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The relative efficiency of investment management of life insurers and takaful operators

Abstract

The objective of this study is to analyze the efficiency and determinants of investment management among life insurers and takaful operators and, thus be able to describe their investment efficiency and provide information to firms about the things that need to be improved. This study will use slack-based measure – data envelopment analysis (SBM – DEA) to determine the efficiency of investment management and Tobit analysis in identifying the determinants of the investment management efficiency. The result of SBM – DEA shows that the investment management efficiency of insurers and takaful operators was moderate. The heterogeneity of investment management efficiency declined during the study period and this is particularly encouraging because it shows that the insurers and takaful operators are converging towards the best practices. Besides, the result also reveals that the inefficiencies in investment management are mostly caused by the failure to manage all the resources at optimum level. Meanwhile, the result from Tobit analysis confirms that operating system and investment-linked product enhance the investment management efficiency of insurers and takaful operators. On the other hand, size does not provide a significant effect on the efficiency of investment management of insurers and takaful operators.

Keywords: efficiency, life insurer, takaful, investment management, data envelopment analysis.
JEL Classification: G22, P45, P47.

Introduction

Similar to other investors, insurance and takaful operators also prefer higher returns from their investments to minimize the cost of insurance/ takaful products and to maximize wealth of the shareholders. The insurers must ensure the returns that exceed pricing assumptions and maintain an appropriate relationship between life insurer's/ takaful operator's asset and liability cash flows (Black and Skipper, 2000). Thus, the return from investment offers an important contribution to their operation as a whole through favorable premium charges to their potential policyholders and attractive bonuses and dividends to their shareholders, thereby improving their competitiveness (Cummins and Grace, 1994; Smith, 1989; Oppenheimer and Schlarbaum, 1983). However, the volatility in investment return is inevitable. Among others the reasons are (1): the prices of life insurance depend on the assumption of loss distribution and interest rate. Conservatively, the interest rate is assumed fixed throughout the term of the policy. The instability of the interest rate can mean that an inadequate premium is charged. Insurers/takaful operators with above-average investment returns are able to offer a more attractive premium than others, and insurers/takaful operators with below-average investment returns are not able to retain customers in a competitive market (Black and Skipper, 2000). Thus, in order to secure solvency and profitability, the return on investment must at least be equal to the return assumed in the pricing calculation, otherwise the life insurers will suffer from interest spread loss, and this will lead to insolvency situation. The inconsistent rate of investment return will endanger the insurers in ensuring the interest spread gain or at least breakeven situations; (2) Life insurance/takaful policies are a package of options that include settlement options, reinstatement privileges, surrender and renewal privileges and policy loan options on the part of the insured (Smith, 1982). The implementation of this option is based on the policyholder situation especially in an environment of stable interest rates (Babbel and Santomero, 1999). The options expose the life insurers/takaful operators to the complex interest rate risk. The execution of the options by policyholders, either in a rising or falling interest rate, can reduce the insurer's capital accordingly. The capital plays an important role in ensuring the profitability and success of the insurer, and in fact, the strength and reliability of the insurer also is reflected by the ability of their capital. With their own capital, together with the premiums paid by the policyholders, insurers pay out insurance policies' claims and the related business expenses (Kielholz, 2000). He further explained the time lag between the raising of capital, the premium collection and the payment of losses and expenses in the life insurance transaction is very important. Insurers utilize this time lag and invest the capital and the premiums until the claims and expenses occur.

Briefly, the unpredictability of the financial market, specifically the interest rate and asset prices can have an effect on the operation of life insurers/takaful operators which in turn will jeopardize their ability to meet obligations to stakeholders (policyholder, regulator and shareholder). Life insurers and takaful operators have been urged towards the need to

strengthen the efficiency and effectiveness of their investment management. The insurers and takaful operator must have the proper framework to balance the risk-return trade-off as well as sound and prudent investment management. Against this backdrop, it is beneficial to investigate the efficiency level and determinants of investment management among the registered life insurers and takaful operators and, thus be able to describe their investment efficiency and provide information to firms about the things that need to be improved.

There are three main contributions in this study. The investment management for takaful operators is more challenging than the conventional one. Tied to the rigid regulation requirements similar to the conventional life insurers and the challenges in complying with Syariah Law, it is constructive to analyze the investment performance of takaful operators. This is the first contribution of the study. The increasingly complex demands of customers and the competitive environment with non-traditional competitors such as banks, mutual fund institutions, and investment firms have led to the creation of non-traditional insurance product such as investment-linked products. In introducing this new product, certain aspects in life and takaful operations need to be reformed. This matter may involve new approaches to firm's risk, investment policy, capital requirements and asset-liability matching. Hence, the second contribution of this study is to observe the effect of investment-linked products on investment efficiency. The methodologies used in the study − SBM-DEA and Tobit analysis are the first used in the scope of life insurers and takaful operator in Malaysia, and this is the final contribution of the study.

The remainder of this study proceeds as follows: in section 1, discusses the literature on previous studies; section 2 describes the research design; section 3 illustrates data and the methodology; section 4 discusses the experimental results; and finally, the conclusion is provided in final section, followed by some useful references.

1. Literature review

Most studies on efficiency among insurance firms have only been carried out to measure the overall efficiency of the firm as well as cost, technical, allocative and revenue efficiency. These studies include studies by Eling and Luhnen (2010), Yao et al. (2007), Yang (2006), and Brockett et al. (2005). However, recognizing that the fact that insurers are the financial intermediary and the importance of the investment performance of insurers, the researchers began to deviate their investigation on the efficiency of investment management of insurers. Hsiao and Su (2006) evaluated the investment performance of life insurers in Taiwan, across 3 different groups of insurers. They used data envelopment analysis (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. He suggested that the efficiency of production and efficiency of investments should be separately identified, and then will be combined to obtain the overall evaluation of the insurance industry. Consequently, he performed 3 models separately, namely, production model, investment model and second-stage DEA model. Each of these models measured the production efficiency score, investment efficiency score and overall efficiency score, respectively. A firm that is considered to be efficient must be efficient from both the production and investment perspectives. He concludes that life and health insurance in Canada operates efficiently and exhibits scale efficiency. Similarly, Wu et al. (2007) studied production and investment performance simultaneously by using three different models. Though, the study by Adam (1996) is quite different as not to focus on the efficiency of investment management directly, but instead provided important insights into the determinants of investment earnings of life insurance firms in New Zealand. His study revealed that the ownership structure, size, leverage and underwriting risk were among other factors that influenced investment earnings.

2. Research design

2.1. Investment management inputs. It is noted that the decision making unit (DMU) observed in this study is the investment management of insurers/takaful operators. According to Thanassoulis (2001), DMU has a control over the process it used to transform its resources into outcomes and these resources are referred to inputs, while the outcomes are referred to outputs. Therefore, the input and output variables must be related to the function of investment management. In terms of inputs, it seems that the inputs that are commonly used in previous studies such as labor, business services and material, and financial capital may be less appropriate because these inputs are more applicable if the insurer itself is observing DMU. Black and Skipper (2000) affirmed that the successful operation of the insurer and its relationship with customers is significantly depending on the investment management. Insurer will use their technical provisions (reserves) and equity capital for investment purposes. However,

reserves are the largest source of investment funds in which it sometimes reaches more than 80% (Black and Skipper, 2000). Thus, the first input of investment management is what is known as net actuarial reserves. These reserves belong to the policyholders only if the policy is surrendered, as specified under the non-forfeiture values options. But, 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 their contractual liability to policyholder can be met.

Continuing on the same notes, 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 estates. 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 investments are non-liquid in nature. She also explained, 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, p. 55). On top of that, 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 life insurance firm's operation and the resulting risk profiles, the majority of life insurance firms' assets comprise fixed-income investments (Black and Skipper, 2000).

2.2. Investment management outputs. Zurich Financial Service (2007) stressed that the investment management role is to harmonize between risk-adjusted return and regulatory requirement in relation to their asset and other financial restrictions. Besides, the solvency and profitability of the insurers are also highly dependent on the investment management (Black and Skipper, 2000). In short, they 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, insurer 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 investment (ROE) or dividends can be only provided by profitable businesses. 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 (Berger and Humprey, 1992). Based on the work by Brockett et al. (2005) together with Wu et al. (2007) and Ren (2007) as well as Yang (2006), the objectives or targets of the intermediation functions of insurers/takaful operators that is solvency and profitability can be treated as the output variables. Thus, in this study, the solvency measurement is represented by the ratio of the policy owner's funds to valuation liabilities (Yakob et al., 2008), which measures the ability of supporting the future obligations to policy owners, while profitability is represented by rate of return on investments (Brockett et al., 2005; 2004). The input and output variables for investment management together with their measurements are described in Table 1.

Table 1. Inputs and outputs of investment management

Input variables	Output variables
Actuarial reserves	Solvency = the ratio of the policy owner's funds to valuation liabilities
Total investment assets	Profitability = Investment return

2.3. External factors affect the investment management efficiency. Three variables are considered in this study to explain the differences in the efficiency of the investment management among insurers/takaful operators. There are size, operating system and investment-linked products. The explanation of these variables is as follows:

2.3.1. Size. Firm size is often associated with the performance of insurer. In Malaysia, the difference in size is obvious among the players in the insurance and takaful industry. The assets owned by the insurer/takaful operator in Malaysia are in the range of 7 million − 32.87 billion during the year from 2003-2007. Most previous studies (Eling and Luhnen, 2010; Hao, 2008; Klumpes, 2007; Hao and Chou, 2005; Eckles, 2003; Diacon et al., 2002; Cummins and Zi, 1997; Meador et al., 1997; Gardner and Grace, 1993) have discussed the effect of size on the efficiency of insurance company operations as a whole, but not on the efficiency of investment management functions in particular.

However, the study by Boose (1993) generated the idea that differences in size also lead to differences in investment returns. She explained that a high return on invested assets were due to economies of scale in the investment management which was resulting from an increase in the size of the firm. Moreover, the difference in size also caused the differences in resources to hire expert fund manager in-house who can maximize the investment returns. The result by Boose (1993) in line with Adams (1996) who suggested that size were significantly related to life insurers' investment earnings. In addition, Mayer and Smith (1994) said that the owner of the larger firms give more discretion to managers in making investment decisions and take advantage of market opportunities. Against this background, it seems that the investment management practice by insurers vary by size. Thus, it is worth to examine the effect of size on investment function of insurer/takaful operator. Besides, size is also treated as a control variable.

2.3.2. Operating system (takaful operator versus conventional insurer). The Malaysian insurance market comprises of conventional insurers and takaful operators, which is governed by different legislation and regulation. 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. The differences emphasized here are in terms of the investment activities practiced by both takaful and conventional systems.

Firstly, it is well acknowledged that under The Takaful Act 1984 (this Act is adopted only in Malaysia), in each and every aspects of Takaful operation must comply with Syariah Law. This aspect is emphasized in investment activities in which all investments must be in instruments and activities allowable under the Syariah. Thus, the takaful operators must avoid interest bearing and haram (prohibited) investments (Frenz et al., 2008). To be specific, all investments made by takaful operators must come from Islamic financial instruments. Takaful operator is forbidden to invest in fixed interest rate assets such as deposits, bonds, loans (policy loans) and also in commodities such as alcohol, gambling and pork as well as any associated activities or investments (Frenz et al., 2008). This prohibition is enforced to keep out the elements of Riba (usury) and Haram, which is contrary to Islamic Law (Shara'). Unlike the conventional insurers, investments made are more diverse and free as long as it does not violate the conditions prescribed in the Insurance Act 1996. The distribution of investments by conventional life insurers clearly demonstrates that the fixed-income investments are the significant majority of life insurance investment, with investment in corporate/bond securities accounted for the largest percentage of investments (63% − Malaysia scenario).

Finally, in terms of overall structure of the firm, the takaful operator set up comprises of three parties namely participants, operators and Shariah board (Frenz et al., 2008). In this regards, the participant means the capital provider, whereas the operator refers to the entrepreneur that manages both investment and underwriting (of risk) on behalf of the participants (Islamic Financial Services Board [IFSB], 2009). To ensure the Shariah rulings are being complied at all time, investments and activities undertaken by the takaful operator (entrepreneur) are governed by the Syariah Board. There are two Shariah boards. The first board is known as The Shariah Advisory Council (SAC) for Islamic Banking and Takaful which was established in The Central Bank of Malaysia (BNM). Another board is called Syariah Supervisory Council (SSC). Each takaful operator is required to establish the SSC which will act as part of its internal governance. Normally, The SSC constitutes of 3 members and they must be Syariah scholars or proficient in Syariah. The appointment of the member of SSC is under the consent of SAC. 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 takaful operator. In contrast, the structure of the conventional systems is formed from two parties, the policyholder and the insurer. The relationship between the investor and the entrepreneur does not exist in the conventional system. The insurer agrees to undertake risk in exchange of premium paid by the policyholders and promises to pay fixed sum of money should the covered losses occur in the future. Furthermore, there is no specific committee (such as SAC and SSC) that will oversee the investment activities of insurers. "There is no restriction apart from those imposed for prudential reasons", (Engku Rabiah Adawiyah et al., 2008). Thus, because of these differences, it is expected that different operating systems have a significant effect on investment management efficiency.

2.3.3. Investment-linked product preference. The development of policies based on consumer needs, such as investment-linked policies is something new for insurance as well as takaful industry in Malaysia. The insurer/takaful operator probably has to dismantle or modify the existing risk profile and investment strategy to the new one which is more suited to the new business which satisfies the need

of marketplace (Forbes, 1987). Indeed, offering new product/policies could be also worsening if the industry does not accomplish market research in detail to perceive the level of customer acceptance of new line of business. Insurance companies and takaful operators are projected to develop and perform appropriate policies and techniques to prudently manage risks related to the products offered by them to ensure their business objectives are achieved and consistent with the ability and capacity to address related risks. Furthermore, the value of such policy is very much influenced by the value of the underlying investment funds in which the amount of death benefit, annuity payment, cash value are all very dependent on the investment performance with a minimum guaranteed death benefit (The Commissioner of Insurance of Hong Kong, 2007). Shortly, the offering of investment-linked by both the conventional insurance and takaful market might be changed their risk profile and investment practices. Therefore, the effect of this determinant on investment efficiency should be considered.

3. Methodology

The methodology used in this study consists of two analyses. Briefly, the first analysis will be carried out to calculate the efficiency score for investment management, and the second analysis is to identify the determinants that affect the investment management efficiency of insurers/takaful operators based on the efficiency score obtained in the first analysis.

3.1. SBM-DEA − Obtaining the investment management efficiency score. After completing a careful review on past studies and the appropriateness of the data, this study will employ the SBM-DEA as a frontier efficiency technique in assessing the efficiency of investment management. 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 Charnes-Cooper-Rhodes (CCR) (Charnes et al., 1978) and Banker-Charnes-Cooper (BCC) (Bankers et al., 1984) 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.

Compared to other DEA models, SBM offers some nice properties (Cooper et al., 2007; Tone, 2001). Cooper et al. (2007, p. 120) claimed that the CCR and BCC measure of efficiency θ^* "is not a complete value and, instead, the nonzero slacks may far outweigh the value of $(1 - \theta^*)$". On the other hand, in SBM model, all such inefficiencies are identified. This means that SBM takes into account these nonzero slacks in the calculation of efficiency score "after the radial inefficiencies have been identified" (Avkiran, 2007, p. 225). Thus, the efficiency score (ρ) of the SBM model can be considered more complete. One of the drawbacks of the CCR and BCC models is that they only estimate the relative performance of the DMU and not absolute performance (Cooper et al., 2007). However, a single measure of efficiency that is provided by SBM (ρ) which is also monotonic makes the ranking process become easily. Equipped with these attractive properties, then SBM is regarded as a more appropriate (in view of this study) than CCR, BCC and additive model as specified by Avkiran (2007, p. 225), "...SBM as a more appropriate model unless one is certain that there are no significant slacks; or, there is no need to summarize 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 investment management of each firm under observation.

Throughout this study the DMUs refer to the investment management function of the life insurers and takaful operators. 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_0, y_0), the following fractional program (FP) is formulated:

$$(SBM_{FP}) \min_{\lambda_j s_i^- s_r^+} \rho = \frac{1 - \frac{1}{m}\sum_{i=1}^{m} s_i^- / x_{i0}}{1 + \frac{1}{s}\sum_{r=1}^{s} s_r^+ / y_{r0}}, \quad (2)$$

subject to $x_0 = X\lambda_j + s^-$, $y_0 = Y\lambda_j - s^+$, $0 \leq \lambda, s^-, s^+$.

The optimization in Eq. (2) is over the variables λ, s^-, s^+. x_{i0}, y_{r0} represent the corresponding input and output values for DMU_0, 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. Referring to the objective function in Eq. (2), by dividing each slack variables s_i^- and s_r^+ with the input and output variables x_{ij} and y_{ij} for numerator and denominator

respectively, the measure of inefficiency is unit invariance because all the slacks have the same scale with its input or output variable and the ratio of these two measures eliminate the scale of each input and output variable. 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, p. 100).

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_0 is said to be fully efficient if and only if all slacks are zero at optimum Eq. (2). This implies that for this DMU_0 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. For the purpose of this study, the efficiency score of the 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 et al. (2007), the key objective of a firm is to operate at CRS. They added further that if the assumption of CRS is waived, the number of DMU that will be efficient is high, especially for a small data set and this causes a problem of comparing and improving the efficiency scores obtained. By using both inputs and outputs that have been discussed before, the efficiency of investment management for each insurer/takaful operator is now can be calculated using the SBM-DEA.

3.2. Tobit analysis − identifying the factors that affect the investment management efficiency. This study implements the two-stage method in order to identify the determinants of the investment management efficiency of insurers/takaful operators. According to Coelli et al. (2005), the first stage involves obtaining the efficiency scores via DEA that requires only the traditional inputs and outputs. In the second stage, the regression analysis is conducted where the efficiency score obtained from the first stage is treated as dependent variable, while the determinants as independent variables. The second-stage regression analysis is used to determine separately the effect of determinants on efficiency. They also explained that the factors include all the variables that cannot be treated as traditional inputs and are assumed not directly under the control of manager.

The dependent variable in this study is the investment management efficiency score which is obtained from the SBM-DEA. It is noted that the efficiency score lies in the range 0 to 1. Thus, it is very important to ensure that the analysis used must accord with the habits of the dependent variable that only takes the values in the range 0 to 1. The regression analysis that can take into account the dependent variables with such limited value is censored regression model or also known as Tobit model (Gujarati, 2011 and Wooldridge, 2002). Tobit analysis was proposed by Tobin (1958) which is assumed that the dependent variable is clustered or censored at a limiting value, which is usually 0. Hoff (2007, p. 428) summarized what was stated by Wooldridge (2002) that Tobit analysis is appropriate when the dependent variable is bounded by the lower or upper limit or both, "with positive probability pileup at the interval ends, either by being censored or by being corner solutions". In relation to DEA efficiency score as dependent variables, Pasiouras (2008), Hoff (2007), Coelli et al. (2005) and Carr (1997) suggested to apply the Tobit analysis in the second-stage DEA approach. Given that DEA efficiency scores resemble corner solution variables (Hoff, 2007), this study also will employ two-limit Tobit regression to estimate the effect of size, operating system and investment-link product preference on the investment management efficiency. The relationship may be described by the model:

$$Y_i^* = X_i\beta + \mu_i, \tag{3}$$

where $\mu_i \sim N(0,\sigma^2) Y_i^*$ is a latent variable following censored normal distribution with mean $X_i\beta$ and variance σ^2. X_i is a $k \times 1$ vector of observations on the constant and $k - 1$ efficiency factor explanatory variables; β a $k \times 1$ vector of unknown coefficients (McDonald, 2009). The data generating process (DGP) – Eq. (3) postulates that Y_i is the observed SBM-DEA efficiency score and the censored values of Y_i^* with censoring below 0 and above 1 (McDonald, 2009). Y_i is defined by the following measurement equation:

$$Y_i = \begin{cases} Y_i^*; \text{ if } 0 < Y_i^* < 1, \\ 0; \text{ if } Y_i^* \le 0, \\ 1; \text{ if } Y_i^* \ge 1. \end{cases} \tag{4}$$

The Tobit model is usually estimated using the maximum likelihood (ML). For a data set with N observations, the ML function is:

$$L = \prod_i^N \left[\frac{1}{\sigma}\varnothing\left(\frac{Y_i - X_i\beta}{\sigma}\right)\right]^{d_i} \left[1 - \Phi\left(\frac{X_i\beta}{\sigma}\right)\right]^{1-d_i}. \tag{5}$$

In general, the Tobit analysis is preferred over other regression techniques because it will take into account all observations to estimate the regression line, including those at the limit and those above it, while, for the other techniques, estimation of

regression line is based on observations above the limit (McDonald and Moffit, 1980). As stated earlier, three independent variables namely size, operating system and investment-link product preference will be considered in this study and all of them will be regressed with the dependent variable (investment management efficiency score) using Tobit analysis. Table 2 summarizes the dependent and independent variables, as well as their measurements.

Table 2. Dependent and independent variables used in Tobit analysis

Dependent variable	Measurement
Investment management efficiency	SBM-DEA investment management efficiency score (The score lies in a range 0-1)
Independent variable	Measurement
Size	Natural logarithm of total asset
Operating system	0 – takaful operator; 1 – conventional insurer
Investment-link product preference	Total investment-linked asset/Total life asset

3.3. Data. For this study, the selection of the firms is restricted to direct conventional (life and composite) insurers and takaful operators which consistently present in the industry for the period 2003-2007. The data is limited to life and family takaful business as well as investment-linked business. For the composite insurers, which offer general and life products, the data is segregated between the two lines of business and can be obtained from the companies' financial report. The study totally excluded the new entrants during the study periods but maintained the firms involved in merger and acquisition (M&A) activities. The total insurance operators observe are 20 firms, which represents about three-quarter 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. The firms under observation according to the type of business are depicted in Table 3.

Table 3. The list of insurer/takaful operator* under observation 2003-2007

No.**	Name of firm	Type of business
A	Allianz Life Insurance Malaysia Berhad	Life
B	Uni. Asia Life Assurance Berhad	Life
C	Manulife Insurance (Malaysia) Berhad	Life
D	Asia Life (M) Berhad	Life
E	Mayban Life Assurance Bhd	Life
F	Great Eastern Life Assurance (M) Berhad	Life
G	Commerce Life Assurance Berhad	Life
H	Tahan Insurance Malaysia Berhad	Composite
I	Hong Leong Assurance Berhad	Composite
J	AmAssuranceBerhad	Composite
K	MCIS Zurich Insurance Berhad	Composite
L	Malaysian National Insurance Berhad	Composite
M	Malaysian Assurance Alliance Berhad	Composite
N	Takaful NasionalSdn. Bhd.	Composite
O	Takaful Ikhlas Malaysia Sdn. Bhd.	Cmposite
P	Syarikat Takaful Malaysia Berhad	Composite
Q	MaybanTakafulBerhad	Composite
R	Prudential Assurance Malaysia Berhad	Composite
S	ING Insurance Berhad	Composite
T	American International Assurance Company, Ltd	Composite

Notes: * Insurers/takaful operatos' name refers to the recent registration: ** After this, insurers and takaful operators will be referred by the letter given.

4. Results

4.1. SBM-DEA analysis − distribution of investment management efficiency. The efficiency of investment management is achieved by different insurers/takaful operators for each year from 2003-2007. According to Table 4, none of the insurers/ takaful operators is seen to preserve efficiency for the 5 consecutive years. Insurer M is the only insurer that has been on the frontier for 4 times. In addition, the performance of takaful operator Q is also encouraging as for achieving efficient investment management for 3 times. Insurer/takaful operator I, L, D, E, C, O, K and T also present efficient investment management at least once in 5 years time, while another 10 insurer/takaful operator experience inefficient investment management.

Table 4. SBM-DEA results for investment management for individual insurer/takaful operator

2003		2004		2005		2006		2007	
DMU	Efficiency score	DMU	Efficiency score	DMU	efficiency score	DMU	Efficiency score	DMU	Efficiency score
A	0.5751	A	0.5149	A	0.5093	A	0.5713	A	0.6526
B	0.5356	B	0.5641	B	0.6984	B	0.5308	B	0.5680
C	0.5597	C	0.5341	C	0.9164	C	0.7272	C	1.0000
D	0.6903	D	0.7249	D	1.0000	D	0.7759	D	1.0000
E	0.5210	E	0.7595	E	0.8105	E	1.0000	E	1.0000
F	0.5532	F	0.6607	F	0.7904	F	0.6387	F	0.7703
G	0.4763	G	0.6175	G	0.5412	G	0.5597	G	0.6505
H	0.5081	H	0.4652	H	0.5465	H	0.7958	H	0.3548
I	1.0000	I	1.0000	I	0.9022	I	0.7038	I	0.9501

Table 4 (cont.). SBM-DEA results for investment management for individual insurer/takaful operator

2003		2004		2005		2006		2007	
DMU	Efficiency score	DMU	Efficiency score	DMU	efficiency score	DMU	Efficiency score	DMU	Efficiency score
J	0.6033	J	0.5919	J	0.7642	J	0.7764	J	0.8415
K	0.4866	K	0.5582	K	0.7390	K	0.8133	K	1.0000
L	1.0000	L	0.6405	L	1.0000	L	0.6947	L	0.9288
M	0.8688	M	1.0000	M	1.0000	M	1.0000	M	1.0000
N	0.2708	N	0.3523	N	0.5072	N	0.3889	N	0.4359
O	1.0000	O	0.1847	O	0.2173	O	0.2752	O	0.3375
P	0.3189	P	0.4479	P	0.4860	P	0.4325	P	0.5946
Q	0.2191	Q	1.0000	Q	1.0000	Q	1.0000	Q	0.4359
R	0.5105	R	0.5619	R	0.7847	R	0.6202	R	0.7424
S	0.4871	S	0.5386	S	0.6586	S	0.5683	S	0.6981
T	0.5158	T	1.0000	T	0.8087	T	0.6865	T	0.8592

Notes: The efficient company is in bold.

The average of investment management performance which is shown in Table 5 is increasing from 58.5% to 74.1% during the period 2003-2007, despite a slight decline in the midterm. According to Cummins (1999), an increase in the average efficiency score indicates increased competition among insurance firms (insurers/takaful operators) especially with the advancement of computing and communications technology as well as dynamically changes in various type of risks. In addition, the average efficiency of 58.5% to 74.1% implies that the average insurers/takaful operators have to improve from 25.9% to 41.5% if it were to perform the best investment management practice.

Table 5. Summary of SBM-DEA results for investment management activity

	2003	2004	2005	2006	2007
Average score	0.585	0.636	0.734	0.678	0.741
Standard deviation	0.220	0.219	0.209	0.192	0.224
Max of efficiency score	1	1	1	1	1
Min of efficiency score	0.219	0.185	0.217	0.275	0.337
% of efficient insurer/takaful operator	15.0	20.0	20.0	15.0	25.0

Moreover, the heterogeneity or dispersion of investment management efficiency (which is shown by the standard deviation values) declined during the period of 2003-2006 and increased in the period 2007. This is particularly encouraging because it shows that the insurers/takaful operators are converging towards the best practices (Cummins, 1999). However, the decreasing rate is quite slow and this condition is reasonable because there are some insurers that show very low efficiency score of investment management which is in the range of 0.185 to 0.337. This indicates that the insurers/ takaful operators are most likely not to put enough effort to compete intensively with each other to achieve efficient investment management. Table 5 also presents that in the year 2003 and 2006, 15% of insurers/takaful operators are identified to have an efficient investment management, while 20% and 25% are efficient in the years 2005, 2006 and 2007, respectively. This clearly shows that the number of insurers/takaful operators that are having inefficient investment management is approximately more than 70% over the period of 2003-2007. The result also reveals that the inefficiencies in investment management are mostly caused by the failure to manage all the resources at optimum level. In the context of this study, it was found that insurers/takaful operators have dealt with excessive total investment and actuarial reserve as well as shortage of both outputs which are investment return and solvency.

From the above observations, it is likely that an efficiency variation among insurers/takaful operator exist. Yao et al. (2007) claimed that the efficiency score itself is not able to provide information on the difference in value achieved. Thus, the Tobit regression analysis is performed to verify the determinants of investment management efficiency (Coelli et al., 2005).

4.2. The Tobit analysis – the determinants affecting the investment management efficiency.

Table 6. Tobit regression results (dependent variable = efficiency score)

Independent variables	Coefficients	z-Statistic
Constant	-0.106	-0.352
Size	0.028	1.900
Investment-linked preference	0.360	2.850*
Operating system	0.182	3.423*

Note: * significant at 5%.

Size does not provide a significant effect on the efficiency of investment management of insurers/ takaful operators which is shown in Table 6. This situation is likely due to the strict regulations governing the insurance and takaful industry, particularly in matters relating to investment activities. Investment regulations and capital requirements come with limitations. For controlling the investment activities among insurers/takaful operators, the Government of Malaysia had introduced the Authorized Malaysian Assets. Authorized Malaysian Assets comprise the range of assets typically held against insurance funds (Lee, 1997). At a minimum, the percentage of total assets in insurance fund to be preserved in Authorized Malaysian Assets is 80%. This requirement has caused the insurance fund of insurer/takaful operator is largely held in the fixed-income investments such as Malaysia Government Securities and corporate securities. Additionally, for investment in real estates or loans, the requirement has stated that this shall not exceed 30% of total assets in insurance funds, while the investment in stocks and shares should not exceed the amount of shareholders' fund of the insurers (Lee, 1997). Thus, regardless of insurer/takaful operator's size, the investment portfolio diversification is restricted to some degree of the percentage and portfolio choices. What is more important is that investment activities need to think about safety, yield and liquidity. If these considerations are given attention and wisely balanced, insurers/takaful operators will certainly be able to meet all their liabilities (Lee, 1997). Boose (1993) and Adams (1996) in their study in the US and New Zealand life insurance industry respectively, however, found different conclusions. They suggested that size were significantly related to life insurers' investment earnings. This was due to larger insurers can taking advantage of economies of scale in their investment function.

In contrast to size, the operating system is found to be a significant predictor to investment management efficiency at 5% critical level. This is exhibited in Table 6. This suggests that the conventional life insurers experience better investment management efficiency than takaful operators. This result is indeed to be expected because both systems are faced with different investment activities, especially in terms of investment instruments used. For conventional life insurers, it seems that their investment mechanisms are more stable and diverse, including investments that have a high risk exposure. Moreover, the conventional insurer does not have restrictions to incorporate the high performing investment instruments into their portfolio apart from those imposed for prudent reasons. Based on the risk return trade off, return received by the conventional insurer from investing in risky investment has to be high as a reward for assuming high investment risk (Fikriyah et al., 2007). Accordingly, investment in corporate/bond securities accounted for the largest percentage of the life insurance total investment.

In contrast, takaful operators are prohibited from investing in conventional bond. The conventional bond transactions involving lending and borrowing (loan) and the investor will receive interest on loans. For zero coupon bond, investors receive the accumulated interest at maturity of the bond as the bond will be issued at a discount. This transaction contains elements of Riba (usury) and gambling, and thus prohibited by Sharia law. Generally, Islamic investment instruments exclude the element of Riba (usury), gambling and uncertainty, and in turn have a low degree of risk exposure (Fikriyah et al., 2007). Accordingly, as proposed by the risk-return trade-off, investments with low risk exposure will produce low returns as well. On top of that, the takaful operators have to confront with several challenges with regard to investment (Frenz et al., 2008) such as: (1). Takaful operators may experience potentially unfavorable investment returns, limited product innovation and high concentration and liquidity risk because of limited accessibility of Islamic investment choices specifically for long term instruments (2). Limited availability of proper Islamic investments prevents the takaful operator to obey the constraints imposed on the asset allocation of the takaful fund assets (3). Suitable Islamic investments might be issued in a foreign currency exposing the operator to potentially significant currency exchange risk. Based on this scenario, it appears that conventional life insurers has an advantage in managing resources and return on investment, and in turn, lead to efficient investment management.

Similar to operating system, the investment-linked preference is proved to be positively and significantly related to the performance of investment management at 5% critical level (Table 6). This implies that the insurers/takaful operators with more investment-linked businesses are having better investment management performance. The efficiency of investment management means that insurers/takaful operators are able to increase investment earnings and solvency of the company at an optimum level by the utilization of available resources. The cash flow of insurers' investment choices have to be consistent with the expected liability cash flows and asset-liability management strategy. Thus, the investment choices are very important. According to Adams (1996), the investment choices for insurers are highly depending on the nature of policies in force. The growth of investment-linked policies will increase the number of policies in force in the market and this will affect the rate of acquisition of new business. Therefore, the higher the amount of investment-linked products

offered by insurers, the higher the investment earnings they are likely to achieve in order to meet any maturity or death benefit promised in the policy in the event of inadequate reserves, as well as promised return to the policyholders. Accordingly, at a favorable stage of investment earnings, the insurers' solvency will be preserved.

Recently, investment-linked products are recognized as very appealing in the eyes of many insurers. This situation as described by Moore and Santomero (1999) in their study − the products with greater flexibility and variability in wealth accumulation and benefit build-up are the choices for the future. Furthermore The Commissioner of Insurance of Hong Kong (2007) emphasized that the main advantage of an investment-linked policy lies in the favorable return on investment and flexibility in which this flexibility permits the suitable insurance plan to be personalized for each individual policyholder. In addition, this policy seems to be more profitable because most of the investment risk that is borne by the insurer is transferred to the policyholder (Masters and Gutterman, 2002). For investment-linked policies, the share of the premium to be invested is greater than the share used for protection.

Typically, customers who buy investment-linked policies have a purpose to accumulate wealth for the future or save for their old age (Tuohy, 1999). As such, it appears that when the insurer/takaful operator write investment-based policies, the investment portfolio of the insurer will also change. According to Black and Skipper (2000) the investment activities of insurer have a very broad interest in the relationship between companies and their customers. Thus, the insurer will endeavor to make a profitable investment to meet the expectations of policyholders. However, higher returns will always be associated with higher risk. This is why asset-liability matching in investment management undertaken by the insurer has to consider the product design and management (Black and Skipper, 2000). Apparently, the insurers will have no choice other than to adopt efficient investment management in order to ensure a profitable investment.

Conclusion

From SBM-DEA results attained, the efficiency investment management of insurers/takaful operators for the period 2003 to 2007 was moderate. The average efficiency of 58.5% to 74.1% implies that the average insurers/takaful operators have to improve from 25.9% to 41.5% if it were to perform the best investment management practice. Thus, there is a large potential for life and takaful industry in improving the performance in investment management functions. The result also reveals that the inefficiencies in investment management are mostly caused by the excessive of total investment and actuarial reserve as well as shortage of both outputs which are investment return and solvency. Further, from the Tobit analysis, this study confirms that the investment management efficiency of insurers/takaful operators vary by operating system and investment-linked product preference but not the size of insurers/takaful operators. This study suggests that the government needs to address the investment related problems faced by takaful operators to be on par with the performance of the investment management of conventional life insurers. The Islamic capital market, especially sukuk should be strengthened and developed. Besides, more customer-based products have to be offered by insurers/takaful operators in the future. However, in the excitement of offering these products, insurers need to be careful about their selected investment portfolio as well as asset-liability matching to ensure that the trade off between risk and return is equitable.

An efficient investment management motivates the optimal allocation of resources. It can realize the function of insurance as a financial intermediary which will ultimately help the economy through the allocation of capital for potential projects that can promise the highest risk-adjusted returns for the shareholders. However, this efficiency requires the legal support and implementation. Before that, what is more important, efficiency is essential in acquiring the confidence of consumers and investors. Last but not least, through the efficient investment management, the ultimate objective of insurer/takaful operators i.e. value creation of the organization can be achieved.

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