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Efficiency, Competition and Financial Resilience of Malaysian Insurance Industry

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Abstract

This paper is aimed to study the financial resilience of Malaysian insurance companies and Takaful operators hence determine how it is determined by the efficiency of the firms. This paper also examines how competition affects financial resilience. Hence, we test the Charter Value Hypothesis where resilience is determined by the number of competitors and choice of technology. In addition, we also test the Strategic focus versus conglomeration hypotheses about financial resilience. We compute the efficiency and financial resilience of 42 general insurers and 28 life insurers from 2005 to 2016 using DEA and Z-score, respectively. Competition is computed using HHI, and the link between them is estimated using static panel modelling. We find that the industry is well equipped to deal with volatilities, where z-score for life insurance averages between 4.16 and 14.63 while for general insurance is between 3.45 and 16.21. Market concentration for general insurance is rather stable while that of life insurance has decreased hence increased competition. On the one hand, we find competition may help life insurers by improving the effect of efficiency on financial soundness. On the other hand, we find concentration is preferred to the solvency of general insurers, and this concentration eliminates the influence of efficiency on the financial soundness of general insurers. This paper contributes to the limited pool of literature on the nexus between efficiency, competition and financial resilience on the insurance industry, and we believe it is the first in Malaysia. Plus, it encompasses both branches of insurance, life and general and both conventional and Islamic insurance.

Keywords: *Z-score, Efficiency, Insurance, DEA, Charter Value Hypothesis*

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Introduction

The link between competition and financial resilience of financial institutions has received a substantial debate, especially in banking industry. With an increased role of other non-banks in asset allocations, it is worth extending this debate to these industry. Insurance sector is unarguably important towards development of any economy. Among other advantages, it facilitates trade, works as financial intermediaries and also facilitates financing of long term projects. Malaysia relies on the sector to move towards high-value added, high income economy by 2020 as the sector is expected to facilitate financial deepening and consumption smoothing. In 2020 the insurance sector is expected to have enhanced role in providing comprehensive protection and investment plans for the entire life cycles of consumers, while offering greater avenues for risk mitigation to reduce the cost of doing business in Malaysia . Hence there is a need for continuous increase in efficiency and financial strength.

While the policy holders are looking for lower loading values/ price of insurance, which depends on efficiency and competitive conditions, regulators are more concerned that highly competitive environment will lead to financially fragile industry due to cutting edge prices. With the new RBC framework, companies are able to make sure there is sufficient funds to meet their risk portfolios. However RBC framework limits insurers' decisions to invest and taking risk which may result into operating below efficient frontier, the limitation could be even more to the Takaful operators whose investment are already limited to halal undertakings only. This framework also resulted into lesser number of firms in the market which could lead to oligopolistic behaviour, unless the consolidation and hence decrease in number firms in the market is also due to efficiency motives such as tapping scale and scope economies.

Under progressive liberalization that is going on in Malaysia foreign companies are intensifying competition in the industry. Stiff competition results into cutting edge prices in which inefficient firms may not be able to survive due to low profitability. Failure of these inefficient firms could be dangerous to the economy as it can result into systemic risk (Cummins and Weiss, 2014) in the financial sector hence disrupt the flow of funds and dampen the economic growth.

Nevertheless efficient firms are expected to have high profitability and more financially resilient (Tan, 2016), therefore able to survive through competition brought by liberalization. So far in Malaysia, researches have not fully covered the sector and have been limited to technical efficiency and its components. In addition recently there has been a growing interest among researchers in Europe and US on the financial resilience of insurance firms and competition, however there is a limited pool of such kind of studies in developing countries.

This study intends to compute technical, cost and revenue efficiency trends, market structure and financial resilience of Takaful operators and conventional insurers. Hence investigate how efficiency and competition affect financial resilience of firms.

Literature review

Efficiency studies on Malaysian insurance sector have been done using different time periods and indicated varying results depending on input and output selections. From the cross-country comparison done by Eling & Luhnen (2010), Malaysia insurance sector is found to be inefficient with average Technical efficiency scores of 0.37 in non-life during 2002-2006. Yakob, Yusop, Radam and Ismail (2014) employed Slack Based Measure (SBM) DEA to compute risk and management efficiency for life insurers and Takaful operators in Malaysia from 2003 to 2007. Their study reported average efficiency scores for risk and investment management being 0.675 and 0.609 respectively and there was small dispersion that shows convergence and hence competition between firms. While Eling and Luhnen (2010) utilized inputs and output as this study, Yakob et al (2014) have divided the efficiency computation into two types hence selection of inputs and output was different.

Between 2006 and 2009, Saad (2012) found average Technical efficiency score to be 0.54 in Takaful and 0.756 in conventional insurance while Miniaoui and Chaibi (2014) found average technical efficiency score of Takaful companies in Malaysia ranged between 20% - 40%. Their study used gross contribution as output, general and administrative expenses and total assets as inputs on CRS and VRS DEA on 4 Takaful operators from Malaysia which were compared with those from GCC. More importantly, some of the studies compare the technical efficiency between conventional insurance and Takaful and found the Takaful operators have lower technical efficiency. Ismail, Alhabshi, & Bacha (2011) finds technical efficiency for Takaful operators is 73.9% while for conventional insurers is 94.7%.

Abduh, Omar and Tarmizi (2012) found the Technical efficiency to be 76.2% for Takaful operators and 94.7% for conventional insurers in 2008 -2010. And the most recent study of Faruk & Rahaman (2015) found the average technical efficiency of 5 Takaful operators in Malaysia for the period 2009 – 2011 to range between 55% to 68%. Qian and Azlinna (2015) find decline in managerial efficiency for general insurers with efficiency scores ranging 91.9% in 2008 and 78.7% in 2011.

On the other hand literature on financial resilience of insurance firms is very limited. Solvency of Malaysian insurance and its determinants has been studied by Yakob et al (2012) and Abduh and Zein Isma (2017). Yakob et al (2012) have measured solvency in terms of valuation ratio and ROA on 19 insurers from 2003 to 2007 while Abduh and Zein Isma (2017) used Equity to Asset ratio and equity to technical reserve ratios as proxies of solvency on 6 family takaful operators from 2008 to 2012. Their results are also contradicting, while leverage was found negative and significant by Yakob at al (2012), it is found positive and significant by the later. Only Yakob et al (2012) finds reinsurance to be significantly negative to solvency. Abduh and Zein Isma (2017) also tested for the effect of size and found it to be negative and significant.

Ismail (2013) have studied the determinants of financial performance of general insurers in Malaysia and found that size and reinsurance to be positive and significant. The study used investment yield as a measure of financial performance. Despite being conducted in Malaysia, the current study differ from the above in three main ways; first the use of z-score as a measure of financial strength, the advantage of this measure is that it has broader perspective and can comprise all measures used before. Second is that in addition to the determinants that have been studied before we also check the effect of efficiency and competition on solvency. Last but not least our study comprise of wider sample of all general and life insurances treated separately for longer period of time.

The link between financial resilience, competition and efficiency was for the first time studied by Rubio-Missas, Cummins and Vencappa (2014) in 10 European life insurance markets from 1999 to 2011. In such study Boone indicator was used to study the link between competition and efficiency (profit elasticity approach) whereby the elasticity of profit with respect to marginal cost changes with the type of market structure that the firm is existing in, it is more elastic in competitive markets compared to less competitive markets. Results from Boone indicator discovered a significant decrease in the level of competition before 2008 crisis and after crisis. Then Boone indicator for each country was used as independent variable (country specific but time varying) to determine the soundness of the firms which was measured by Z-score. The results showed that competition increases the soundness of the EU life insurance markets but incentivizes EU life insurers to hold less capital as the relationship is stronger for financially weak insurers as compared to healthy ones. Our study will be differentiated form this in terms of sample and approach to measure efficiency and competition, in our study these two elements will be measured separately using DEA and HHI respectively.

Similar relationship between financial resilience and efficiency was recently studied by Al Amri et al. (2014) on global Takaful industry from 2004 to 2009 using Z-score and DEA respectively. The study concluded that more cost efficient insurers had less probability to default as they found positive and significant relationship between cost efficiency and Z-score. On the link between competition and financial soundness the researchers deduced that competition reduces financial resilience. Competition was measured using HHI of each country and was found to be in insignificant on z-score, however significantly negative on standard deviation of ROA. Current research will test these findings in Malaysian perspective using longer time interval and extend the efficiency measures to technical and revenue efficiency.

The association of efficiency and risk of insolvency has been studied by Brockett et al. (2004) by evaluating how solvency affects efficiency performance in US property- liability insurance companies in 1989. The study treated solvency as output while computing efficiency scores using DEA and found that solvency has no influence on efficiency scores of those firms. Alternatively Yakob et al. (2011) treated solvency measured by financial leverage ratio as inputs for 15 life and 2 Takaful in Malaysia for 2003 to 2007, they found an increase in efficiency and convergence between firms. Chen et al. (2014) also found that insurer’s solvency increases the firm’s productivity in Malaysia’s general insurance industry. However Biener et al. (2016) regressed leverage ratio on efficiency scores for Swiss and found significant negative relationship amongst them.

On the opposite direction, treating financial resilience as the dependent variable, Chen and Wong (2004) studied the determinants of financial health in Japan, Malaysia, Singapore and Taiwan insurance companies, they found that factors vary in different countries however investment performance is found to be robust in all countries. The study covered a sample period 6 years from 1994-1999 and used logit regression with probability of being insolvent as dependent variable. The study used HHM model (Hollman, Hayes, and Murrey, 1992) to predict the risk of insolvency.

From above review we find that Malaysian insurance industry is blessed with vast literature on its efficiency, however the importance of that efficiency is narrowly studied. This paper extends from just efficiency literature to how efficiency can actually satisfy the needs of regulators which is financial resilience of insurance firms. In addition the study provide the first test of efficiency transmission mechanism hypothesis to Malaysian insurance industry.

Theoretical Framework: Charter-Value Hypothesis

We analyse financial resilience of an insurer in relation to efficiency and competition using Charter Value Hypothesis. Charter value which is also known as franchise value is the value of intangible assets such as experience and reputation which the company can benefit only if it continues to exist and it is used to measure market value of stock of insurance firm (Babbel, 1998). This model assumes a firm starts with zero equity and fails to survive when gross profits are insufficient to pay the insurance claims. Hence survival is highly correlated with firm’s financial resilience.

The insurers are assumed to begin operations at time 0 by issuing insurance contracts. They use premiums to invest in securities (bonds) and choose a set of risky technologies indexed by T. Given input level, the risky technology yields Tx with probability P(T) and 0 otherwise. At date 1 insurance claims are paid and success of technology T can be verified.

Insurance contracts are simple debt contracts which have been reinsured incase insurer fails to fulfill their claims in future, therefore supply of premiums do not depend on insurer's risk. The premiums of insurer j are denoted by P_j and total premiums by $Z = \sum_{j=1}^{N} P_j$

Insurance companies are assumed to compete for policy holders a` la Cournot. They choose risk parameterσ, invest in technology T, bond holding B and premiums P that are the best response to strategies of other insurers to maximise profit:

$$p(\sigma)\big(\sigma T + rB - c(P_{-j} + P)P\big) + \big(1 - p(\sigma)\big)\max\{0, rB - c(P_{-j} + P)P\}$$

Subject to T + B = P (1)

Where c is the cost of premium collection, r is the return from bonds and P_(-j) is the premium choice of all insurers except insurer j. From the above objective function, companies can choose between two strategies, No moral hazard which results in max{.} > 0 and moral hazard which results in max{.} = 0. As illustrated by Boyd, De Nicolo` and Jalal (2006) at equilibrium insurer's profits monotonically decline as N increases, hence the risk of failure is strictly increasing in the number of competing firms and become maximal under perfect competition. Therefore according to this hypothesis, the ability of insurer to survive to the next period is determined by efficiency in terms of choice of technology and investment and competition in the market. Our study will improve from this hypothesis by including cost and revenue efficiencies in the model

Methodology

Efficiency Analysis

Efficiency is obtained when a firm can successfully minimise costs, maximise revenue or maximise profit given certain level of technology. The efficiency theory has its foundation in micro economic theory, where efficiency is obtained when marginal cost equals to marginal revenue. Efficiency indicates that the firm is producing on its production frontier and hence used to study firms' performance because it indicates proper utilization of resources and maximization of general welfare.

This study aims at computing cost and revenue efficiency which are then be decomposed into technical, scale and allocative efficiencies. Hence we make use of input oriented and output oriented Variable Return to Scale (VRS) DEA for cost and revenue efficiencies respectively.

DEA-VRS Models

DEA computes efficiency by solving linear programming problems which are either input oriented (minimization) or output oriented (maximization) problems. Hence DEA constructs a non-parametric production frontier based on the actual input–output observations in the sample relative to which efficiency of each firm (Decision Making Unit, DMU) in the sample is measured. Originally DEA as introduced by Charnes et al. (1978) assumed constant returns to scale (CRS), whereby efficiency does not relate to the scale of operations. To accommodate economies and diseconomies of scale, Banker et al. (1984) extended the DEA model by assuming variable returns to scale (VRS). This study use input-oriented VRS DEA (BCC) models to empirically estimate the cost, allocative, technical, pure technical and scale efficiencies for individual insurers and output oriented VRS DEA (BCC) for revenue efficiency and its components.

Cost efficiency can be computed using linear programming BCC envelopment developed by Tone (2002), which takes into account that insurers can be faced by different input prices and that costs can be reduced by reducing the input factor prices. Suppose $\widetilde{\overline{X_{\iota o}}}$ is the unknown cost of i^{th} input by firm o, $\widetilde{\overline{X_{\iota o}^{*}}}$ is the optimal value of $\widetilde{\overline{X_{\iota o}}}$ and $\overline{X_{ij}} = w_{ij} * x_{ij}$ is the actual cost of input i for j^th insurer. To find the optimal cost of input i for insurer 'o' (i.e. $\widetilde{\overline{X_{\iota o}^{*}}}$) that produces output y_ro independently of the firm's current input's unit price w^o, cost efficiency can be computed using the formula below

$$\min_{\lambda,\overline{X}} \sum_{i=1}^{n} \widetilde{\overline{X_{\iota o}}}$$

Subject to (2)

$$\sum_{j=1}^{N} \lambda_j \overline{X}_{ij} \le \widetilde{\overline{X_{\iota o}}}$$

$$\sum_{j=1}^{N} \lambda_j y_{rj} \ge y_{ro}$$

$$\lambda_{j,}\widetilde{\overline{X_{\iota o}}} \ge 0$$

$$\sum_{j=1}^{N} \lambda_j \ge 1,$$

Consequently, technical efficiency is computed using SBM DEA introduced by Tone (2001) as adopted by Sufian (2011) as follows;

$$\min l_o - \varepsilon \left[\sum_{i=1}^{m} S_i^- + \sum_{i=1}^{s} S_r^+\right]$$

Subject to: (3)

$$\sum_{k=1}^{N} \lambda_k \, x_i k_0 = lox_i k_0 - S_i^-$$

$$\sum_{k=1}^{N} \lambda_k \, y_r k_0 = S_r^+ \, y_r k_o$$

$$\sum_{k=1}^{N} \lambda_k = 1$$

$$\lambda_k \ge 0, k = 1,2,3 \dots N, S_i^-, S_r^+ \ge 0$$

Where l_o and ε are radial efficiency factor that shows possible reduction of inputs for DMU, k_0 and very small positive number used as lower bounds to inputs and outputs respectively. Consecutively, S_i^- is a slack variable to proxy extra savings in inputs and S_r^+ is a proxy for extra gain in output. For an efficient firm $l_o = 1$ and both slack variables are equal to zero, when S_i^- or S_r^+ is positive DMU, k is considered inefficient. λ_k is an intensity vector indicating contribution of DMU, k in deriving the efficiency of rated DMU, k_0. Hence constraint $\sum_{k=1}^{N} \lambda_k = 1$ implies that DMUs are allowed to operate at VRS.

Analogously revenue efficiency is computed using the output oriented linear programming model developed by Tone (2002) which considers that insurers charge different prices for their services as below;

$$\max_{\lambda,\overline{X}} \sum_{i=1}^{n} \widetilde{\overline{Y_{ro}}}$$

Subject to (4)

$$\sum_{j=1}^{N} \lambda_j \overline{Y}_{rj} \le \widetilde{\overline{Y_{ro}}}$$

$$\sum_{j=1}^{N} \lambda_j x_{ij} \ge x_{io}$$

$$\lambda_{j,}\widetilde{\widetilde{Y_{ro}}} \geq 0$$

$$\sum_{j=1}^{N} \lambda_j \geq 1,$$

Whereby $\widetilde{\widetilde{Y_{ro}}}$ is the unknown revenue of r^{th} output by firm o, $\widetilde{\widetilde{Y^*_{ro}}}$ is the optimal value of $\widetilde{\widetilde{Y_{ro}}}$ and $\overline{Y_{rj}} = p_{rj} * y_{rj}$ is the actual revenue of output r for j^{th} insurer. To find the optimal revenue of output r for insurer 'o' (i.e. $\widetilde{\widetilde{Y^*_{ro}}}$) that utilizes input x_{io} independently of the firm's current output's unit price p^o.

Estimation Strategy

In Malaysia direct insurers can be classified into five groups based on the license provided by Bank Negara Malaysia; Life and General business(composite insurers), General business only, Life business only, Takaful operators for Family and General Takaful business (composite Takaful) and Takaful operators for Family Takaful business. The study pools all firms that provide life insurance together to construct one efficient frontier and another frontier is for all insurers providing general insurance which is the basis of comparison. Pooled frontier allow us to compare average efficiency between firms. We separate life and general due to the difference in the nature of the final product they are selling especially due to difference in the duration of insurance contract.

Due to fact that some firms did not exist throughout the study period, we adopt a dynamic panel estimation procedure where we estimate efficiency of each for each year. Furthermore estimating efficiency by year allows individual-firm efficiency scores to differ by year and avoids comparing a firm's efficiency in a given year with its own efficiency in other years (Cummins et al. 2010).

Input and output selection

The validity of efficiency results are significantly affected by the choice of inputs and outputs used. It is commonly acknowledge that the choice of inputs, outputs and their prices are complicated in the service sector because they are jointly produced and prices are typically assigned to a bundle of services. Value added (production) approach is adopted to select inputs and outputs. This approach is believed to be more appropriate for all types of insurers as it can cover all functions of insurance companies (Cummins and Weiss, 2013). According to value added approach insurance companies perform three functions; risk pooling and risk bearing, real financial service related to insured losses and intermediation, hence outputs and inputs reflect these functions.

Outputs

Insurance companies generally perform three main functions, risk pooling for non-life, financial services for life insurance and intermediation function. Thus outputs used are in line with previous literature from Eling and Luhnen (2010), Cummins et al. (2010) and Biener et al. (2016) among others which are claims paid and additions to reserve and real invested assets.

Risk pooling and real financial services function is measured by present value of claims paid and additions to reserve, this proxy reflects losses incurred, which are losses expected to be paid as a result of providing insurance coverage during a particular period. This is considered appropriate proxy for risk pooling risk bearing function because they measure the amount of funds distributed to policyholders for insured events. This measure has its theoretical underpinning from Pratt–Arrow concept of the insurance premium which explains the value added by insurance transaction as the value above the amount that just makes an individual indifferent between purchasing insurance and retaining the risk (see Cummins and Weiss, 2013). Output for the intermediation function is captured by total invested assets by the insurer.

Inputs

Inputs are selected based on their proportions (weight) in the financial statements of insurance companies. The inputs used are labour, capital and raw materials which in the case of insurance companies are business services (Eling and Luhnen, 2010; Cummins and Weiss, 2013, Biener et al. 2016). Labor is equivalent to fees and commission expenses as this the amount paid to agents for acquisition of premiums. Business services are equivalent to management expenses as such is the administrative cost. Capital is divided into equity and debt capital; Equity capital is comprised by share capital while debt capital is mostly comprised of insurance contracts liabilities and other forms liabilities such as future tax payments. Total liabilities is used to measure debt capital.

Input prices

It has been a common practice in the literature to combine labour and administrative cost as operating expenses and use price of labour as the price of such input (e.g Eiling and Luhnen, 2010; Biener et al. 2016). For this study the price of labour plus business services is equal to sum of fees and commission expenses and management expenses divided by total assets for each insurer. Price of capital is computed as the opportunity cost incurred by policy holders and stock holders by keeping their money with an insurance firm instead of investing somewhere else. Hence 12 months interest rate on fixed deposit is used as a price of debt capital for conventional insurers and 12 months profit rate is used for Takaful operators. As for price of equity capital we use annual average rate of return from EMAs index and EMAS shariah index for conventional and Islamic insurance respectively.

Output prices

According to insurance economic literature price is the amount required to deliver one unit of benefits. Consistent with the value added approach, price is value added per unit of output. Value added is defined as revenues minus loss payment and interest on equity, hence price for risk pooling output is measured by the difference between net premiums and net claims paid divided by the present value of loss paid (e.g Biener et al. 2016; Levert and Grace, 2010). Consequently the price of the intermediation output is measured by the expected rate of return on the insurer's investments which is Total investment divided by investment income.

Financial Resilience

Given the importance of insurance sector in the economy, resilience of insurance firms becomes primary concern of regulators and policy holders. Financially weak insurers are less likely to survive. In the CVH model the definition of an insurer failure is when gross profits are insufficient to pay off claims. If there were equity capital in the model, bankruptcy would occur exactly when equity capital was depleted (Boyd et al. 2006). Thus, this study measures financial resilience using Z-score, which measures how many standard deviations a firm is away from exhausting its capital base. In this study Z- score is regressed on efficiency and other controlled variables proposed by Boyd et al. (2006) and Cummins et al. (2017). However they have applied the model in international setting while ours is based on one country, hence the study use the model in equation 3,5 to estimate the effect the included variables on firm's financial resilience.

In addition to investigating the financial strength of Malaysian insurance sector, our estimation model tests two hypothesis regarding competition and efficiency and their association with financial resilience. First as explained earlier, the CVH where competition is expected to increase the risk of failure and second is the recent transmission mechanism hypothesis (Schaeck and Ciha`k, 2010) which suggests that efficiency is the mechanism through which competition enhances financial stability. Therefore we expect that if HHI is positive on Z-score, it should change its sign when we control for efficiency to negative. Negative sign on HHI coefficient indicate that more competitive environment increase financial resilience.

$$Z = \alpha + \beta Eff_{it} + \theta \boldsymbol{X}_{it} + \varepsilon_{it} \quad (5)$$

Where Eff and X stand for efficiency and other controlled variables respectively.

Definition of Variables

Dependent Variable: Z-score

The Z-Score is a popular measure of soundness because it combines firms' buffers (capital and profits) with the risks they face (measured by the standard deviation of returns) in a way that is grounded in theory (Cihak et al. 2009). The Z-score is be computed as in eq (4.11), where ROA is the rate of return on assets, EA is the ratio of equity to assets, and σ (ROA) is an estimate of 3 years standard deviation of the rate of return on assets, all measured with accounting data. Hence it takes into account quality of asset portfolio, firm's leverage and volatility of returns on assets. This risk measure ensues monotonically with a measure of insurer's probability of failure, a higher Z-Score implies a lower probability of insolvency, providing a more direct measure of soundness than, for example, simple leverage measures.

$$Z = (ROA + E/A)/\sigma ROA \quad (6)$$

Independent Variables:

Market concentration: In relation to the CVH, to measure the effect of competition we use Herfindahl Hirchsman Index (HHI) which is be time variant but constant in the cross-sectional observations. HHI is chosen because of its consistency with our theory and considers heterogeneity between firms. In the theory, the degree of competition is simply represented by the number of competitors, computation of HHI includes all firms however they are weighted according to their relative importance in the market. HHI is the sum of the squared market share of each insurer in the market, hence ranging from zero for perfect competition and 1 for monopoly. Therefore depending on the CVH, higher HHI will result into higher Z-score.

Efficiency: To test for transmission mechanism hypothesis, we use technical, scale, cost and revenue efficiency computed from DEA as one of the independent variables. Technical efficiency has been used as firm specific variable that capture different production technologies and how well firms manage their funds (Boyd et al. 2006; Cummins et al., 2017). According to this hypothesis higher efficiency sore is expected to increase financial resilience of firm. Previous studies have tested this hypothesis via Boone Indicator since they were cross-countries. Given the nature of this study, includes only one country, we tests for the mediation effect between efficiency, market concentration and Z-score.

Other Control variables

Larger firms are normally subjected to too-big-to-fail policies hence we control for the firm size using log of total assets. This measurement also reflect economies and diseconomies of scale such that bigger insurers can operate in less sounded manner (Schaeck and Cihak, 2010). To capture the effect of diversification we include a dummy variable which is equal to 2 for composite firms and 1 for specialized insurers. The use of reinsurance reflect differences in quality of insurance service and has been found to have positive effect on profit (Weiss and Choi, 2008; Cummins et al., 2017) hence expected to increase financial resilience of insurer. This is measured using ratio of ceded premiums to direct premiums plus reinsurance premium assumed. Leverage ratio which is equal to ratio of net premium to equity is included in the model as it is found to be significant determinant of insurer's financial performance in the previous studies (Cummins et al, 2017; and Yakob et al, 2012).

Table 3.3: Summary of Variables for Z-Score model

Variable	Measurement	Expected Sign
Market Concentration	HHI	
Efficiency	Technical efficiency / Cost efficiency	Positive
Firm size	Total Assets	Negative
Diversification	2 for composite and 1 for specialized insurers	Positive
Reinsurance	Ratio of ceded premiums to direct premiums plus reinsurance premium assumed	Positive
Leverage	Net premium/Total equity	Negative

Findings and Discussion

Table 4.1 and 4.2 shows that there have been ups and down on the financial resilience of general insurers and life insurers, ranging between 3.46 and 16.21 for life insurers and between 4.16 and 14.63 for life insurers. General insurers are more resilient than life insurers however the z-score seem to fluctuate more for the former than the later. General insurers have higher capitalization ratios, earn higher ROA and also have higher volatility as compared to their life counterparts. The lowest z-scores are attained during 2008 and 2009 and can be attributed to the global financial crisis, the impact is more on general insurers than on life. 2015 seems to have experienced high level of resilience but this is due stable returns from 2012 and hence decreasing volatility. In addition to the general improvement in the industry there are 3 composite firms plus 3 specialized firms which had more than 50 times of their volatility risk; these firms pulled up the industry average even higher.

All in all the industry seem to be financially resilient with most firms having enough buffers to absorb shocks in the return on assets. Composite firms are found to be more resilient, followed by firms specialized in general insurers and then those specialized in life insurers. Throughout our study we find few firms that have negative z-score, some of them did not survive and were acquired by more resilient firms, for example, Tahan insurance and Pan Global insurance.

Table 4.1: Annual averages for Financial Resilience measures of General insurance

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
ROA	5.89	5.88	5.43	2.50	3.92	3.70	3.68	4.41	4.38	4.05	3.80	4.39
Volatility	1.59	1.71	1.91	2.45	2.48	1.75	1.11	1.02	0.89	0.80	0.70	0.69
E/A	0.32	0.31	0.29	0.28	0.24	0.23	0.23	0.24	0.24	0.24	0.24	0.26
z-score	7.26	8.27	6.84	3.65	3.46	6.71	5.61	8.99	9.00	9.73	16.21	10.76
HHI	0.029	0.028	0.022	0.021	0.021	0.021	0.022	0.023	0.023	0.027	0.030	0.030
TE	0.954	0.950	0.917	0.889	0.773	0.831	0.746	0.848	0.893	0.880	0.860	0.860
SE	0.970	0.982	0.980	0.943	0.910	0.953	0.882	0.923	0.950	0.944	0.928	0.916
RE	0.781	0.771	0.639	0.699	0.745	0.711	0.718	0.794	0.858	0.844	0.830	0.833
CE				0.248	0.295	0.411	0.407	0.568	0.533	0.480	0.489	0.464
AE				0.253	0.327	0.468	0.482	0.607	0.563	0.506	0.519	0.493

Descriptive Statistics

Table 4.3 presents the summary statistics of variables used in the regressions. The data has been transformed to natural logarithm to reduce the possibility of outliers/ to reduce the divergence between firms and to simplify the interpretation later on. Since we have explained the z-score and its components, concentration and efficiency in previous sections, here we will focus on other control variables.

The average size of life insurer is RM 8,146.17 million while that of general insurer is RM 3,807.76 million. Even though the general insurers are on average smaller than life insurers, the gap between biggest and smallest firms is smaller for general insurance as compared to life insurance. The size of general insurers ranges between RM million 206.67 and RM million 48, 379.6 while that of life insurance ranges between RM 165.02 million and RM million 72,945.98. The average use of reinsurance is 23% for general insurance and 12% for life insurance. General insurance on average invest 69% of their total assets while life insurance invest 79% of their assets. The least efficient insurer in managing their investment, invests only 3.9% and 3.2% of their asset for general and life respectively. The leverage ratio (Net premium/equity) ranges between 1.15 and 18.08 for life insurers. And for general insurers leverage ratio ranges between -53.5 for Tahan insurance which was undergoing insolvency to 19.04.

Table 4.2: Annual Averages for Financial Resilience Measures of Life Insurance

Year	05	06	07	08	09	10	11	12	13	14	15	16
ROA	1.1	1.4	1.3	0.4	1.6	1.4	1.6	1.9	1.3	1.8	1.4	1.8
Volatility	0.9	1.4	0.6	0.6	1.1	0.8	0.7	0.6	1.0	1.0	0.8	0.7
E/A	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1
z-score	6.8	7.3	7.3	5.6	4.2	6.0	5.1	6.1	4.7	6.2	14.6	10.3
HHI	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
TE	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8
SE	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
RE	0.8	0.3	0.9	0.8	0.8	0.7	0.8	0.8	0.8	0.9	0.9	0.6
CE				0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.9
AE				0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.9

Table 4.3: Descriptive Statistics

	General					Life				
Variable Name	Max	Min	Average	Standard deviation	Obs	Max	Min	Average	Standard deviation	Obs
TA in million RM	48,379	206	3,807	6,686	368	72,945	165	8,146	12,607	245
Reinsurance	0.671	0.004	0.233	0.144	368	0.885	0.004	0.125	0.168	245
TI/TA	0.992	0.039	0.691	0.211	368	0.981	0.032	0.796	0.152	245
Leverage	19.048	(53.5)	1.564	3.593	368	18.089	0.153	2.642	2.173	245

Correlation Analysis

We perform correlation analysis to check if there is any bivariate correlation between variables that we expect to help determine the financial resilience of insurance firms and the Z-score itself. Thus check for any sign of severe multicollinearity between variables. From both tables 4.4 and table 4.5 for life and general insurance respectively we see no sign of severe multicollinearity between independent variables.

Life Insurance

Concentration (HHI) and technical efficiency (TE) in life insurance have no direct relationship with Z-score, however correlated with other variables in the model. TE is positively related with efficiency in managing investment (TI/TA) and leverage, while negatively related with line (diversified firms) and system (Takaful operators). System is also negatively related to Z-score indicating family and composite Takaful are less resilient than conventional insurers. Takaful operators are facing higher risk of volatility and they are less efficient in managing their investments.

Concentration is negatively related to leverage indicating that competition can cause life insurers to hold less capital. Other variables that we find significantly correlated with Z-score are size of life insurer (lnTA) and reinsurance which are both positive. Implying that bigger insurers and insurers which cede more of their premiums to re-insurers or re-takaful are more resilient.

General Insurance

In contrast to life insurance, we find significant and positive direct relationship between concentration and Z-score indicating that less competition is associated with financially stronger insurers. Technical efficiency on the other hand is not directly related to z-score but directly related to net profit, ROA and standard deviation of ROA. Similar to life insurance, Takaful operators are less resilient but more efficient. Contrary to table 4.4, we find negative association between system and standard deviation of ROA in table 4.5. We can suggest that composite Takaful operators are facing lower risk of volatility as compared to family takaful.

As mentioned in previous section, the movement in z-score is to a large extent lead by volatility of earnings, it worth seeing its association with other variables. It is negatively related to technical efficiency, concentration, investment management and size of the firm. On the other hand size of the firm is positively related to resilience, concentration and technical efficiency. In the next section we describe how these variables are affecting insurers' financial resilience in a multiple regression.

Table 4.4: Correlation analysis of Z-Score and its Determinants for Life Insurance

Correlations

	Ln Z-Score	Line	System	Ln ROA	Ln σROA	Ln TA	Ln TE	Ln SE	Ln RE	Ln Reins	Ln HHI	Ln TI/TA	Ln Leverage
Ln Z-Score	1												
Line	0.12	1											
System	-0.2**	0.4**	1										
Ln ROA	0.4*	0.2*	-0.1	1									
Ln σROA	-0.7**	-0.5	0.2**	-0.1	1								
Ln TA	0.5**	0.1	-0.5**	0.6**	-0.2**	1							
Ln TE	-0.1	-0.2**	-0.1*	0.1	-0.001	0.1	1						
Ln SE	0.1	-0.1	-0.1	0.2**	-0.1	0.1	0.7**	1					
Ln RE	-0.2*	-0.1	0.1	-0.1	0.1*	-0.1	0.3**	0.1	1				
Ln Reins	0.4**	0.4**	-0.1	0.2**	-0.4**	0.6**	-0.1	-0.1	-0.2*	1			
Ln HHI	-0.02	-0.03	0.16*	0.02	0.07	0.05	-0.03	-0.06	0.08	0.06	1		
Ln TI/TA	0.06	-0.10	-0.25**	-0.04	-0.17**	0.26**	0.38**	0.19**	0.08	0.12	0.038	1	
Ln Leverage	0.01	0.07	-0.03	-0.02	-0.17**	0.19**	0.16*	0.16*	0.32**	0.04	-0.266**	0.079	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Efficiency Improves Firm's Financial Resilience

Life Insurance

To capture the effect of efficiency on resilience we estimate 3 Z-score models and 3 additional models on the components of Z-score as shown in table 4.6. Due to the nature of the data and the results from Hausman test we use random effect as a method of estimation. After we control for firm specific variables such as size (lnTA), efficiency of account receivable management, leverage and reinsurance, we test for different type of efficiency in a separate models.

From the regression results we find that overall technical efficiency in model 1 is negative and significant at 10% in determining the financial resilience of a life insurer. This is in line to what has been found previously by Cummins and Nini, 2002 and Cummins et al 2015 that there in negative relationship between overcapitalization and efficiency. However our analysis went further and tested the effect of scale efficiency which is found to be positive influence to life insurer's resilience. That is efficient life insurers minimize their input utilization inclusive of equity capital which results into appearing less financially resilient. Never the less as the firm is approaching the optimum scale of operation they tend to be financially resilient.

Looking at the components of Z-score in model 4, 5 and 6. We find efficiency is only significant to standard deviation of ROA which is used to proxy the risk of volatility. Technical efficiency is found to have positive and significant effect on volatility risk and the scale efficiency has significant decreasing effect on volatility. This means that as life insurers minimize their inputs to maximize their risk pooling and intermediation activity they also open themselves to more risk, however again they can reduce the risk by operating at optimum capacity. This can be translated that being too big or too small opens up risk of financial distress to life insurers. Technical and scale efficiency levels have the same direction of influence on the capitalization in model 6 and opposite direction on ROA in model 4, but they are all insignificant.

We find neither of revenue efficiency (model 2) nor cost and allocative efficiencies (model 3) to have significant effect on life insurer's financial resilience. The results of revenue efficiency is in line with Cummins and Nini (2002) that it has negative and insignificant influence towards financial strength of an insurer. With regard to other control variables, size proxied as total asset is found to have positive influence on financial resilience of life insurer as it also significantly reduce the risk of volatility which is main determinant of Z-score as we have seen in the previous section. Total asset also have negative influence on firm's capitalization however this has been diluted by accompanied reduction in volatility risk. Similar to Cummins et al 2017 we find there is negative effect of ratio of total investment to total assets on Z-score, however insignificant. In addition to that the ratio also has negative and significant influence on ROA at 10%.

In line with previous literature (Al Amri et al 2014, Yakob et al 2012 and Cummins et al 2017) leverage of life insurers has inverse relationship to the insurers' financial resilience, but in our study is not significant. Nevertheless it is negative and significant to all components of Z-score indicating that poorly capitalized firms could be at risk of financial distress. Reinsurance is positively and significantly improve the financial resilience of life insurers by increasing capitalization (see Cummins and Nini, 2002) and reducing the risk of volatility facing life insurers.

We find that diversification has no significant effect on life financial resilience and any of the components of Z-score. Takaful operators are neither financially weaker nor stronger than their conventional counterparts. Despite insignificant influence on Z-score we find Takaful operators are significantly more capitalized than conventional insures.

General Insurance

To test for the effect of efficiency on financial soundness of general insurance we use fixed effect and estimate 3 models (model 1 to 3) on Z-score and 3models for components of z-score (model 4,5 and 6). The choice of fixed effect is based on the results of Hausman test as shown in table 4.7.

From model 1 we find that technical efficiency is positive and significantly related to z-score while scale efficiency is not significant. This means that those firms which can provide risk pooling and financial intermediation using least inputs (labour, capital and management services) are more likely to be finically more resilient than those which are less efficient. This effect is supported by positive and significant effect of cost efficiency in model 3, which indicates that insurers that are able to minimize their input cost are likely to be more efficient. The positive influence of cost efficiency is also reported by Al-Amri et al 2014. Allocative efficiency on the other hand is significant but negatively influencing z-score. Allocative efficiency explains how insurers are able to choose the right mix of inputs given the input prices. Since general insurance industry is moderately regulated, firms are not free to choose the most efficient mix.

Table 4.5: Correlation analysis of Z-Score and its Determinants for General Insurance

Correlations

	Ln Z-Score	Net Income	Ln TE	Ln Reins	Ln HHI	Ln TI/TA	Ln Leverage	Ln σROA	Ln ROA	Ln TA	Line	System
Ln Z-Score	1											
Net Income	0.39**	1										
Ln TE	0.03	0.13*	1									
Ln Reins	0.02	-0.42**	-0.29**	1								
Ln HHI	0.27**	0.26**	0.01	0.02	1							
Ln TI/TA	-0.06	0.02	0.6**	-0.26**	-0.15**	1						
Ln Leverage	0.06	0.06	-0.01	-0.12*	0.04	0.02	1					
Ln σROA	-0.70**	-0.36**	-0.16**	0.23**	-0.31**	-0.13*	-.12*	1				
Ln ROA	0.45**	0.14**	-0.11*	0.25**	0.03	-0.10	0.01	0.07	1			
Ln TA	0.27**	0.72**	0.19**	-0.55**	0.27**	0.09	0.11*	-0.54**	-0.18**	1		
Line	-0.03	0.28**	0.29**	-0.59**	0.07	0.32**	0.12*	-0.51**	-0.41**	0.59**	1	
System	-0.15**	-0.16**	0.1*	-0.21**	0.2**	0.15**	0.06	-0.20**	-0.27**	-0.01	0.5**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Regarding the control variables, we find total assets is positively and significant determinant of general insurers financial resilience similar to the life insurance. As a matter of fact all control variables have similar sign as in life insurance. Apart from size only re-insurance is significantly contributing to financial soundness. Efficiency in investment (TI/TA) on the other hand despite being insignificant to z-score, it is positively influencing ROA.

Competition improves financial resilience

Life Insurance

We use random effect estimation in table 4.8 to estimate the effect of competition on financial resilience of life insurance. We find the relationship between concentration and financial resilience of life insurers is negative however insignificant. That is to say the extent of concentration in the market has no direct role in improving financial strength of these firms.

When we test the transmission mechanism to see if the influence of efficiency scores changes when we control for concentration in model 2, 3 and 4; we find that technical and scale efficiency remain significant and their impact have increased by 0.015 and 0.025 percentage points respectively. The sign of their coefficient remain the same (negative for TE and positive for SE) implying that overall technical efficiency will result into more weaker insurers and operating at optimum scale will result into more financially stronger firms when there is an increase in competition. Therefore even though competition has no direct relationship with financial resilience but its effect is channeled through firm's efficiency. Hence these results are in line with the transmission mechanism hypothesis introduced by Schaeck and Cihak (2010) which suggest that efficiency is a channel through which competition can result into financially stronger firms.

In model 2 revenue efficiency is found to be insignificant determinant of z-score. Surprisingly when we control for revenue efficiency, scale efficiency becomes positive and significant at 10% in determining financial resilience of general insurers. Therefore like in life insurance as firms approach optimum scale of production they become more resilient. When we test for effect of efficiency on components of z-score, we find efficiency reduces the risk of volatility of earning in model 5 and significantly improves capital buffers in model 6.

Table 4.6: Regression of Z-Score and Components on Efficiency of Life Insurance

	Baseline model		1	2	3	4	5	6
Dependent Variable	fixed	random	Z-score	Z-score	Z-score	ROA	σROA	Equity/Assets
Size (Ln TA)	0.088	0.112	0.098	0.104	0.122	0.034	-0.367	-0.196
	(0.165)	(0.000)	(0.001)	(0.000)	(0.001)	(0.191)	(0.001)	(0.000)
Ln TI/TA	-0.053	-0.022	-0.032	-0.067	-0.053	-0.058	-0.120	0.070
	(0.468)	(0.737)	(0.630)	(0.279)	(0.439)	(0.082)	(0.549)	(0.200)
Ln HHI	-0.237	-0.364						
	(0.498)	(0.270)						
Ln TE	-0.232	-0.327	-0.351			-0.101	1.120	0.120
	(0.308)	(0.116)	(0.063)			(0.284)	(0.050)	(0.433)
Ln SE	0.312	0.502	0.525	0.155		0.199	-1.701	-0.115
	(0.354)	(0.097)	(0.070)	(0.453)		(0.184)	(0.054)	(0.630)
Ln CE					-0.227			
					(0.260)			
Ln RE	0.001	-0.021		-0.050				
	(0.992)	(0.636)		(0.219)				
Ln AE					0.168			
					(0.400)			
Ln Leverage	-0.084	-0.047	-0.046	-0.041	-0.027	-0.057	-0.171	-0.564
	(0.032)	(0.148)	(0.130)	(0.193)	(0.501)	(0.001)	(0.084)	(0.000)
Ln Reinsurance	0.103	0.049	0.057	0.055	0.073	-0.003	-0.252	0.005
	(0.004)	(0.046)	(0.024)	(0.030)	(0.013)	(0.868)	(0.004)	(0.827)
Line (Diversification Dummy)	0.114	0.000	0.024	0.021	-0.083	0.081	0.146	-0.009
	(0.301)	(0.997)	(0.694)	(0.732)	(0.298)	(0.100)	(0.511)	(0.891)
System	omitted	0.031	-0.014	0.005	0.109	-0.234	-0.111	0.286
		(0.674)	(0.858)	(0.944)	(0.275)	(0.230)	(0.727)	(0.012)
Number Observations	245	245	245	245	202	245	245	245
Number of Firms	30	30	30	30	29	30	30	30
R-square	0.207	0.256	0.246	0.241	0.276	0.070	0.256	0.772
Wald-statistic	3.530	70.020	61.640	60.120	51.720	24.470	61.900	503.510
P-value	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
Hausman		2.970						
P-value		0.966						

Looking into the components of Z-score we find that concentration is significant and positively related to ROA at 10%, which means less competition can improve ROA. Revenue and cost efficiency remained insignificant as shown in model 3 and 4. The dummy variables for diversification and Takaful operators remain insignificant while reinsurance remain significant. Leverage on the other hand become significant when we control for concentration and the sign remains negative implying that firms having higher ratios of premium to equity become less financially resilience. This finding is similar to that of Al-Amri et al, 2014 and Yakob et al 2012.

Table 4.7: Regression of Z-Score and Components on Efficiency of General Insurance

	Baseline model		1	2	3	4	5	6
Dependent Variable	fixed	random	Z-score	Z-score	Z-score	ROA	σROA	Equity/Assets
Size (Ln TA)	0.059	0.135	0.341	0.331	0.506	-0.075	-0.822	-0.095
	(0.552)	(0.018)	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)	(0.000)
Ln TI/TA	0.022	0.006	-0.058	0.052	-0.165	0.050	0.012	0.028
	(0.832)	(0.953)	(0.568)	(0.571)	(0.182)	(0.069)	(0.937)	(0.332)
Ln HHI	0.860	0.731				0.150		
	(0.000)	(0.000)				(0.011)		
Ln TE	0.288	0.204	0.543			-0.037	-0.667	0.146
	(0.257)	(0.385)	(0.019)			(0.560)	(0.051)	(0.025)
Ln SE	0.181	0.432	0.024	0.526	0.429	0.013	-0.132	0.012
	(0.621)	(0.212)	(0.947)	(0.075)	(0.186)	(0.895)	(0.805)	(0.907)
Ln CE					0.594			
					(0.028)			
Ln RE	-0.088	-0.133		0.002				
	(0.303)	(0.077)		(0.982)				
Ln AE					-0.589			
					(0.035)			
Ln Leverage	-0.008	0.084	-0.039	-0.028	0.030	-0.042	-0.093	0.023
	(0.961)	(0.591)	(0.824)	(0.873)	(0.895)	(0.357)	(0.717)	(0.633)
Ln Reinsurance	0.112	0.056	0.142	0.131	0.193	0.008	-0.346	-0.024
	(0.102)	(0.294)	(0.040)	(0.062)	(0.011)	(0.652)	(0.001)	(0.210)
Line (Diversification Dummy)	-0.070	-0.124	0.022	0.008	Omitted	0.012	0.120	0.257
	(0.912)	(0.493)	(0.973)	(0.990)		(0.941)	(0.899)	(0.153)
Number Observations	368	368	368	368	271	368	368	368
Number of Firms	44	44	44	44	39	44	44	44
R-square	0.125	0.190	0.089	0.097	0.160	0.029	0.270	0.110
F-statistic	6.300	71.900	5.630	4.750	7.230	1.910	12.920	9.050
P-value	0.000	0.000	0.000	0.000	0.000	0.057	0.000	0.000
Hausman		18.220						
P-value		0.033						

General Insurance

For general insurance we use fixed effect estimation to test the effect of competition on financial soundness of general insurers, and the results are shown in table 4.9. We find that concentration, measured as HHI has positive and significant relationship with z-score. This implies that as fewer firms holding majority of market share, that is with reduced competition general insurers will be less likely to default. Malaysian general insurance industry rejects the transmission mechanism hypothesis as not only the z-score is positively influenced by concentration but also controlling for concentration makes all types of efficiency insignificant determinants of financial resilience of general insurers. These findings can be depicted from model 1 to 3 in table 5.23.

Table 4.8: Regression of Z-Score and Components on Competition and Efficiency of Life Insurance

	Baseline model		1	2	3	4	5	6	7
Dependant Variable	fixed	random	Z-score	Z-score	Z-score	Z-score	ROA	σROA	Equity/Assets
Size (Ln TA)	0.088	0.112	0.113	0.111	0.114	0.128	0.018	-0.405	-0.218
	(0.165)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.525)	(0.000)	(0.000)
Ln TI/TA	-0.053	-0.022	-0.062	-0.020	-0.054	-0.046	-0.063	-0.138	0.061
	(0.468)	(0.737)	(0.310)	(0.757)	(0.375)	(0.504)	(0.059)	(0.492)	(0.269)
Ln HHI	-0.237	-0.364	-0.396	-0.386	-0.351	-0.232	0.310	1.224	0.357
	(0.498)	(0.270)	(0.222)	(0.237)	(0.284)	(0.521)	(0.055)	(0.207)	(0.176)
Ln TE	-0.232	-0.327		-0.367			-0.112	1.081	0.108
	(0.308)	(0.116)		(0.053)			(0.233)	(0.058)	(0.487)
Ln SE	0.312	0.502		0.542			0.221	-1.623	-0.073
	(0.354)	(0.097)		(0.061)			(0.141)	(0.066)	(0.762)
Ln CE						-0.265			
						(0.187)			
Ln RE	0.001	-0.021			-0.044				
	(0.992)	(0.636)			(0.285)				
Ln AE						0.202			
						(0.314)			
Ln Leverage	-0.084	-0.047	-0.060	-0.053	-0.049	-0.022	-0.048	-0.133	-0.554
	(0.032)	(0.148)	(0.061)	(0.097)	(0.139)	(0.576)	(0.008)	(0.198)	(0.000)
Ln Reinsurance	0.103	0.049	0.056	0.049	0.052	0.060	-0.001	-0.250	0.011
	(0.004)	(0.046)	(0.026)	(0.039)	(0.038)	(0.026)	(0.968)	(0.004)	(0.656)
Line (Diversification Dummy)	0.114	0.000	0.015	0.002	0.007	-0.088	0.089	0.189	0.005
	(0.301)	(0.997)	(0.803)	(0.969)	(0.904)	(0.199)	(0.072)	(0.400)	(0.942)
System	omitted	0.031	0.025	0.026	0.035	0.129	-0.273	-0.225	0.232
		(0.674)	(0.754)	(0.719)	(0.657)	(0.141)	(0.143)	(0.496)	(0.032)
Number Observations	245	245		245	245	202	245	245	245
Number of groups	30	30		30	30	29	30	30	30
R-square	0.207	0.256	0.236	0.255	0.243	0.280	0.063	0.264	0.782
Wald/ F-statistic	3.530	70.020	59.280	69.730	61.710	64.190	28.540	63.530	523.840
	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
Hausman		2.970							
P-value		0.966							

Regarding the components of z-score in models 4, 5 and 6, we find that concentration significantly positive to ROA and capitalization and is insignificant in reducing the risk of earning volatility. Leverage remains insignificant to z-score while re-insurance remains significant positive effect on z-score however with a decreased influence (models 1-3).

Conclusion

This study aimed at testing the CVH hypothesis on Malaysian insurance industry. This hypothesis suggest that firms' financial resilience is positively related to efficiency and negatively related to competition. We studied the entire industry from 2005 to 2016. We measured financial resilience using z-score which is equivalent to firm's distance to default, efficiency with DEA and competition with HHI. We find that the industry on average if financially strong with increasing in good performance. The lowest distance to default is found in 2009 in both life and general insurance and we believe it is associated with Global financial crisis. Overall general insurers are found to be more resistant and less concentrated. Firms are performing well in terms technical, scale and revenue efficiency, however they are cost inefficient. Life insurance are more efficient than general insurance.

The debate on competition and stability of financial institution still remain inconclusive for Malaysian insurance industry. On one hand we find competition may help life insurers by improving the effect of efficiency on the financial soundness. On the other hand we find concentration is preferred to solvency of general insurers and this concentration eliminates the influence of efficiency on financial soundness of general insurers. Hence we support CVH on general insurance and reject it on life insurance.

We find that Total asset is positively related to financial resilience of life insurers, which is contrary to the previous studies, however scale efficiency has positive influence on Z-score. In this regard we recommend a further research to be done how big is safe and if there is a threshold when it comes to size of the insurance firms.

Table 4.9: Regression of Z-Score and Components on Competition and Efficiency of General Insurance

	Baseline model		1	2	3	4	5	6
Dependent Variable	fixed	random	Z-score	Z-score	Z-score	ROA	σROA	Equity/Assets
Size (Ln TA)	0.059	0.135	0.053	0.023	0.039	-0.075	-0.635	-0.202
	(0.552)	(0.018)	(0.593)	(0.805)	(0.825)	(0.004)	(0.000)	(0.000)
Ln TI/TA	0.022	0.006	0.032	0.080	-0.068	0.050	-0.046	0.061
	(0.832)	(0.953)	(0.758)	(0.369)	(0.586)	(0.069)	(0.766)	(0.031)
Ln HHI	0.860	0.731	0.850	0.943	1.048	0.150	-0.550	0.318
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.011)	(0.100)	(0.000)
Ln TE	0.288	0.204	0.207			-0.037	-0.449	0.020
	(0.257)	(0.385)	(0.392)			(0.560)	(0.218)	(0.762)
Ln SE	0.181	0.432	0.260	0.441	0.370	0.013	-0.285	0.100
	(0.621)	(0.212)	(0.469)	(0.124)	(0.244)	(0.895)	(0.599)	(0.312)
Ln CE					0.265			
					(0.347)			
Ln RE	-0.088	-0.133		-0.058				
	(0.303)	(0.077)		(0.475)				
Ln AE					-0.283			
					(0.324)			
Ln Leverage	-0.008	0.084	-0.008	-0.001	0.068	-0.042	-0.113	0.035
	(0.961)	(0.591)	(0.962)	(0.997)	(0.760)	(0.357)	(0.660)	(0.461)
Ln Reinsurance	0.112	0.056	0.115	0.105	0.164	0.008	-0.329	-0.035
	(0.102)	(0.294)	(0.092)	(0.123)	(0.028)	(0.652)	(0.001)	(0.066)
Line (Diversification Dummy)	-0.070	-0.124	-0.064	-0.082	omitted	0.012	0.176	0.226
	(0.912)	(0.493)	(0.919)	(0.896)		(0.941)	(0.853)	(0.193)
Number Observations	368	368	368	368	271	368	368	368
Number of Firms	44	44	44	44	39	44	44	44
R-square	0.125	0.190	0.110	0.105	0.150	0.029	0.270	0.062
F-statistic	6.300	71.900	6.990	6.960	7.980	1.910	11.710	11.970
P-value	0.000	0.000	0.000	0.000	0.000	0.057	0.000	0.000
Hausman		18.220						
P-value		0.033						

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