COST EFFICIENCY, PROFITABILITY AND FIRM SIZE OF THAI INSURANCE COMPANIES

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Abstract

With an increasingly open economic condition in Thailand, insurance firms exposed to competition should improve efficiency to ensure their survival. This paper examines the cost efficiency and its relationship with profitability of life insurance firms: Cobb-Douglas stochastic cost frontier model is used. We find that the industry, on average, is 86 percent to 114 percent inefficient. There is no significant relationship between inefficiency and age of firms. The test results show that inefficiency is negatively correlated with the ROE ratio suggesting that efficient firms, on average, have higher return on equity. Inefficiency has substantial effect on the profitability of life insurance companies. The mean inefficiency is positively correlated with size suggesting a need for rationalization of the insurance industry. One solution could be consolidation of the large number of smaller insurers: another is to increase capital requirements of life insurers.

JEL Classification: G14, G20 & G21
Key words: Financial institutions, Cost efficiency, Profitability, Firm size

1. Introduction

Insurance industry in Thailand is set to have a bright future according to industry sources. However, the international insurance markets are becoming increasingly open to competition from foreign insurance companies. Liberalized environment under the General Agreement on Trade and Services (GATS) has removed entry barriers to foreign firms. The opening up of domestic market under GATS in year 2008 will cause the inflow of foreign insurance firm, hence heightening competitive pressures that may result in the demise of inefficient insurers and improving efficiency of others. As such, insurance firms in Thailand need to be efficient to ensure their survival. This paper attempts to investigate the cost efficiency of life insurance firms in Thailand during the period 1997 to 2001 using the Cobb-Douglas stochastic cost frontier method to address the readiness of insurance firms to face increased competition from year 2008, when foreign

firms will be permitted.

The insurance industry in Thailand contributes to the nation's economy not only by providing economic or financial security to firms and individuals but also by helping to mobilize the country's savings and hence, investment. The insurance industry will become an increasingly important sector as the country develops. The association of Thai insurance industry estimates that by the year 2010, about thirty percent of residents will have life insurance policies with a total premium of US$ 6.3 billion.

Efficiency of financial services industry particularly in the banking industry has been widely studied since the last decade. However, these studies focus mainly on developed countries as surveyed by Berger and Humphrey (1997), and Cummins and Weiss (2001). Cummins and Weiss (2001) recorded 20 studies of insurance efficiency across countries, most of which are focused on the US insurance sector. Moreover, in their survey, they do not report any study that deals with insurance industry in developing countries.

The rest of the paper is organized as follows. Section 2 presents an overview of the Thai life insurance industry. Section 3 reviews the literature on efficiency studies in insurance industry. Section 4 describes the methodology in estimating cost efficiency and its relation with profitability. Section 5 describes the data and defines outputs, input and input prices used for this study. Section 6 contains the empirical results. Section 7 concludes.

2. An overview of Thailand's life insurance industry

The Thai life insurance industry started with the establishment of a foreign company, American Life assurance, AIA, in 1931. Eleven years later, a local firm, Thai Life Insurance, was established. The number increased to 25 later: three of them are listed on the Stock Exchange of Thailand (see Table 1).

According to the Annual Insurance Report of Thailand, only fifteen percent of the population hold insurance policies with a premium amounting to about US$ 3 billion: non-life insurance premium is about US$ 1.3 billion. The top five largest insurers control 91 percent of the market share with AIA with total assets

Table 1:Number of companies in insurance industry: Thailand, as at 2003

Line of Insurance Business	Domestics Company	Foreign's Branch	Total
Life Insurance	24	1	25
Non-life Insurance	66	5	71
Health Insurance	5	0	5
Re-Insurance(Life Insurance)	1	0	1
Re-Insurance (Non-life Insurance)	1	0	1
Total	97	6	103

of US$ 4 billion still holds 52.1 percent. The four other largest insurers (Thai Life, Ocean, Muang Thai and Ayudhaya Alliance CP) control 43 percent of the market share. Thai Life Insurance has total assets of US$ 1.6 billion. Ten of the insurance companies have total assets less than US$ 25 million each. Benefit payments of life insurance to insured and beneficiaries amounted to US$ 742.3 million dollars in 2002. Out of this, benefit payments of US$ 627.3 million dollars come were from the five largest insurance companies. The general insurance market is not as concentrated as the life market, with over 77 insurers. The largest general insurer holds only 12 percent of the market and there is considerable competition in the market. Thus in the non-life sector has informed customers.

3. Review of literature

Efficiency of the financial services industry particularly in the banking industry has been widely studied since the last decade. However, these studies focus mainly on developed countries as surveyed by Berger and Humphrey (1997), and Cummins and Weiss (2001). In their survey, they do not report any study that deals with insurance industry in the developing countries. However, Boonyasai, Grace and Skipper (2002) did a study on the effect of liberalization and regulation on life insurer's efficiency in Korea, Philippines, Taiwan and Thailand. They argue that the liberalization have had little effect on improvements in productivity in the Thai's life insurance industry. They conclude that in a restrictive regulatory environment, welfare gains will be minimal if deregulation does not closely follow liberalization.

On the studies of insurance firm efficiency, most of them use non-parametric methods to estimate efficiency (for example, study on productivity and efficiency (Cummins, Turchetti, and Weiss, 1998; Cook and Cummins, 1996); Fukuyama, 1997), firm output choices and X-efficiency (Meador, Ryan, and Schellhorn, 2003), consolidation and efficiency (Cummins, Tennyson, and Weiss, (1998); Cummins and Rubio-Misas, 2002), organizational structure and efficiency (Cummins, Weiss, and Zi, 1996; Cummins, Rubio-Misas, and Zi, 2003; Jeng and Lai, 2005), and profitability and efficiency (Greene and Segal, 2004).

Cummins, Turchetti and Weiss (1998) examine technical efficiency and productivity growth in the Italian insurance market based on a sample of 94 Italian insurers for the period 1985-1993. Using the method of non-parametric data envelopment analysis, the results of the study showed that there is no efficiency change over the sample period. However, productivity declined significantly over the sample period. Fukuyama (1997) investigates productive efficiency and productivity changes of Japanese life insurance companies. Results of the study show that productive efficiency differs from time to time between mutual and stock companies.

Cummins, Tennyson, and Weiss (1998) examine the relationship between

mergers and acquisitions, efficiency, and scale economies in the US life insurance industry by estimating cost and revenue efficiency over the period 1988-1995 using data envelopment analysis (DEA). The results of the study indicate that overall, mergers and acquisition in the life insurance industry have had a beneficial effect on efficiency. Cummins and Rubio-Misas (2002) study the effects of deregulation and consolidation in the Spanish insurance industry using the non-parametric frontier analysis to estimate cost, technical, and allocative efficiency. The results of the study show that acquirers in the mergers and acquisitions market prefer relatively efficient target firm.

Cummins, Weiss and Zi (1996) analyze the efficiency of stock and mutual organizational firms in the property-liability insurance industry using non-parametric frontier efficiency methods. Results of the study indicate that stock companies are more successful than mutuals in minimizing cost. Cummins, Rubio-Misas and Zi (2003) in studying the effects of organizational structure on efficiency by analyzing Spanish stock ad mutual insurers found similar results. Stocks of all sizes dominate mutuals.

Jeng and Lai (2005) studied the differences in efficiency for three unique organizational forms in the Japanese non-life insurance industry – *keiretsu* firms, non-specialized independent firms (NSIFs), and specialized independent firms (SIFs) using non-parametric frontier method. The results show that keiretsu firm seems to be more cost-efficient than NSIFs. Their results also show that the efficiency deteriorates for all three types of firms throughout the 1985-1994 sample period.

4. Theory and test model

A specific model, namely the stochastic frontier model, is selected for studying the efficiency of the insurance firms. The general form of stochastic frontier model was introduced independently by Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977). These models were developed to address the research problem of applying the production function. The selected method examines the deviation from the estimated production frontier and introduces a number of potential variables that may affect the frontier values as control variables. The main difference of stochastic frontier model from other deterministic model is the use of the composite error term from the estimated model.

Cost efficiency is derived from a cost function in which the variable, namely cost, depends on price of the inputs, the quantity of outputs, random errors and (in) efficiency. Cost efficiency estimates in this study shows how far the life insurers' cost relative to its best practice frontier would be for producing the same output bundle under the same conditions. Therefore, a cost function can be written as.

$$C = C\ (Y;\ P;\ U;\ v_i) \qquad (1)$$

Where Y *is* the vector of quantities of outputs; P *is* the vector of the price of input; U is an inefficiency factor which can cause cost to rise above the best-practice level; v_i is the random error term that incorporates measurement error that can increase or decrease cost. The independent variable of the cost function can be separated into three groups; the quantity of outputs and the prices of inputs; the inefficiency, U; and the random error, v. After taking natural log of both sides of equation (1), the cost function can be depicted as:

$$\ln C_{it} = \ln C^*(Y_{it}, P_{it}) + \ln(u_{it} + v_{it}) \quad (2)$$

Where,

i : indicates the firms,
t : indicates time period measured as year,
lnC : the natural log of observed total cost,
$\ln C^*(Y_i, P_i,)$: the natural log of the cost function of firm i,
u_i : one-sided error term that captures cost inefficiency ($U_i \geq 0$),
v_i : a random error or two sided error term, and
u_i+v_i : the composite error terms.

A two-sided error term, v, represents the random error that is unrelated to inefficiency. A one-sided error term, u represents inefficiency. The procedure of stochastic frontier has to make assumption on both errors. Generally, both components of the composite errors are assumed to be independent and identically distributed (i.i.d.) (Greene, 1997). Therefore, $\exp(U_i) = C/C^* \exp(v_i)$ or cost inefficiency measures the proportion by which the firm could have reduced its cost and still attain the same level of outputs that can be computed as follows (Greene *et al.*, 2004);

$$\text{Inefficiency} = 1-\exp(-u_i) \quad (3)$$

Conventionally, the random error component is assumed to be normally distributed. The distribution assumption of inefficiency component or non-negative random variable can be assumed in half-normal model, exponential model, truncated normal model and gamma model (Kumbhakar and Lovell, 2000). Technical details pertaining to these distributions are given in Greene (1993; 1995). With these assumptions of the two error terms, the test estimator used is maximum likelihood ratio.

The firm's inefficiency is computed, which is not observed directly as the conditional expectation $E(U_{it}|\varepsilon_{it})$or the conditional distribution of u_{it} given ε_{it} as in Jondrow *et al.* (1982). Assuming a Cobb-Douglas cost function, the stochastic cost frontier can be written as follow.

$$\ln C_{it} = \alpha_0 + \sum_{j=1}^{n} \alpha_j \ln Y_{jit} + \sum_{k=1}^{m} \beta_k \ln P_{kit} + \delta t + v_{it} + u_{it} \quad (4)$$

Where, $\ln C_{it}$ is the natural logarithm of the total cost (discussion of what constitutes an insurance firm's input and output will be in the next section). $\ln Y_{jit}$ is the natural logarithm of the jth output (j = 1,2,…,n). $\ln P_{kit}$ is the natural logarithm of the k-th input price (k = 1,2,…,m) with t as the time trend. α, β, γ, δ,θ, and ρ are the parameters to be estimated.

Following Huang and Liu (1994) and Greene *et al.* (2004), we also model the inefficiency as a function of firm specific variables, rather than using a two-stage analysis where the inefficiency term is regressed on firm specific variables. The inefficiency effects, u_{it}, are assumed to be defined as

$$u_{it} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 AGE_{it} + \alpha_3 D_{crisis} + \alpha_4 t + \upsilon_{it} \quad (5)$$

Where, SIZE is the natural log of total asset and AGE is the age of the firm. More experienced firm with longer life is argued to be more efficient that less experienced newer firms. In Jovanovic (1982), technical efficiency is found to be positively related to firm's age. Over time, the least-efficient firms exit the industry, leaving a technically more-efficient population of firms; D_{crisis} is a dummy variable which equals 1 for year 2000 to 2001 and zero otherwise. This dummy variable is to control the impact of financial crisis effect on the insurance firms. Based on the study by Moon (2001), financial turmoil was eliminated in March 1999. Thus for our study, the post-crisis period starts from year 2000; and t is the time trend;

Profitability and inefficiency are related, and have to be examined. We examine the association between profitability and inefficiency by examining the association between annual profitability and inefficiency. We measure profitability by return on equity, ROE. The ROE is computed as net profit on equity in year t divided by average equity in year t. The independent variables consist of the inefficiency estimates, log of assets, ownership variable and time trend. We estimate the parameters by fixed-effect panel data model.

The model is as follows:

$$\ln PROFIT = \lambda_0 + \lambda_1 INEFF_{it} + \lambda_2 ASS_{it} + \lambda_3 OWN + \lambda_4 t + \nu_{it} \quad (6)$$

Where *PROFIT* is the profitability measure; *INEFF* is the inefficiency estimates; *ASS* is a proxy for size and is computed as the log of total assets; *OWN* is dummy variable which equals 1 if foreign owned and 0 otherwise; and t is the time trend.

5. Data and measurement of output and input

The data for this study, except for the number of agents, are obtained from the *Annual Insurance Report of Thailand* published by the Department of Insurance, Ministry of Commerce. 'Number of agents' is obtained directly from the Department of Insurance: there were twenty-five life insurance firms in our study and the time period is from 1997-2001.

Cummins and Zi (1997; 1998) defined output as benefit payments to individual life insurance, benefit payments to group life insurance, benefit payment to individual annuities, benefit payment as group annuities, accident/health insurance benefit payment and additions to reserves. Benefit incurred in life insurance consists of ordinary, industrial and group, which represent 85, 15 and 5 percent of the total benefit, incurred respectively. In this study, we separate benefit incurred into five categories: life insurance (Y_1), accident (Y_2), health (Y_3), industrial (Y_4) and group (Y_5). Following Cummins and Rubio-Misas (2001), the other outputs are based on the intermediary function, life policy reserve (Y_6) and investment asset (Y_7). There is no annuity in Thai life insurance. All of the outputs are expressed in real terms by deflating it with the country's consumer price index (CPI).

Following Cummins and Zi (1997; 1998) and Greene *et al.* (2004), we separate inputs into three types; labor, financial capital, and materials/business services. Labor consists of home office labor (X_1) and agent labor (X_2) following Cummins Tennyson and Weiss (1998). Home office labor is defined as the number

Table 2: Descriptive statistics of Thai life insurance firms: 1997-2001 (in US$ million)

	Variable	Mean	Standard Deviation	Minimum	Maximum
Total Cost		472	1728	.0004	17812
Output					
	Y_1	17.21	48.31	0	231.20
	Y_2	1.31	3.89	0	25.31
	Y_3	3.20	8.76	0	54.16
	Y_4	2.92	10.12	0	63.32
	Y_5	1.13	2.12	0	10.46
	Y_6	158.46	410.28	0	2710.71
	Y_7	181.21	506.2	1.12	3596.12
Inputs					
	X_1	4.21	6.72	0.05	40.86
	X_2	49.76	128.90	0	949.27
	X_3	1012.37	812.91	.0001	4210.32
	X_4	7.47	15.12	0	72.69
Total assets		201.63	486.21	2.13	37281.46
Premium		53.13	151.32	0	1151.32

of staff and executive agent while agent labor is defined as number of agents. Financial capital input (X_3) is defined as the amount of equity capital following Cummins Tennyson and Weiss (1998). Finally, business services (X_4), includes materials and physical capital expense (excluding labor expenses) which is related to selling and servicing policies.

The price of office labor, (P_1), is computed as the total salaries and welfare divided by the total number of staff. The price of agents labor, (P_2), is calculated as total commission and brokerages paid divided by total number of agents. Following Greene *et al.* (2004), the price of financial capital, (P_3), is computed as the difference between the ratio of total net income to total financial capital (return on equity) and the ratio of total investment income to total assets (return on investments) over the same period. The price of business services, (P_4), is calculated as underwriting expenses divided by the total number of policies sold and terminated. All the values are deflated by consumer price index (CPI).

Table 3: Maximum-Likelihood Estimates for parameters of Cobb-Douglas Stochastic Cost Function

Independent variable	*Dependent variable (lnCOST)*					
	Truncated Normal (U_1)			*Half-normal (U_2)*		
	Coef.	*s.e.*	*t-stat*	*Coef.*	*s.e.*	*t-stat*
constant	-0.915	0.898	-1.019	-0.685	0.743	-0.922
lnP_1	0.184	0.074	2.493	0.163	0.076	2.132
lnP_2	0.159	0.082	1.932	0.166	0.084	1.988
lnP_3	0.129	0.034	3.826	0.135	0.034	3.954
lnP_4	0.017	0.022	0.765	0.008	0.021	0.367
lnY_1	-0.038	0.039	-0.990	-0.025	0.332	-0.757
lnY_2	0.017	0.038	0.044	-0.017	0.034	-0.525
lnY_3	0.138	0.099	1.393	0.132	0.101	1.305
lnY_4	0.212	0.098	2.163	0.222	0.109	2.037
lnY_5	-0.046	0.091	-0.505	-0.034	0.091	-0.374
lnY_6	0.312	0.161	1.937	0.365	0.151	2.417
lnY_7	0.564	0.233	2.421	0.516	0.232	2.224
t	0.086	0.056	1.536	0.082	0.054	1.518
Inefficiency Model						
Intercept	1.466	0.578	2.536	1.556	0.755	2.061
SIZE	-0.141	0.071	-1.984	-0.212	0.093	-2.279
AGE	-0.044	0.072	-0.628	-0.057	0.092	-0.619
Dcrisis	0.125	0.061	2.049	0.133	0.064	2.078
t	0.023	0.069	0.333	0.071	0.081	0.876
Variance Parameters						
Gamma	1.821	1.766	1.031	2.321	0.954	2.433
$Sigma^2$	1.517	1.832	0.828	1.613	0.567	2.845
Log-likelihood			-178.83			-181.22
Mean Inefficiency			0.858			1.143

A quick review of the statistics in Table 2 shows that the data on the needed variables are indicative of the stage of development of the industry. The data are from primary sources, and we expect the data to be reliable and accurate.

6. Findings and analysis

A: Cost efficiency model

The results of the analysis are presented and discussed in this section. Testing whether the translog function is more appropriate than the Cobb-Douglas function yielded a log likelihood ratio of 2.03, which lies in the region less than the upper 5 percent of the χ^2 distribution. This indicates that the null hypothesis that the second-order coefficients in the translog cost function are zero cannot be rejected. Hence, we estimate cost inefficiency using a Cobb-Douglas stochastic cost frontier function under the assumption of truncated normal and half normal distributions. This is the appropriate procedure for identifying the model, so it ensures that the results to be obtained are likely to be accurate for this data set.

In Table 3 are presented the result of cost frontier model estimates for each of the model assumption: truncated normal and half normal distributions. The

Table 4: Mean cost inefficiency of insurance firms, Thailand

Firms	*Inefficiency*			
	Truncated	*Rank*	*Half-normal*	*Rank*
Bangkok Life	*0.837*	*13*	*1.213*	*16*
Krungthai Axa Life	*1.271*	*23*	*1.867*	*24*
Allianz C.P. Life	*0.963*	*19*	*1.331*	*20*
TPI Life	*0.801*	*12*	*1.045*	*12*
Millea Life Insurance	*0.559*	*6*	*0.689*	*8*
Thai Life Insurance	*0.597*	*8*	*0.673*	*7*
Nationwide Life	*1.331*	*24*	*1.781*	*23*
Siam Commercial New York Life	*0.844*	*14*	*1.221*	*15*
Thai Cardiff Life	*0.853*	*15*	*1.051*	*13*
Ocean Life	*0.951*	*18*	*1.416*	*19*
Zurich National Life	*0.522*	*5*	*0.552*	*5*
Ayudhaya Allianz C.P.	*0.679*	*10*	*0.856*	*10*
General Life	*0.863*	*16*	*1.102*	*14*
Prudential TS. Life	*0.799*	*11*	*0.928*	*11*
Muang Thai Life	*2.516*	*25*	*3.221*	*25*
ACE Life Assurance	*1.012*	*21*	*1.456*	*21*
Max Life Assurance	*0.521*	*4*	*0.562*	*4*
Siam Samsung Life	*0.670*	*9*	*0.851*	*9*
Siam Life Insurance	*0.471*	*3*	*0.481*	*3*
Saha Life Insurance	*0.924*	*17*	*1.412*	*17*
South East Life	*0.411*	*2*	*0.467*	*2*
Inter life John Hancock	*0.593*	*7*	*0.678*	*6*
Advance MLC Assurance	*1.131*	*22*	*1.571*	*22*
ING Aetna Osotspa	*0.971*	*20*	*1.341*	*19*
A.I.A	*0.311*	*1*	*0.321*	*1*

results for truncated normal and half normal are quite similar. The likelihood ratios for testing the overall significance of the two frontier models are -178.83 and -181.22 respectively for the truncated normal and half normal respectively. Since the critical value of a χ^2-square distribution with twelve degrees of freedom at 5 percent acceptance level is 28.46, we reject the null hypothesis that all of the coefficients of explanatory variables are zero.

In both models, the coefficients of price of office labor (P_1), price of agent labor (P_2), price of financial capital (P_3), industrial net benefit payment incurred (Y_4), life policy reserve (Y_6) and investment asset (Y_7) are significantly away from zero.

Panel B of Table 3 presents the estimated parameter of the mean inefficiency equation (Equation 5). The coefficient of SIZE is negatively significant in both truncated normal and half normal indicating that inefficiency decreases with size suggesting the need for rationalization in the insurance industry in Thailand. Since insurance companies in Thailand are relatively small in size, consolidating the large number of smaller insurers should be high on the Thai government's agenda. The coefficients of D-crisis are positively significant indicating that the financial crisis has somewhat affected the efficiency of insurance firms. The coefficients of Age are negative but not significant for both truncated normal and half normal indicating that age of firms does not matter to efficiency. The coefficients of the time trend are not significant in all of the models implying that the distribution of inefficiency has not shifted over time.

Table 4 provides the mean inefficiency estimates for the insurance firms. The ranking by mean inefficiency of firms from both models are quite similar. The overall mean inefficiency is 0.86 to 1.14. This indicates that the life insurance industry in Thailand use about 86 to 114 percent more inputs than needed if they were fully efficient. This is the critical measure for the judgment about the readiness of the industry to face competition and also the need for reforms to improve the efficiency levels of the firms urgently.

Table 5: Panel data estimation results for the profitability equation

Independent variable	*Dependent variable(ROE)*					
	Truncated Normal			*Half-normal*		
	Coef.	*s.e.*	*t-stat*	*Coef.*	*s.e.*	*t-stat*
INEFF	*-0.213*	*0.101*	*-2.121*	*-0.234*	*0.112*	*-2081*
ASS	*-0.821*	*0.416*	*-1.998*	*-0.913*	*0.584*	*-1.562*
OWN	*-0.00013*	*0.00025*	*-0.626*	*-0.00023*	*0.00031*	*-0.731*
t	*-0.071*	*0.078*	*-0.910*	*-0.082*	*0.074*	*-1.112*
R^2			*0.71*			*0.73*
Hausman statistic			*5.12*			

B: Profitability and Efficiency

We investigate the relationship of profit and cost inefficiency using fixed-effect panel data estimation. We represent profitability by ROE. Table 5 shows the regression results of the profitability model using the fixed-effect panel data estimation. Hausman test result suggests we can reject the assumptions of the random effects estimator: Hausman statistic is 5.12. The coefficient of inefficiency estimate (INEFF) is negative and significant at the 5 percent level for both truncated normal and half normal model. The coefficient of size (ASS) is only significant at the 5 percent level for the truncated normal model. However, the coefficient of ownership is not significant in all the models.

The above results show that inefficient firms, on average, have lower profitability. This indicates that inefficiency has a substantial effect on the profitability of life insurance companies. Hence, for life insurance firms to be profitable, they can manage the firms more efficiently by reducing the inputs while achieving the same level of outputs. A policy recommendation, if faster results are to be obtained, is to reform the management of the insurance firms with rules aimed at reducing cost: for example possibly through more consolidation in the life insurance industry.

7. Conclusions

This study arose from the need to examine the efficiency and profitability of Thai insurance firms as at 2002 to establish some benchmarks about their efficiency before foreign insurance firms enter the industry under the WTO agreement for services sector comes into force in 2008. Our aim was to use cost function model to examine the relative efficiency of the industry prior to 2008 implementation of the agreement. We sampled large number of firms and estimated the cost and profit functions using a cost function model.

We find that the industry, on average, is 86 percent to 114 percent inefficient meaning that there is room for extracting more outputs from the use of the inputs. Firms are using 86 to 114 percent more inputs to produce the same output over the period tested. There is no significant relationship between inefficiency and age of the firm, a finding contrary to those reported in some developed economies. But, the mean inefficiency is positively correlated with size suggesting the need for rationalization in the insurance industry. Consolidation exercise for the large number of smaller insurers into more efficient groups should be high on the government's agenda if quick results are to be obtained to improve efficiency. The capital requirements for life insurers need to be increased in order to drive the smaller firms to consolidate with the larger ones.

In addition, we show that inefficiency is negatively correlated with the ROE ratio: that is, efficiency improvement is positively correlated with profitability. This shows that efficient firms, on average, have higher returns on equity. This

indicates that inefficiency has substantial effect on the profitability of life insurance companies. Hence, increasing efficiency should be the main priority for the Thai life insurance industry. Propagating these findings to the policymakers and the insurance company management would perhaps provide a useful reminder for them on the need to improve efficiency in this regard in the face of the more efficient new foreign entrants to the industry in 2008.

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