20 firma. Keputusan daripada slack-based measure (SBM) – analisis penyampulan data (APD) mengimplikasikan bahawa purata penanggung insurans/pengendali takaful perlu meningkatkan kira-kira 20% jika ia hendak melaksanakan amalan pengurusan kewangan terbaik. Jelas sekali, ketidakcekapan dalam kedua-dua fungsi pengurusan kewangan adalah disebabkan oleh kedua-dua dimensi input dan output. Kajian ini juga mendedahkan bahawa pengendali takaful menunjukkan pengurusan kewangan yang lebih cekap secara relatifnya dari segi pengurusan risiko berbanding penanggung insurans konvensional. Walau bagaimanapun, tidak boleh dipastikan sama ada satu sistem operasi adalah lebih baik daripada sistem yang lain dari segi pengurusan pelaburan kerana keputusannya adalah bercampur-campur.

Kata kunci: Pengendali takaful; penanggung insurans konvensional; pengurusan kewangan, kecekapan, slack based measure – analisis penyampulan data

INTRODUCTION

Using the methodology employed in the area of finance, financial management seeks decisions concerning what and how much risk a company runs, how much capital (Kielholz 2000) is required to offset that risk-return relationship, and, finally, the quality and quantity of the company's investments. The two most important functions in financial management are risk and investment management (Black & Skipper 2000). Today, with the sophisticated and dynamic business environment, such as changes in interest rates, the rapid growth of competition among the other insurers in the industry, including *takaful* operators and non-insurance institutions, and the risk of insolvency, financial management is becoming increasingly important. Cummins and Lamm-Tennant (1993) stated that to ensure the profitability of insurance business today along with nervous observation in quantifying the risk-return trade-off, financial techniques, such as asset-liability management, hedging, futures and options are needed. This point of view is supported by Black and Skipper (2000) who wrote that it is clearly shown that good financial management can give a competitive advantage among life insurers rather than a good experience of the mortality and morbidity rate. In addition, Santomero and Babble (1997) commented that wise financial risk management is one of the ways to succeed in today's global business. It has been recorded that the mismanagement of risk, capital and investment can affect the whole system both within and outside the insurance company. By way of illustration, over the past few decades, there were 70 cases of insolvency among life insurers in the United States and the number is increasing year to year. Among other causes, the real story behind this is inadequate risk management practices (Babbel & Santomero 1999) which results in losses on assets investment, mispricing of insurance policies, insolvencies among the reinsurers, market misconduct of insurance agent and noncompliance with insurance regulations. Hence, the industry players need to give more attention to their financial management to ensure the survival of their business and gain a competitive advantage. Thus, based on this background, this study aims to evaluate the efficiency of the financial management of each insurer and *takaful* operator in the industry. In addition, due to the industry being divided into two different systems, namely, conventional and *takaful*, this study also expects to identify the most efficient operating system between that of the conventional and *takaful*.

There are three significant contributions to this study. First, this study is among the first attempts to examine the efficiency of financial management, which is divided into two main functions, namely, risk and investment management. Most of the previous studies focus on the overall operating efficiency as it is reasonably difficult for an inefficient firm to recognize which of its operations is contributing most to the inefficiency. Second, the assessment of the financial management involves different operating systems, i.e. conventional insurance companies and *takaful* operators in Malaysia. Finally, the method used in this study to determine the efficiency of financial management is the slack-based measure – data envelopment analysis (SBM-DEA) – which has several advantages over the methods that have been used by most previous researchers, such as Charnes-Cooper-Rhodes (CCR) (Charnes, Cooper & Rhodes 1978) and Banker-Charnes-Cooper (BCC) (Banker, Charnes & Cooper 1984) - DEA method.

The remainder of this study proceeds as follows. The following section discusses the literature on previous studies and the subsequent section describes the methodology and data. The next section discusses the experimental results and the final section concludes the study.

LITERATURE REVIEW

The concepts of overall/economic efficiency that have been introduced by Farrell (1957) have been widely used in previous studies to assess the efficiency and performance of the firm. Among the first serious discussions and analyses of measuring efficiency in the insurance industry were Houston and Simon (1970), Kellner and Mathewson (1983), Fields (1988), Boose (1990), and Grace and Timme (1992). Later, the study on the economic efficiency of the insurance companies, such as Fukuyama (1997), Cummins and Zi (1997), Carr, Cummins and Regan (1999), Cummins (1999), Gamarra (2007), Eling and Luhnen (2010), Abdul Kader, Adams and Hardwick (2010) and many more, used the frontier analysis methods, including DEA, stochastic frontier analysis (SFA), deterministic frontier analysis (DFA), free distribution hull (FDH) as well as different models of DEA, such as CCR, BCC, additive, SBM and range-adjusted measure (RAM).

However, the above studies were only carried out to measure the overall efficiency of the firm as well as cost, technical, allocative and revenue efficiency. Indeed, the findings from these studies provide many firm performance enhancements. Nevertheless, it is reasonably difficult for an inefficient firm to recognize which of its operations is contributing most to the inefficiency. Far too little attention has been given to the performance of the central components of an insurer's finances, namely, risk, capital and return in insurance efficiency studies. Recognizing the fact that the risk and investment management has become increasingly important, especially in the insurance business, a few researchers, such as Cummins et al. (2009), Lin and Wen (2008), Ren (2007), Wu et al. (2007), Hsiao and Su (2006), Yang (2006) and Adams (1996) examined the efficiency of risk and investment management rather than the overall performance of the life insurers.

Cummins et al. (2009) investigated whether risk management was a potential determinant of firm efficiency. They concluded that both activities in the insurers' operation, i.e. risk management and financial intermediary, play a significant role in enhancing a firm's efficiency. Lin and Wen (2008) proved that risk management mechanisms can increase the cost efficiency of property and liability insurers. Empirically, they verified that the cost efficiency can be enhanced by handling the investment risk through the financial derivatives. Conversely, the reinsurance method used to handle underwriting risks did not increase the cost efficiency of insurers. However, neither of these studies makes any attempt to analyse the risk management efficiency of insurers themselves. Ren (2007) computed a Risk Management Performance Index (RMPI) to reflect the performance of risk management for property-liability insurers. Adopting the same methodology as Brockett et al. (2004) the RAM-DEA model was used to produce performance scoring for each firm, thereby constructing an RMPI.

Motivated by the financial intermediary function of the insurer, Hsiao and Su (2006) evaluated the investment performance of life insurers in Taiwan across three different groups of insurers. They used DEA to estimate the efficiency scores and calculated the Malmquist Index to measure the productivity change. They concluded that the performance of an investment is a fundamental factor in the overall performance of the business management. Yang (2006) disagreed with most previous researchers that aggregated the production performance and investment performance into the same model. The function of insurers is primarily that of risk bearing as well as real financial service providers and financial intermediation. Thus, he suggested that the efficiency of production and efficiency of investments should be separately identified, and then combined to obtain the overall evaluation of the insurance industry. He concluded that life and health insurance in Canada operates efficiently and exhibits scale efficiency. Continuing on the same principle as Yang (2006), Wu et al. (2007) studied production and investment performance simultaneously.

METHODOLOGY

INPUT AND OUTPUT VARIABLES

The issue that is still being debated until today in the study of insurance company efficiency is the determination of input and output variables. Cummins and Weiss (2000), and Leverty and Grace (2010) claimed that the determination of input and output in studies involving the efficiency of the insurer as a decision making unit (DMU) is complicated. This matter will be further complicated if the DMU involved is an activity or a department in the insurance company. It is noted that the DMU observed in this study is the risk and investment management function of insurers/*takaful* operators. According to Thanassoulis (2001), a DMU has control over the process it uses to transform its resources into outcomes in which resources are referred to as inputs, while the outcomes are referred to as outputs. Therefore, the input and output variables must be related to the function of both risk and investment management. In terms of inputs, it seems that the inputs that are commonly used in previous studies, such as labour, business services and materials, and financial capital, may be less appropriate because these inputs are more applicable if the insurers themselves are observing the DMU. However, in terms of output, it is likely that the value-added or the intermediation approach (Cummins & Weiss 2000) can still be applied since the outcomes of both risk and investment management should be consistent with the outcomes of the insurers/*takaful* operators as a whole. Based on previous studies, the availability and suitability of data, this study has identified a number of input and output variables for the risk and investment management that will be used to obtain the relative efficiency of each insurer/*takaful* operator observed. The input and output variables are as follows:

Risk Management Inputs Insurers/*takaful* operators must be very careful about their risk profiles and address them in their management control framework because it is associated with performance improvement (Doff 2007). Hence, efficient risk management is seen as an important requirement in reducing the exposure to risk by handling the amount of risk accepted in a better way. This would imply that the resources or input of risk management is the risk itself (Ren 2007). In their studies, both Doff (2007) and Ren (2007) considered three types of risk that are very significant to insurers/*takaful* operators, namely, investment risk, underwriting risk and leverage. Simultaneously, each of these risks will be treated as risk management input and is described below:

Investment Risk Black and Skipper (2000) explained that the investment management seeks to maximize investment return at a given level of risk. They also defined investment risk as "potential variability of returns." Doff (2007) divided the investment risk into market risk and credit risk, while Cummins et al. (2009) explained the investment risk includes "market value risk, credit risk from investing in bonds and other debt instruments, and foreign exchange rate risk resulting from investment in international capital market." The most important and significant market risk to insurers is interest rate risk and the investment risk assumed by the insurer is due to the nature of the insurer's own business (Black & Skipper 2000). In particular, the mismatch of maturity and liquidity between the secondary securities (insurance contract) and the primary securities (mortgages, bonds, stocks, etc.) create the interest rate risk.

Generally, insurers possess long term assets and liabilities. The market value of assets or liabilities is equal to the present value of its cash flow. Higher interest rates would increase the discount rate, and, consequently, reduce the market price of assets and liabilities. If the maturity of assets are longer than the liabilities, higher interest rates will cause a substantial decline in the market value of assets compared with the value of liabilities. This situation exposes insurers to losses and potential insolvency (Black & Skipper 2000; Babbel & Santomero 1999). In addition, interest rate risk can also lead to refinancing and reinvestment risk. The situation becomes more formidable as life insurance policies also known as policy with embedded options (Smith 1982) and guarantees such as settlement option, non-forfeiture option, dividend options, loan option and many more. The market price of insurers' assets and liabilities, together with the embedded options and guarantees of life insurance product are highly influenced by changes in interest rates (Cummins et al. 2009; Doff 2007). Thus, the first input of risk management is the investment risk, which is represented by the variance of investment return, which is consistent with the study by Ren (2007) and the definition by Black and Skipper (2000).

Underwriting Risk Underwriting risk consists of life risk and non-life risk. However, non-life risk is beyond the scope of this study. Doff (2007) defined, "Life risk is the risk of decreases in value due to different mortality than expected or due to a change in the mortality expectation". Meanwhile, the life risk itself can be divided into mortality risk and longevity risk, in which the former refers to the condition when the insured dies earlier than expected, while the latter is when the insured lives longer than expected. Higher mortality and longevity rate can be disadvantageous to insurers, and may pose an investment risk in which investment returns are not as expected when the customers receive benefit payments (Doff 2007). The underwriting policy is the most important tool to handle the life risk. Underwriting is regarded as a main gateway to the insurer because that is where all of it begins – risk is assessed and a decision is made whether to accept or reject a certain risk. In addition, being an insurer, as a financial intermediary and manager of a risk pool, the primary sources of risk are from underwriting and investment (Ren 2007). As representing underwriting risk, Ren (2007) used the variance of loss ratio because his study sample covered the property and liability insurers. However, for this study, in which the sample consists of insurers/*takaful* operators doing life business, the equivalent measurement to a loss ratio is the benefit paid to premium ratio. Thus, underwriting risk is treated as the second input and the proxy used is the variance of benefit paid to premium ratio (Adams 1996).

Leverage Ren (2007) noted that leverage represents a very significant financial risk to the insurer. He further explained that leverage is reflected by the increased level of capital, which can be considered as a direct substitute for the risk management. Usually, leverage is equal to liability to asset ratio. This ratio essentially reflects the insurer's ability in fulfilling the contractual obligation to their policyholders. To fulfil their promise, the insurer must be solvent, and one of the reasons why insurers manage their risk is because of the cost of financial distress. Financial risk management can reduce the propensity of a firm facing financial distress or insolvency risk by reducing the volatility of firm value. Hence, risk management reduces the costs the firm would encounter if it met with financial distress (Smith 1993). Following the study by Ren (2007) and Adams (1996), this study will also use leverage as a third input of risk management with the same measurement, i.e. liability to asset ratio.

Risk Management Output In determining the output, it is very important to know the services that are relevant to risk management. According to Cummins et al. (2009), risk management is very closely related to the risk pooling/bearing services to their policyholders. However, knowing that risk management is a key function of insurers/*takaful* operators, the outcomes to be achieved in the risk management must be able to describe the overall outcome of insurers/*takaful* operators. Perhaps the value-added approach is more suitable to be applied in determining the output of risk management. Based on this approach, the selected output must be able to describe three main services provided by insurers/*takaful* operators, namely, risk pooling/bearing, real financial services and intermediation (Cummins 1999; Cummins & Weiss 2000). The most common output variable under this approach is incurred benefit plus additions to reserves. The incurred benefit represents the amount received by the policyholders for the losses that occurred in the current year, while the addition to reserve refers to the funds that are not used and which will be invested (Cummins & Weiss 2000). Cummins and Weiss (2000) and Cummins (1999) agreed that this output variable is able to reflect the three functions of insurers. Therefore, following prior research with the value-added approach, such as Cummins and Zi (1997), Eling and Luhnen (2010), and Leverty and Grace (2010), net incurred benefits plus addition to reserve are treated as outputs for the risk management in this study. The input and output variables of risk management as well as their measurements are summarized in Table 1.

TABLE 1. Input and output variables and measurements of risk management

Variable	Measurement
Input	Investment risk = Variance of investment return Underwriting Risk = Variance of (Benefit paid/ Premium) Leverage = Liability/Asset
Output	Net incurred benefit plus reserves

Investment Management Inputs The successful operation of the insurer and its relationship with customers is significantly dependent on investment management (Black & Skipper 2000). Insurers will use their technical provisions (reserves) and equity capital for investment purposes. However, reserves are the largest source of investment funds, which sometimes reach more than 80% (Black & Skipper 2000).These reserves only belong to the policyholders if the policy is surrendered, as specified under the non-forfeiture value options. However, as long as the insurance contract remains in force, the reserve is the responsibility of the insurer and it forms part of the death benefits to be claimed in the future. These reserves will be invested by the insurers to guarantee that their contractual liability to policyholders can be met. Thus, the first input of investment management is what is known as net actuarial reserves.

Continuing on the same note, the final input for investment management performance analysis is total investment assets. Insurance firms place their investment in a variety of instruments including equity and debt issues or bonds, mortgages, loans, government securities and real estate. Government securities, corporate bonds, mortgages and private loans are fixed income investments. Vela (1999) stated that the first two investments are free from insolvency and default risk, while the other two investments offer higher lending rate to compensate for higher risk. However, these types of investment are non-liquid in nature. She also explained that investments in equities do not promise a fixed rate of interest or "repayment of the purchase money in any amount at any fixed date" (Vela 1999). Furthermore, real estate investment is considered very interesting because, besides providing a high rate of return and increasing capital value, it also offers cash flow from the tenancy rates and rental fees (Vela 1999). However, because of the unique nature of the operations of life insurance firms and the resulting risk profiles, the assets of the majority of life insurance firms comprise fixed-income investments (Black & Skipper 2000).

Investment Management Outputs In many countries, the aggregate investment activities contribute the main source of capital for national economic growth. The investment management role is to harmonize between risk-adjusted return and regulatory requirement in relation to their assets and other financial restrictions (Zurich Financial Services 2007). In addition, the solvency and profitability of the insurers are also highly dependent on the investment management (Black & Skipper 2000). In short, Black and Skipper (2000) claimed that the prominent elements for most life insurers are solvency and profitability in which the former is for regulatory and policyholders requirement, while the latter is to reward the shareholders for bearing the risk. In order to accomplish their promise to regulators and especially to policyholders and provide strong creditworthiness, the insurers must be solvent. Therefore, insurers must ensure that their investment is sufficient to cover future liabilities (Doff 2007). The investment management has to foresee the potential mismatch in the value of its assets and liabilities and ensure that such a mismatch will not endanger the company as a going concern (Zurich Financial Services 2007). However, at the same time, the party that provides the capital and bears the risk, that is, the shareholder, must be rewarded too. Value added from bearing risk via return on equity or dividends can only be provided by profitable businesses.

Against this backdrop, it seems that investment management activities fulfil the pure intermediaries' function of insurers. Therefore, the choice of output variables for investment management activity is following the intermediation approach. Based on the work by Brockett et al. (2005), Wu et al. (2007) and Yang (2006), the objectives or targets of the intermediation functions of insurers/*takaful* operators – solvency and profitability – can be treated as the output variables. In this study, the solvency measurement will use the solvency scores obtained from the study by Yakob et al. (2012) which is estimated using the factor analysis described in Hsiao (2005), as total financial index (TFI). Meanwhile, the profitability is represented by the rate of return on investments (Brockett et al. 2004, 2005). The input and output variables for investment management together with their measurements are described in Table 2.

TABLE 2. Inputs and outputs of investment management

Input variables	Output variables
Actuarial reserves	Solvency score = TFI
Total investment assets	Profitability = Investment return

SBM-DEA

The SBM model is a variant of the additive DEA model, which was first presented by Tone (2001). As in the additive model, the SBM differs from the CCR and BCC model as it combines both orientations in a single model, i.e. input-oriented model and output-oriented model. SBM focuses on maximizing the non-zero slacks in the optimal objective. The slacks give the estimate of input excess and output shortfalls that could be improved without worsening any other input and output. The subsequent properties are regarded as important in designing the SBM measures (Cooper, Seiford & Tone 2007): (P1) The measure is unit invariant, which implies that this measure is independent (invariant) of changes in the location and scale of the input and output and, (P2) The measure is monotone decreasing in each input and output slack.

Equipped with these attractive properties, SBM is regarded as more appropriate (in view of this study) than CCR, BCC and the additive model, as specified by Avkiran (2007: 225), "...SBM as a more appropriate model unless one is certain that there are no significant slacks; or, there is no need to summarise efficiency evaluation in a single figure which facilitates ranking; or, variables have the same dimensions." Thus, the SBM model will be applied to obtain the efficiency score of risk and investment management of each firm under observation. Throughout this study, the DMUs refer to the two main activities of the life insurers and *takaful* operators, i.e. risk management and investment management. According to Tone (2001), for each DMU_j ($j = 1, ..., n$) and input matric $X = x_{ij} \in R^{mxn}$ used by DMU_j and amount of output matric $Y = y_{ij} \in R^{sxn}$ yielded by DMU_j, with the assumption, the data set is positive $X > 0$ and $Y > 0$, the production possibility set for SBM is defined by:

$$P = \{(x, y) \mid x \geq X\lambda, y \leq Y\lambda, \lambda \geq 0\} \quad (1)$$

Where λ is a nonnegative vector in R^n. In an attempt to estimate the efficiency of a DMU (x_o, y_o), the following fractional programme (FP) is formulated:

$$(SBM_{FP}) \min_{\lambda_j s_i^- s_r^+} \rho = \frac{1-\frac{1}{m}\sum_{i=1}^{m} s_i^-/x_{io}}{1-\frac{1}{s}\sum_{r=1}^{s} s_r^+/y_{ro}} \quad (2)$$

subject to:

$$x_o = X\lambda_j + s^-$$
$$y_o = Y\lambda_j - s^+$$
$$0 \leq \lambda, s^-, s^+$$

The optimization in Eq. (2) is over the variables λ, s^-, s^+. x_{io}, Y_{ro}, which represent the corresponding input and output values for DMU_o, the DMU whose efficiency is to be evaluated. The vectors $s^- \in R^m$ and $s^+ \in R^s$ represent the input excess and output shortfall, respectively, and are called slacks. Again, referring to the objective function in Eq. (2), by dividing each slack variable s_i^- and s_r^+ with the input and output variables and for the numerator and denominator, respectively, the measure of inefficiency is unit invariance because all the slacks have the same scale as its input or output variable, and the ratio of these two measures eliminate the scale of each input and output variable. This feature, according to Cooper et al. (2007), is a "dimension free" measure of SBM inefficiency, and, thus, the satisfies (P1). It can also be verified that, the increase in either s^- or s^+, all else held constant, will decrease the value of ρ, and, "indeed, do so in a strictly monotone manner" (Cooper et al. 2007). Thus, (P2) is satisfied.

The SBM index of efficiency ρ actually portrays the ratio of average input and output mix efficiencies with the upper limit, $\rho = 1$, that will be achieved only when slacks are zero in all inputs and outputs (Cooper et al. 2007). Consequently, DMU_o is said to be fully efficient if and only if all slacks are zero at optimum Eq. (2). This implies that for this DMU_o no other DMU (or combination of DMUs) can produce the same output with smaller amounts of inputs, or can use the same set of inputs to produce more output. In order to simplify the calculation, SBM Eq. (2) can be transformed into a linear program (LP) using the Charnes-Cooper transformation (Charnes et al. 1978). By introducing variable t as a positive scalar, and defining $S^- = ts^-$, $S^+ = ts^+$, $\Lambda = t\lambda$, then, Eq. (2) is replaced by the following LP in t, S^-, S^+ and Λ:

$$SBM_{LP} \min_{t, s^-, s^+, \Lambda} \tau = t - \frac{1}{m}\sum_{i=1}^{m} S_i^-/x_{io} \tag{3}$$

subject to :

$$1 = t + \frac{1}{s}\sum_{r=1}^{s} S_r^+/y_{ro}$$
$$tx_o = X\Lambda + S^-$$
$$ty_o = Y\Lambda - S^+$$
$$\Lambda, S^-, S^+ \geq 0; t > 0$$

The constraint $t > 0$ makes the transformation reversible, thus, the FP is equivalent to LP (Cooper et al. 2007). If the optimal solution of SBM_{LP} is $(\tau^*, t^*, \Lambda^*, S^{-*}, S^{+*})$, defined by, then, the optimal solution of SBM_{LP} is defined by $(p^* = \tau^*, \lambda^* = \Lambda^*/t^*, s^{-*} = S^{-*}/t^*, s^{+*} = S^{+*}/t^*)$. Therefore, based on this definition, a DMU (x_0, y_0) can be decided as SBM-efficient if and only if $\rho^* = 1$. This condition is achieved when $s^{-*} = 0$ and $s^{+*} = 0$, i.e. the value of all slack variables is equal to zero. On the other hand, a DMU (x_0, y_0) is considered as SBM-inefficient when $s^{-*} \neq 0$ and/or $s^{+*} \neq 0$, then the expression of (x_0, y_0)would be:

$$x_0 = X\lambda^* + s^{-*} \tag{4}$$

$$y_0 = Y\lambda^* + s^{+*} \tag{5}$$

As for this condition, Tone (2001) stated, "Since the SBM ρ^* depends only on s^{-*} and s^{+*}, i.e., the reference-set dependent values, ρ^* is not affected by values attributed to other DMUs not in the reference-set". Therefore, he claimed that the SBM measure of efficiency ρ^* is unlike the other efficiency measures in which they "incorporate statistics over the whole data set." For the purpose of this study, the efficiency score of the risk and investment management will then be taken from the SBM-efficiency measure ρ^*. This study will also use the SBM-constant return to scale (CRS) model. According to Yao, Han and Feng (2007), the key objective of a firm is to operate at CRS. They further added that if the assumption of CRS is waived, the number of DMU that will be efficient is high, especially for a small data set, which causes a problem for comparing and improving the efficiency scores obtained.

DATA

For the purpose of this study, the selection of the firms is restricted to direct insurers (composite and life) and *takaful* operators operating in Malaysia. Data are limited to life and family *takaful* businesses. For the composite insurers that offer general and life products and for *takaful* operators that offer general and family *takaful* products, the data is segregated between the two lines of business and can be obtained from the companies' financial report. The study also totally excludes the new entrants during the study periods but maintains the firms involved in merger and acquisition activities. Thus, based on these characteristics, for the period 2003-2007, this leaves a sample of 20 firms, which consist of 7 conventional life insurers, 9 conventional composite insurers and 4 *takaful* operators, which represents about 91% of the total players for the study period. The sample also accounts for approximately more than two-thirds of the total assets of life insurance fund assets and family *takaful* fund assets in the overall life insurance and *takaful* industry, respectively. Insurers/*takaful* operators' name refers to the recent registration. The firms under observation according to the type of business are depicted in Table 3.

EMPIRICAL RESULTS

DESCRIPTIVE STATISTICS

Based on Table 4, for the 5 consecutive years, "Leverage" ranges from a minimum of 0.0179 in 2004 to a maximum of 0.5650 in 2003. The highest and lowest mean value of "Leverage" are 0.1194 (2003) and 0.0853 (2005), respectively. However, the standard deviation values from 2003-2007 confirm that the "Leverage" for each player in the industry are not too scattered. Meanwhile, the minimum value of "Investment Risk" and "Underwriting Risk" is too small, which means that some firms faced a low investment and underwriting risk over a period of 5 years. This is also reflected by the small average value of "Investment Risk" and "Underwriting Risk" in which the highest average is only at 0.0009 (2003) and 0.0537 (2006), respectively. Comparing "Investment Risk" and "Underwriting Risk", "Underwriting Risk" has a greater dispersion. This likely indicates that the underwriting risk faced by each player in the industry is more diverse than the investment risk, which seems to be more stable. In addition, minimum and maximum value of the output variable "Benefit plus Reserve" ranges from the lowest minimum value of 0.1349 (2003) to the highest maximum

TABLE 3. The list of insurer/*takaful* operators under observation 2003-2007

No.	Name of Firm	Type of Business
1	Allianz Life Insurance Malaysia Berhad (A)	Life
2	Uni. Asia Life Assurance Berhad (B)	Life
3	Manulife Insurance (Malaysia) Berhad (C)	Life
4	Asia Life (M) Berhad (D)	Life
5	Mayban Life Assurance Bhd (E)	Life
6	Great Eastern Life Assurance (M) Berhad (F)	Life
7	Commerce Life Assurance Berhad (G)	Life
8	Tahan Insurance Malaysia Berhad (H)	Composite
9	Hong Leong Assurance Berhad (I)	Composite
10	Am Assurance Berhad (J)	Composite
11	MCIS Zurich Insurance Berhad (K)	Composite
12	Malaysian National Insurance Berhad (L)	Composite
13	Malaysian Assurance Alliance Berhad (M)	Composite
14	*Takaful* Nasional Sdn. Bhd. (N)	Composite
15	*Takaful* Ikhlas Malaysia Sdn. Bhd. (O)	Composite
16	Syarikat *Takaful* Malaysia Berhad (P)	Composite
17	Mayban*Takaful* Berhad (MTak) (Q)	Composite
18	Prudential Assurance Malaysia Berhad (R)	Composite
19	ING Insurance Berhad (S)	Composite
20	American International Assurance Company, Ltd (T)	Composite

TABLE 4. Descriptive statistics for the input and output variables of risk management for 5 years – conventional and *takaful* industry

Year	Statistic	Leverage	Investment Risk	Underwriting Risk	Benefit plus Reserve
2003	Average	0.1194	0.0009	0.0254	0.9046
	Standard deviation	0.1310	0.0012	0.0344	0.2074
	Min	0.0309	0.0000*	0.0000*	0.1349
	Max	0.5650	0.0040	0.1279	1.0425
2004	Average	0.0928	0.0006	0.0303	0.9141
	Standard deviation	0.0564	0.0008	0.0403	0.1398
	Min	0.0179	0.0000*	0.0000*	0.4965
	Max	0.2350	0.0027	0.1745	1.0582
2005	Average	0.0853	0.0005	0.0416	0.9178
	Standard deviation	0.0423	0.0006	0.0573	0.1423
	Min	0.0223	0.0000*	0.0000*	0.5039
	Max	0.1984	0.0026	0.2360	1.0700
2006	Average	0.0928	0.0004**	0.0537	0.9161
	Standard deviation	0.0485	0.0004**	0.0856	0.1755
	Min	0.0347	0.0000*	0.0004	0.4116
	Max	0.2161	0.0016	0.3594	1.0989
2007	Average	0.0904	0.0003#	0.0299	0.9504
	Standard deviation	0.0430	0.0003#	0.0455	0.1245
	Min	0.0248	0.0000*	0.0000*	0.5178
	Max	0.2054	0.0012	0.1385	1.1105

Notes: All inputs and outputs are in the form of a ratio. *refers to a very small value; **mean = 0.000379, standard deviation = 0.0003953; #mean = 0.000301, standard deviation = 0.0002963

value of 1.1105 (2007), with average values ranging from 0.9046 (lowest value in 2003) to 0.9504 (highest value in 2007). The dispersion of "Benefit plus Reserves" is quite large and ranges from 12.45% (2007) to 20.74% (2003).

From Table 5, over 5 consecutive years, the range between the minimum and maximum value for "Total Investment" is quite large with the lowest minimum value being 0.3179 (2006) and the highest maximum value being 0.9652 (2003). The average for "Total Investment" is up to 65.36% (2007). In addition, the standard deviation is up to 20.62% (2003). Meanwhile, "Actuarial Reserve" ranges from the lowest minimum of 0.1249 (2003) to the highest maximum of 0.9681 (2003), with the lowest average being 72.48% (2003) and the highest average being 76.85%

TABLE 5. Descriptive statistics for the input and output variables of investment management for 5 years – conventional and *takaful* industry

Year	Statistic	Total Investment	Actuarial Reserve	Investment Return	Solvency (TFI)
2003	Average	0.6110	0.7248	0.0605	16.0600
	Standard deviation	0.2062	0.2105	0.0221	20.3880
	Min	0.3540	0.1249	0.0154	0
	Max	0.9652	0.9681	0.1034	100.00
2004	Average	0.6139	0.7491	0.0611	14.8200
	Standard deviation	0.1720	0.1101	0.0223	15.4710
	Min	0.3743	0.4807	0.0140	6.0000
	Max	0.9598	0.8681	0.1080	78.0000
2005	Average	0.6285	0.7539	0.0631	12.3000
	Standard deviation	0.1399	0.1362	0.0212	6.5080
	Min	0.3601	0.3486	0.0146	6.0000
	Max	0.9444	0.8958	0.0964	34.0000
2006	Average	0.6008	0.7359	0.0637	13.2600
	Standard deviation	0.1461	0.1543	0.0168	6.3700
	Min	0.3179	0.3189	0.0228	7.0000
	Max	0.9483	0.9033	0.0909	27.0000
2007	Average	0.6536	0.7685	0.0603	14.5200
	Standard deviation	0.1330	0.1284	0.0163	10.7460
	Min	0.4913	0.4154	0.0238	7.0000
	Max	0.9391	0.9248	0.0838	53.0000

Note: All inputs and outputs are in the form of ratio

(2007). The standard deviation takes the lowest value at 0.1101 (2004) and the highest value at 0.2105 (2003). The standard deviation values indicate that the conventional insurers and *takaful* operators have large variations of total investment and actuarial reserve. For "Investment Return", the average value seems to be smaller, with a minimum value as low as 0.0140 (2004) to a maximum value as high as 0.1080 (2004). The dispersion of return on investment, which is shown by the standard deviation, is small with the lowest value being 0.0168 (2006). The range between the minimum and maximum value for the TFI index is between 0 (2003) and 100 (2003), with average values of around 12 to 16 (during 5 years) and the smallest and highest value for the standard deviation being 6.37 (2006) and 20.388 (2003), respectively.

SBM-DEA RESULTS

Table 6 summarizes the results of SBM-DEA. The average efficiency score for risk management increased from 59.6% to 77.9%, although it decreased from 67.5% to 62.9% during the period from 2004 to 2005. Meanwhile, the average investment management performance also increased from 49.9% to 69.9% during the period 2003-2007, despite a slight decline in the midterm. According to Cummins (1999), an increase in the average efficiency

TABLE 6. Summary of SBM-DEA efficiency score

	2003	2004	2005	2006	2007
Risk Management Function					
Average score	0.596	0.675	0.629	0.688	0.779
Standard deviation	0.305	0.328	0.313	0.309	0.245
Max of efficiency score	1	1	1	1	1
Min of efficiency score	0.031	0.162	0.167	0.134	0.238
% of efficient insurer/*takaful* operator	27.8	44.4	33.3	44.4	50.0
Investment Management Function					
Average score	0.499	0.515	0.719	0.611	0.699
Standard deviation	0.277	0.245	0.203	0.226	0.244
Max of efficiency score	1	1	1	1	1
Min of efficiency score	0.158	0.187	0.419	0.335	0.280
% of efficient insurer/*takaful* operator	15.0	15.0	30.0	15.0	25.0

score indicates increased competition among insurance firms (insurers/*takaful* operators), especially with the advancement of computing and communications technology as well as dynamic changes in the various types of risk. In addition, the average efficiency of 59.6% to 77.9% and 49.9% to 69.9% implies that the average insurers/*takaful* operators have to improve from 22.1% to 40.4% and 30.1% to 50.1% if it were to perform the best risk and investment management practice, respectively.

Moreover, the heterogeneity or dispersion of both the risk and investment management efficiency (which is shown by the standard deviation values) declined during the period of 2003-2007. This is particularly encouraging because it shows that the insurers/*takaful* operators are converging towards the best practices (Carr et al. 1999). However, the decreasing rate is quite slow, which is reasonable because some insurers show a very low efficiency score for risk and investment management, which is in the range of 0.031 to 0.238 and 0.158 to 0.419, respectively. This indicates that the insurers/*takaful* operators are most likely not to exert enough effort to compete intensively with each other to achieve efficient risk and investment management. It is also found that from Table 6, the percentage of insurers/*takaful* operators that are identified to have efficient risk management in 2003-2007 is approximately 28%, 44%, 33%, 44% and 50%. On the other hand, for the years 2003, 2004 and 2006, 15% of insurers/*takaful* operators were identified as having efficient management, while 30% and 25% were efficient for the years 2005 and 2007, respectively. This clearly shows that the number of insurers/*takaful* operators having inefficient risk and investment management is slightly more than 50% and 70%, respectively, for the period from 2003 to 2007. Furthermore, the efficiency of risk and investment management is observed as having been achieved by different insurers/*takaful* operators for each year from 2003-2007.

According to Table 7, for risk management, it is obvious that insurer K is the only insurer that has been on the frontier throughout this period. In addition, the performance of insurers N and P are also encouraging in as much as they achieved efficient risk management four times. Apart from insurers H, J, M, and O, the other insurers/*takaful* operators enjoyed efficient risk management for at least one year.

Likewise, from Table 8, it can be seen that the distribution of insurers/*takaful* operators that are efficient in terms of investment management is not the same throughout the years. In fact, none of the insurers/*takaful* operators is seen as having preserved efficiency for the 5 consecutive years. However, among the insurers/*takaful* operators having efficient investment management, insurers M and O are the most prominent because they have been on the frontier four and three times, respectively. Insurers D, E, F, H, I, K, L and Q also present efficient investment management at least once in the 5-year period, while another 10 insurers, namely, insurers A, B, C, G, J, N, P, R, S and T experience inefficient investment management. These results confirm that, on average, insurers that are inefficient in terms of investment management number more than the insurers that are inefficient in terms of risk management. Therefore, on average and individually, it seems likely that the insurers/*takaful* operators have a better performance in the risk management aspect compared to investment management.

TABLE 7. SBM-DEA (individual results) – efficiency score for risk management

2003		2004		2005		2006		2007	
DMU	Score	DMU	Score	DMU	Score	DMU	Score	DMU	Score
A	0.6496	A	1.0000	A	0.2960	A	0.6072	A	1.0000
B	0.4815	B	1.0000	D	0.4650	B	0.5993	B	1.0000
C	1.0000	C	0.9334	E	1.0000	C	0.4911	C	0.5040
D	0.5051	D	0.3747	F	1.0000	D	1.0000	D	1.0000
E	0.5842	E	0.3942	H	0.3895	E	1.0000	E	0.7466
F	0.4606	F	0.3727	I	0.8498	G	1.0000	F	0.6337
H	0.3765	G	1.0000	J	0.3824	H	0.1340	G	1.0000
I	1.0000	H	0.3175	K	1.0000	I	0.6005	I	1.0000
J	0.8292	I	0.4200	L	0.4299	J	0.3883	J	0.6015
K	1.0000	J	0.5967	M	0.2994	K	1.0000	K	1.0000
L	0.3739	K	1.0000	N	1.0000	L	1.0000	L	0.5634
M	0.2256	L	1.0000	O	0.1674	M	0.3472	M	0.5315
N	0.6349	M	0.2279	P	1.0000	N	1.0000	N	1.0000
O	0.0312	N	1.0000	Q	0.3416	O	0.2600	O	0.2379
P	1.0000	O	0.1617	S	0.8144	P	1.0000	Q	1.0000
Q	0.1926	P	1.0000			Q	0.2545	R	0.7621
R	1.0000	Q	0.3569			R	1.0000	S	1.0000
T	0.3911	T	1.0000			S	0.7008	T	0.4453

TABLE 8. SBM-DEA (individual results) – efficiency score for investment management

2003		2004		2005		2006		2007	
DMU	Score	DMU	Score	DMU	Score	DMU	Score	DMU	Score
A	0.4441	A	0.5488	A	0.5099	A	0.4924	A	0.5401
B	0.5026	B	0.2934	B	0.4785	B	0.3613	B	0.3468
C	0.2824	C	0.2679	C	0.6268	C	0.4523	C	0.7488
D	0.4570	D	0.4538	D	1.0000	D	0.4630	D	1.0000
E	0.2385	E	0.3455	E	0.6705	E	1.0000	E	1.0000
F	0.5361	F	0.6820	F	1.0000	F	0.7885	F	0.8778
G	0.2856	G	0.5587	G	0.5196	G	0.5449	G	0.6114
H	0.1761	H	0.3181	H	0.5201	H	1.0000	H	0.2745
I	1.0000	I	1.0000	I	0.6645	I	0.4052	I	0.6469
J	0.4112	J	0.3546	J	0.6281	J	0.5144	J	0.5730
K	0.2156	K	0.2647	K	0.4914	K	0.5570	K	1.0000
L	1.0000	L	0.2718	L	1.0000	L	0.3800	L	0.4967
M	0.8541	M	1.0000	M	1.0000	M	1.0000	M	1.0000
N	0.1041	N	1.1838	N	0.4095	N	0.3000	N	0.4668
O	1.0000	O	0.0000	O	1.0000	O	0.3168	O	0.4625
P	0.1294	P	0.3009	P	0.5135	P	0.3320	P	0.6445
Q	0.2064	Q	0.6049	Q	1.0000	Q	0.8277	Q	1.0000
R	0.3956	T	0.5136	R	0.7319	R	0.6805	R	0.7742
S	0.2767		0.3550	S	0.5827	S	0.4602	S	0.5414
T	0.2574		0.4350	T	0.6912	T	0.6593	T	0.8046

Slack Variables This study also reveals the main causes of inefficiency in the risk and investment management of conventional insurers and *takaful* operators. Figures 1a and 1b portray the average value of nonzero slacks that correspond to the inefficiencies in each input and output of risk management for inefficient insurer/*takaful* operators. Generally, the sources of the inefficiency of risk management are from both the input and output dimensions. From Figure 1a, the inefficiencies in risk management are mostly caused by the failure to manage all three inputs at the optimum level, particularly in respect of the inputs of leverage and underwriting risk. Clearly, the largest input that causes inefficiency in the risk management is the underwriting risk for four consecutive years from 2004-2007, followed by leverage for the year 2003. In addition, Figure 1B shows that insurers/*takaful* operators indicate a higher shortage in the output of benefit plus reserve, with the highest shortage having occurred in 2004.

In terms of investment management, the inefficiency is also in the input and output dimensions. The sources of the investment management inefficiency are shown

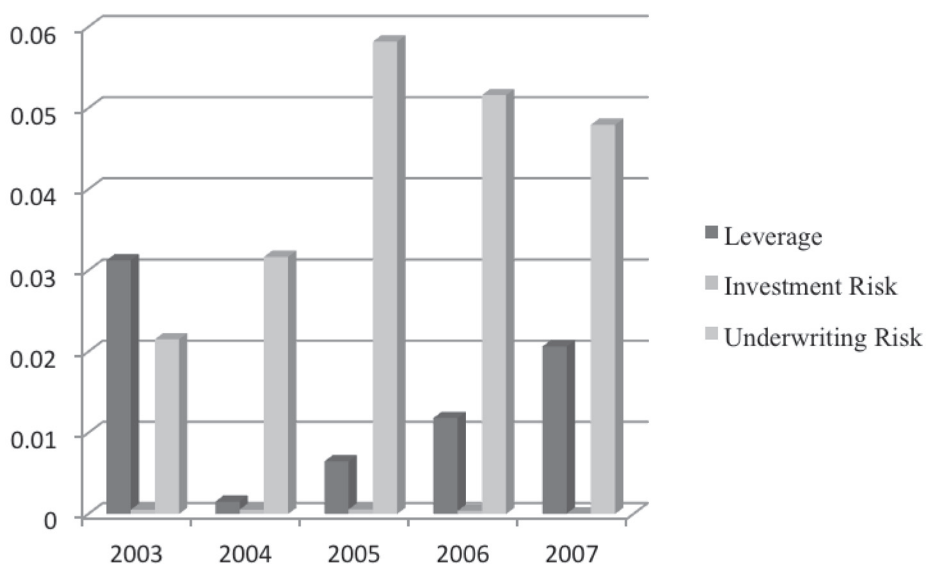

FIGURE 1a. Average inputs excess of risk management for inefficient insurers/*takaful* operators

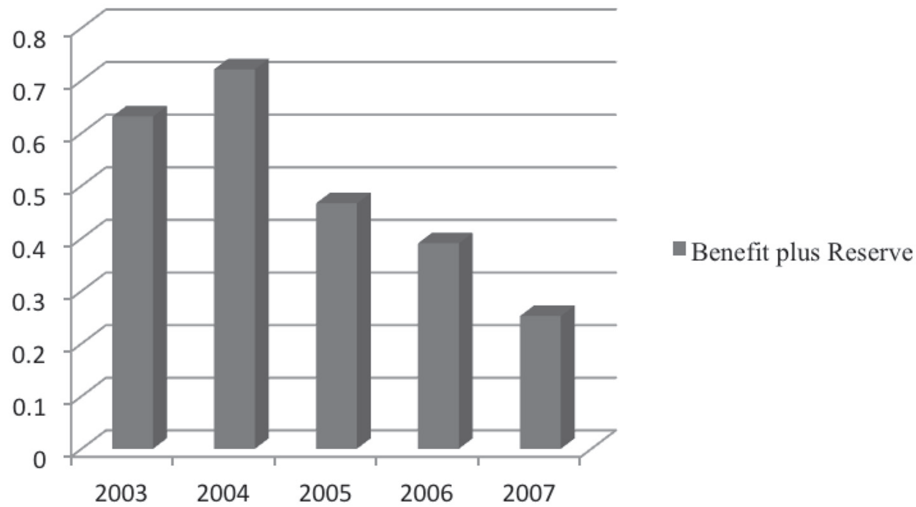

FIGURE 1b. Average output shortage of risk management for inefficient insurers/*takaful* operators

graphically in Figures 2a-2c. Figure 2a demonstrates that only input of actuarial reserve is identified as the cause of the inefficiency of investment management in 2003. However, between 2004 and 2007, it can be seen that the insurers/*takaful* operators dealt with excessive inputs of both total investment and actuarial reserve. In addition, the insurer/*takaful* operators experienced a shortage of investment returns for the period 2004-2007 (Figure 2b). This is coupled with the high shortage of solvency index over the period 2003-2005, which is depicted in Figure 2c.

From the above observations, it is likely that an efficiency variation among insurers/*takaful* operators exists. Yao et al. (2007) claimed that the efficiency score itself is not able to provide information concerning the difference in value achieved. Therefore, in the context of

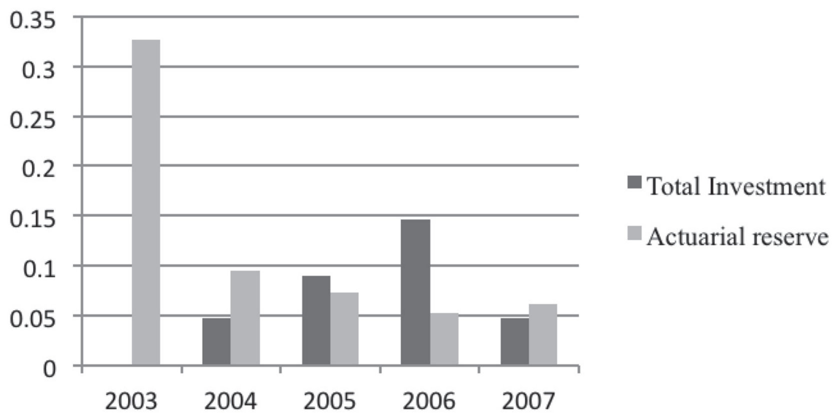

FIGURE 2a. Average input excess of investment management for inefficient insurers/*takaful* operators

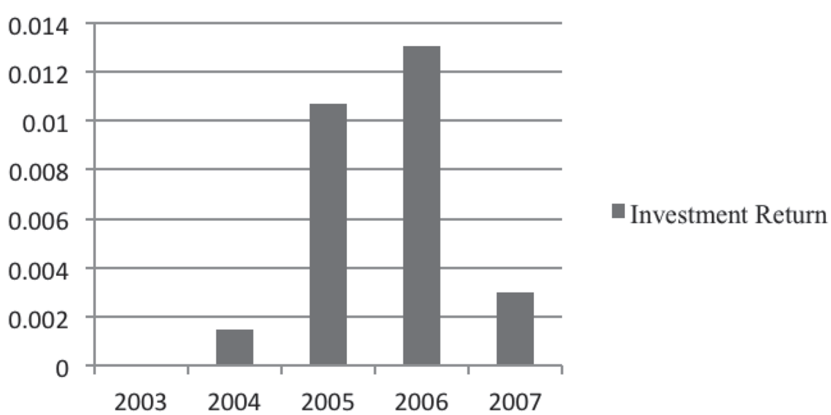

FIGURE 2b. Average output shortage of investment management for inefficient insurers/*takaful* operators

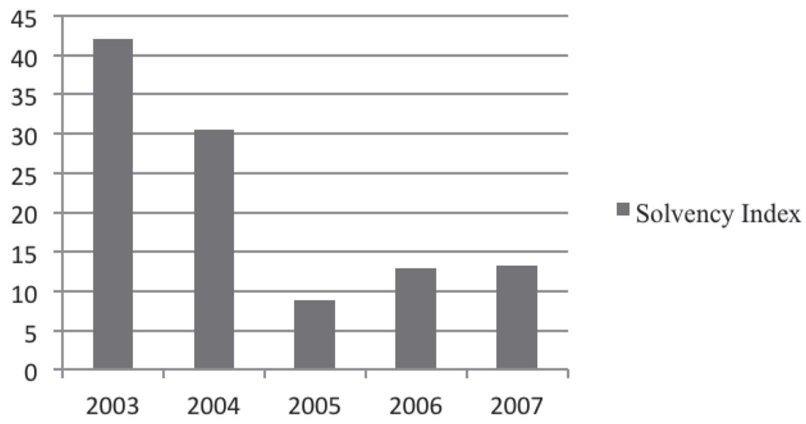

FIGURE 2c. Average output shortage of investment management for inefficient insurers/*takaful* operators

this study, one of the aspects that have to be associated with the variations in the risk and investment management efficiency is the operating system, i.e. conventional life insurers and *takaful* operators.

Operating System Vs. Efficiency Figure 3a and 3b reveals that the risk and investment efficiency vary according to the companies operating system. From the total of *takaful* operators, as shown in Figure 3A, 25%, 50%, 50%, 50% and 67% enjoyed efficient risk management between the years 2003 and 2007, whereas only 29%, 43%, 27%, 43% and 47% from the total of conventional insurers demonstrated efficient risk management. Thus, it can be considered that *takaful* operators have better performance than conventional insurers from the risk management perspective except for the year 2003.

In contrast to the risk management, the results shown in Figure 3b for the investment management in terms of the relationship between the efficiency and the company's operating system are mixed. In the first three years (2003-2005), it can be concluded that *takaful* operators have a better performance in investment management compared with conventional insurers with a percentage of (25%, 12.5%), (25%, 12.5%), and (50%, 25%). Surprisingly, it is found that none of the *takaful* operators attained an efficiency score equal to 1 in 2006, as compared to 18.8% of conventional insurers being able to demonstrate an efficient investment management. On the other hand, in 2007, the percentage of conventional insurers and *takaful* operators having efficient investment management is the same, which is equal to 25%.

A variation in the efficiency ranking above is likely due to inherent differences in the conventional and *takaful* systems. The conventional insurers and *takaful* operators are governed by different legislation and regulations. *Takaful* operators are governed by the *Takaful* Act 1984, whereas the conventional life insurer is guided by the Insurance Act 1996. These different Acts give the impression that some aspects of the operation of conventional insurance and *takaful* are different. Under the *Takaful* Act 1984, each and every aspect of *Takaful* operation must comply with Syariah Law. This aspect is emphasized in investment activities in which all investments must be in activities and instruments allowable under Syariah. To be specific, a *takaful* operator is forbidden to invest in commodities, such as alcohol, gambling and pork, as well as any associated activities or investments. To ensure this regulation is being complied with at all times, activities undertaken by the *takaful* operator are not only governed by the Shariah Advisory Council (SAC) for Islamic Banking and *Takaful*

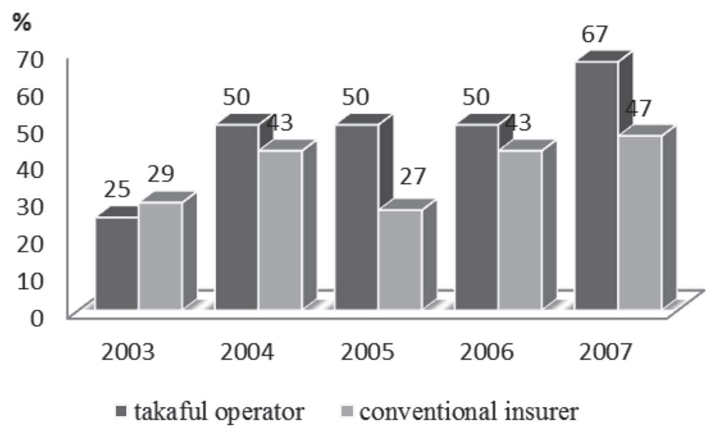

FIGURE 3a. Risk management efficiency by company's operating system

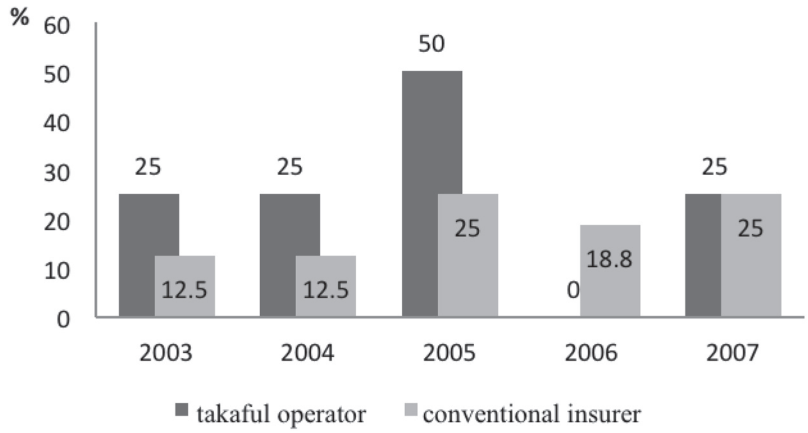

FIGURE 3b. Investment management efficiency by company's operating system

(established in Central Bank of Malaysia), but they must also comply with the appointed Syariah Supervisory Council (SSC) as part of its internal governance. The rigid internal and external oversight from SSC and SAC is able to minimize mistakes in the asset-liability management as well as investment activities and thus will reduce the investment risk assumed by the *takaful* operator. In addition, Kwon (2007) declared that *takaful* operators possess the unique characteristics of the underwriting and pricing practices when compared with conventional systems. The underwriting process is carefully implemented to the extent that some *takaful* companies only accept participants (insured) with standard risk, or, in a more rigorous situation, they will be put in a different class even if they only differ in the year of their entry into the plan (Abdul Kader et al. 2010; Ali 1989). Thus, because of the differences between the two operating systems, it is expected that different operating systems have a significant effect on risk and investment management efficiency.

CONCLUSION

Generally, from the SBM-DEA results attained, the efficiency of risk and investment management of insurers/*takaful* operators for the period 2003 to 2007 was moderate, which does not exceed 80%. This implies that the average insurer/*takaful* operators have to improve by about 20% if they are to perform the best financial management practice. There is considerable potential for the life and *takaful* industry to improve the performance of its financial management, particularly in risk and investment management functions. In addition, the results imply that the insurers/*takaful* operators are competing with each other to converge towards the best practices. However, the converging rate is slow. This condition may also be a good sign for inefficient insurers/*takaful* operators, as they can still survive for a few years to come. However, the increasingly intense competition, as evidenced by the dramatic increase in the average efficiency of both financial management functions during the 5-year study period, does not provide many options for inefficient insurers, unless they (1) increase their operational performance; (2) merge with a more efficient insurer, or (3) they exit from the business (Cummins 1999). In comparing both functions, the risk management technical efficiency is relatively higher than the investment management technical efficiency. This indicates that the insurers/*takaful* operators have a better performance in the risk management aspect compared to investment management. This is probably due to more inefficient observations in the investment management group. Clearly, the inefficiency in both functions is caused by both the input and output dimensions. The sources in input dimension of risk management inefficiencies are excessive leverage, underwriting and investment risk. Additionally, insurers/*takaful* operators also experience a shortfall of benefit plus reserve. Meanwhile, the investment management inefficiencies are mostly due to the overutilization of total investment and actuarial reserve, together with a shortfall in outputs, i.e. investment return and the low level of solvency index. This can perhaps provide the material information to the managerial team in addressing the inefficiency sources for any particular inefficient insurer/*takaful* operator. The results also illustrate that it is possible that the variations in the efficiency ranking of risk and investment management are due to differences in the operating system between the conventional insurers and *takaful* operators. The *takaful* operators exhibit more efficient risk management than conventional insurers. However, it cannot be confirmed whether one type of operating system is better than the other system in terms of investment management, as the result is mixed. The causes of the inefficiency of each financial management function were also determined.

The findings of this study will provide firms with the necessary information to identify their weaknesses in each inefficient activity, thereby enabling them to seek the required improvement. The firms can better understand the profile of the risks they run, the appropriate matching between assets and liability, and the adequacy of the capital and the portfolio of their investments. In addition, the management can also plan their strategies according to the efficiency level in each aspect of input excess and output shortfall. Finally, this study can be extended to a more detailed study to determine favourable operating systems in order to enhance the efficiency of the financial management in the insurance/*takaful* industry by using larger data sets, particularly for the *takaful* operator group.

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