

# Efficiency Performance of Japanese Non-Life Insurers and Their Underwriting and Distribution Strategies+

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## ABSTRACT

This study investigates how underwriting and distribution strategies affect the cost efficiency of non-life insurers in a deregulated market environment. The Japanese non-life insurance market experienced a sweeping reform in 1996. The deregulation increased the number of competitors with a variety of strategies on underwriting and distribution. Our investigation spans the whole period after the deregulation of 1996-2006, and covers 19 non-life insurers operating in the Japanese market. Since strategic considerations are important for non-life insurers, this study tries to clarify the relationship between insurers' cost efficiency and their business strategies. For the analysis, we employ the ordered probability model where dependent variables are ranking numbers of efficiency performance derived from the fixed effect model. We choose explanatory variables representing differences in strategies including the business mix, agency commission ratios and personnel expenses ratios. The results of our analyses reveal that factors affecting insurers' cost efficiency differ between relatively larger insurers and smaller ones. Domestic insurers with larger size and long operating history tend to deteriorate their efficiency as they increase the composition ratio of any line of insurance. In contrast, no such relationships except for fire insurance are observed for smaller insurers including new entrants, niche underwriters and foreign based insurers, but negative relationships exist between their efficiency and personnel expenses ratios.

## 1. Introduction

The purpose of this study is to examine relationships between non-life insurers' cost efficiency and their business strategies including the selection of business portfolios, targeted customers, operating regions and distribution channels in the Japanese market after the deregulation by utilizing the ordered probability model. Previous studies on the Japanese non-life insurance market have studied efficiency and productivity of insurers using panel data. Many of these have focused on the organizational and ownership structure of insurers. However, there have been an insufficient number of works to

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investigate insurers' efficiency from the viewpoint of diversity of business strategies. In addition, this study covers 19 insurers, including major domestic insurers, foreign-based insurers, niche underwrites, life insurers' subsidiaries and new entrants from other industry segments. Moreover, this study is unique in its methodology since it employs the ordered probability model. We first measure the cost-inefficiency of insurers based on the fixed effect model and then convert the results into ranking data. We use the ranking number as the dependent variable and choose explanatory variables representing differences in business strategies, including the business mix, agency commission ratios and personnel expenses ratios. The use of the ordered probability model in this context is unique and makes it possible to overcome inappropriateness of using conditioned values directly.

## 2. Background

### 2.1. Brief Description of the Japanese Non-Life Insurance Market

Following the enforcement of the new Insurance Business Law in 1996, regulatory reforms were steadily implemented in the non-life insurance sector, and they replaced the traditional situation in which each insurer sold similar products at the same price. The brokerage system was introduced in April 1996, and mutual entry of life and non-life insurers through subsidiaries was allowed in October of the same year. In September 1997, insurers were allowed to market automobile insurance policies with differentiated premium rates, and simultaneously some of them started to utilize the direct response scheme to distribute such risk-differentiated products. The obligation for member insurers to use the premium rates calculated by the rating organizations was abolished in July 1997, which further enhanced the flexibility in price and coverage of insurance products.

Some insurers including foreign-based companies and new entrants have actively utilized the direct response model by utilizing mailing, telephone and internet systems to sell risk-differentiated insurance policies which target certain groups of customers, e.g. those who categorized in a certain age, region, or gender. Meanwhile, traditional domestic insurers have generally maintained relationships with insurance agencies and have not actively taken the direct response approach even after the deregulation.

### 2.2. Literature Review

There are still not many works on Japanese non-life insurers' efficiency from the perspective of business strategies. Fukuyama and Weber (2001) examined Japanese non-life insurers in terms of

technical efficiency and productivity changes during the period 1983–1994<sup>1)</sup>. They focused on scale and scope economies based on non-parametric techniques and found that the main source of growth was technological advancement in the years of expansion. Hirano and Inoue (2004) conducted an efficiency analysis on non-life insurers by using data from 1980 to 1990<sup>2)</sup>. They employed an error components model and found that the effects of economies of scope were statistically significant between the third sector including personal accident insurance, and other lines of insurance such as automobile and fire insurances. The above-mentioned studies are important for analysing the efficiency impact of insurers' business portfolios in the pre-deregulation period.

As the first decade passed since the deregulation in 1996, we can now notice several works attempting to conduct a comparative analysis on the efficiency performance of Japanese non-life insurers covering the post-deregulation era. Yanase et al. (2007) examined the impacts of the market deregulation on non-life insurers' productive efficiency using a nonparametric frontier approach<sup>3)</sup>. They used sample data from the period 1989–2005, and found that the rush for consolidation after 2000 had a positive effect on the efficiency and productivity of the industry. As studies investigating non-life insurers' efficiency from the perspective of their business portfolios, Miyashita and Yoneyama (2007)<sup>4)</sup> focused on voluntary automobile insurance (hereafter referred to as automobile insurance) with the largest premium volume among non-life insurance lines and found that the shift to automobile insurance significantly contributed to the cost efficiency. They employed the ordered probability model to assess as to how the explanatory variables related to automobile insurance impact the efficiency of non-life insurers. Suzawa and Miyashita (2007) followed the approach of Miyashita and Yoneyama (2007) and expanded their subject to other major lines of non-life insurance and investigated the profit performance of insurers by using panel data from 1996 to 2000<sup>5)</sup>. They observed that the higher ratio of the earned premium of compulsory automobile liability insurance (hereafter referred to as CALI) and automobile and personal accident insurances to the total premium contributed to the profitability of insurers in the deregulation period. Miyashita et al. (2008) conducted comparative analyses on pre- and post-deregulation periods based on panel data of 1970–2005, and found that insurers tend to ameliorate their efficiency by diversifying their insurance policy portfolios in both strictly regulated and competitive markets<sup>6)</sup>. These works, however, targeted a limited number of major domestic insurers. Thus, being grounded

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1) Fukuyama and Weber (2001), pp.129–146.

2) Hirano and Inoue (2004), pp.501–530.

3) Yanase et al. (2007).

4) Miyashita and Yoneyama (2007), pp.1–41.

5) Suzawa and Miyashita (2007), pp.101–119.

6) Miyashita et al. (2008).

in the findings of above referred works, this study widens the scope of subject insurers to smaller ones including newly established insurers and foreign-based insurers, and tests the relationships between insurers' cost-efficiency and not only portfolio considerations but also selections of distribution channels.

### 3. Research Methodology and Data

#### 3.1. Research Methodology

We conduct the analyses in the following two steps. First, we measure the cost-inefficiency of insurers based on the fixed effect model and convert the results into ranking data. Second, by using this ranking data, we analyze the relationships between insurers' efficiency performance and underwriting/distribution characteristics based on the ordered probability model. For the analyses, we utilize the LIMDEP/NLOGIT software<sup>7)</sup>.

#### Step 1: Cost-Inefficiency Measurement

As Brockett et al. (2005) pointed, the inputs generally represent resources to be employed in order to conduct operations, and the outputs reflect the results that are desired from the inputs utilized<sup>8)</sup>. In order to measure insurers' cost-inefficiency, we choose the surplus (Y) as the variable indicating production outputs, and the total assets (K), number of employees (L) and insurance agency (E) as the factors of production inputs. The cost of total assets (PK), cost of employees (PL), and cost of insurance agency (PE) are obtained by the following calculations<sup>9)</sup>:

$$PK = (K \times \text{Domestic Contracted Interest Rate} + \text{Non-Personnel Expenses})/K$$

$$PL = \text{Personnel Expenses}/L$$

$$PE = \text{Agency Commissions}/\text{Premiums Earned} \quad (1)$$

We then construct the fixed effect model based on the factors of production inputs and outputs chosen above. The model takes the form of a translog model.

7) Greene (2007).

8) Brockett et al. (2005), p.397.

9) All insurance-related data are collected from various annual issues of *Statistics of Japanese Non-Life Insurance* over the 1996-2006 period published by Insurance Research Institute. Domestic contracted interest rates are based on the annual issues of *Japan Statistical Year Book* of the subject period compiled by the Statistics Bureau, Ministry of Internal Affairs and Communications.

$$\begin{aligned}
 \ln(C/p_{E,it}) &= \beta_0 + \sum \mu_r D_r + \sum \theta_s T_s + \beta_K \ln(p_K/p_{E,it}) + \beta_L \ln(p_L/p_{E,it}) + \beta_Y \ln Y_{it} \\
 &+ \beta_{yy} (1/2) \ln^2 Y_{it} + \gamma_{yK} \ln Y_{it} \ln(p_K/p_{E,it}) + \gamma_{yL} \ln Y_{it} \ln(p_L/p_{E,it}) \\
 &+ \delta_{KK} (1/2) \ln^2(p_K/p_{E,it}) + \delta_{KL} \ln(p_K/p_{E,it}) \ln(p_L/p_{E,it}) + \delta_{LL} (1/2) \ln^2(p_L/p_{E,it}) + \varepsilon_{Cit} \\
 S_{Kit} &= \beta_K + \delta_{KK} \ln(p_K/p_{E,it}) + \delta_{KL} \ln(p_L/p_{E,it}) + \gamma_{yK} \ln Y_{it} + \varepsilon_{Kit} \\
 S_{Lit} &= \beta_L + \delta_{KL} \ln(p_K/p_{E,it}) + \delta_{LL} \ln(p_L/p_{E,it}) + \gamma_{yL} \ln Y_{it} + \varepsilon_{Lit} \\
 i &= 1, \dots, 9 \text{ or } 10 \quad t = 1, \dots, 11
 \end{aligned} \tag{2}$$

where *i* denotes the insurer, and *t*, the year. *C* and *Y* indicate the total cost and the surplus, respectively. *S<sub>K</sub>* and *S<sub>L</sub>* denote the cost shares of PK and PL, respectively. The model is based on the seemingly unrelated regression (SUR) model and follows the maximum likelihood procedure. The share equation of *S<sub>e</sub>*, i.e. the cost share of PE, is cut out by dividing PK and PL by PE since the total value of the three cost shares equals to 1. *D* is a dummy variable measuring the cost-inefficiency by insurer, and *T* is a dummy variable measuring the inefficiency by year. The consistency of the estimate can be derived only when the inefficiency and explanatory variables are mutually independent. However, as Yoneyama and Miyashita (1999) demonstrated, the technical inefficiency was found to be correlated with explanatory variables for life insurers<sup>10)</sup>. Considering the possibility of a similar tendency for non-life insurers, we construct the fixed effect model representing the cost-inefficiency by these two dummy variables. From these dummy variables of *D* and *T*, 9 or 10<sup>11)</sup> and 11 inefficiency values are derived, respectively. In order to determine the inefficiency values of 9 and 10 insurers for 11 years, i.e. 99 and 110 values, we add up the values from these two variables for all 99 and 110 combinations of insurers and years. The smaller the value derived from the fixed effect model, the higher cost-efficiency the insurer achieves.

### Step2: Cost-Inefficiency Ranking

The calibrations to derive 99 and 110 inefficiency values lead to inappropriateness in using the inefficiency values directly for the quantitative analyses. We, thus, convert these values into ranking data by eliminating the decimals of the cost-inefficiency values. Using ranking data instead of directly using the inefficiency values creates the possibility of employing the ordered probability model. Assuming the normal distribution, we construct the following model based on the ordered probit model which is one of the sub-models of the ordered probability model.

10) Yoneyama and Miyashita (1999).

11) We categorize the subject insurers in two groups, as mentioned in the next section. Group A consists of nine relatively larger insurers, and Group B consists of ten smaller insurers.

$$\begin{aligned}
Y_{it}^* &= \beta' x_{it} + u_{it} \\
Y_{it} &= 0 \text{ if } Y_{it}^* \leq \mu_0 \\
&1 \text{ if } \mu_0 < Y_{it}^* \leq \mu_1 \\
&2 \text{ if } \mu_1 < Y_{it}^* \leq \mu_2 \\
&\dots \\
&J \text{ if } \mu_{J-1} < Y_{it}^*, i=1,2,\dots,n
\end{aligned} \tag{3}$$

where  $Y_{it}^*$  denotes a dependent variable that is not observed, and  $Y_{it}$  denotes an observed variable.  $\beta' = (\beta_1, \beta_2, \beta_3, \dots, \beta_k)$  is an unknown parameter vector,  $x_i$  is a vector of the explanatory variable, and  $u_{it}$  is an error term<sup>12)</sup>:  $E(u_{it}) = 0$  and  $E(u_{it}^2) = \sigma^2$ .

The estimation was conducted based on the maximum likelihood procedure. Probability values input into the log likelihood function are as follows:

$$\begin{aligned}
\text{Prob}(Y_{it} = 0) &= \Phi(-\beta' x_{it}) \\
\text{Prob}(Y_{it} = 1) &= \Phi(\mu_1 - \beta' x_{it}) - \Phi(-\beta' x_{it}) \\
\text{Prob}(Y_{it} = 2) &= \Phi(\mu_2 - \beta' x_{it}) - \Phi(\mu_1 - \beta' x_{it}) \\
&\dots \\
\text{Prob}(Y_{it} = J) &= 1 - \Phi(\mu_{J-1} - \beta' x_{it})
\end{aligned} \tag{4}$$

where  $\Phi$  denotes the cumulative distribution function.

In order for all probability values to be positive, the following restriction is placed.

$$0 < \mu_1 < \mu_2 < \dots < \mu_{J-1} \tag{5}$$

The algorithm to derive the maximum likelihood estimator is Davidon/Fletcher/Powell (DFP). The initial value is given by the least-squares method or the generalized least-squares method, depending on the form of the data.

Then, the effects of the change of explanatory variables on probability after estimations are measured by the marginal effects that are represented accordingly:

12) When the distribution of the error term is logistic, the model is an ordered logit model, and if its distribution is normal, the model is an ordered probit model.

$$\partial \text{Prob}(Y_{it}=j) / \partial \mathbf{x}_{it} = [f(\mu_{j+1} - \beta' \mathbf{x}_{it}) - f(\mu_j - \beta' \mathbf{x}_{it})] \beta \quad (6)$$

where  $f(\mu_{j+1} - \beta' \mathbf{x}_{it})$  or  $f(\mu_j - \beta' \mathbf{x}_{it})$  denotes the standard normal density function or standard logistic density function<sup>13)</sup>.

Regarding  $Y_{it}$  in Formula (3) as ranking variables,  $\mu_0$  is set at zero, and the model is transformed as follows:

$$\begin{aligned} Y_{it} &= 0 \text{ if } Y_{it}^* \leq 0 \\ &1 \text{ if } 0 < Y_{it}^* \leq \mu_1 \\ &2 \text{ if } \mu_1 < Y_{it}^* \leq \mu_2 \\ &\dots \\ &8 \text{ or } 9 \text{ if } \mu_7 \text{ or } \mu_8 < Y_{it}^* \end{aligned} \quad (7)$$

The ranks extend from 0 to 8 or 9<sup>14)</sup>; the smaller the ranking, the more cost-efficient the insurer. The estimation begins with the least-squares method, and the estimated value is obtained and input into the maximum likelihood estimation method.

### 3.2. Explanatory Variables

We conduct the estimates based on explanatory variables representing insurers' distributing and marketing strategies including composition ratios of net premium income of four major lines of insurance, agency commission ratios and personnel expenses ratios described below.

1. Composition Ratio of CALI
2. Composition Ratio of Automobile Insurance
3. Composition Ratio of Fire Insurance
4. Composition Ratio of Personal Accident Insurance
5. Agency Commission Ratio
6. Personnel Expenses Ratio

13) As observed in Formula (6), the marginal effect depends on the value of parameter vector. Thus, it is not necessarily the case that the marginal effect definitely represents the probability change.

14) For the analysis on Group A consisting of nine insurers, the ranks extend from 0 to 8. For the analysis on Group B consisting of ten insurers, the ranks are from 0 to 9.

Composition ratios, i.e. the proportions of an insurer's premiums income for four major lines of insurance are calculated based on the net premiums income of each line of insurance divided by the total number across all lines of individual insurers. Agency commission ratios are calculated by dividing the agency commission by the net premiums income. Personnel expenses ratios are calculated by dividing the personnel expenses by the net premiums income<sup>15)</sup>.

### 3.3 Data

We construct panel data based on the underwriting and financial data of 19 non-life insurers operating in the Japanese market from fiscal year 1996 to 2006. Due to significant market consolidations after 2000, many of non-life insurers merged into single entities. Their past figures are added up according to their present entities, and are regarded as those for single insurers<sup>16)</sup>. We then divide the subject insurers into two groups, Group A and Group B, according to the difference in their underwriting and distribution strategies, expecting different tendencies between these two groups. Group A consists of nine relatively larger domestic insurers with long operating history from the pre World War II era. Such insurers, in common, hold diversified business portfolio by underwriting a variety of insurance lines and operating nationwide. They also utilize agency channel rather than the direct response approach, as mentioned earlier. Group B, on the other hand, consist of ten relatively smaller insurers including foreign-based companies with shorter operating history in the Japanese market, niche underwriters specializing in certain lines of business or in certain regions, life insurers' subsidiaries having entered after the deregulation, and new entrants from other industry segments. Many of these insurers employ the direct response scheme. Insurers comprising each group are as follows.

#### Group A:

1. Tokio Marine & Nichido Fire Insurance, 2. Sompo Japan Insurance, 3. Mitsui Sumitomo Insurance,

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15) The savings portion of premiums of savings-type fire insurance policies is excluded from net premiums income of fire insurance in order to eradicate overvaluation. For the same purpose, net premiums income of automobile insurance and personal accident insurance include premiums of non savings-type policies only.

16) Aioi Insurance was formed by the merger of Dai-Tokyo Fire & Marine and Chiyoda Fire & Marine in April, 2001. Nipponkoa Insurance started after the merger of Nippon Fire & Marine and Koa Fire & Marine in April, 2001. Taiyo Fire & Marine joined this company in April, 2002. Nissay Dowa General Insurance was formed by the merger of Dowa Fire & Marine and Nissay General Insurance in April, 2001. Mitsui Sumitomo Insurance was built by the merger of Mitsui Marine & Fire and Sumitomo Marine & Fire in October, 2001. Sompo Japan Insurance started in July, 2002 after the merger of Yasuda Fire & Marine and Nissan Fire & Marine, and the company acquired Taisei Fire & Marine subsequently in December of the same year. Antecedent to that, Yasuda had merged with Daich Property & Casualty in April of the same year. Tokio Marine & Nichido Fire started after the merger of Tokio Marine & Fire and Nichido Fire & Marine in October, 2004.



4. Nipponkoa Insurance, 5. Nissay Dowa General Insurance, 6. Aioi Insurance, 7. Nisshin Fire & Marine Insurance, 8. Fuji Fire & Marine Insurance, and 9. Kyoei Fire & Marine Insurance

**Group B:**

1. Asahi Fire & Marine Insurance, 2. Secom General Insurance, 3. Daido Fire & Marine Insurance, 4. Saison Automobile & Fire Insurance, 5. JI Accident & Fire Insurance, 6. Allianz Fire & Marine Insurance, 7. Hitachi Capital Insurance, 8. Ace Insurance, 9. Sumi-Sei General Insurance, and 10. Meiji Yasuda General Insurance

**4. Results**

**4.1. Analysis on Group A**

First, we obtained the results from the data of Group A as shown on Table 1.

Table 1. Outputs from the Data of Group A

Variable	Coefficient	Standard Error	t-Value	P-Value	Mean
Constant	-11.5881632	2.31859134	-2.806	.0022	
CR*-CALI	19.4673189	4.11549389	3.277	.0001	.14079650
CR-Auto	2.55352810	2.83961390	1.831	.0013	.48108543
CR-Fire	32.1954821	6.42280375	7.509	.0000	.16350751
CR-PA**	13.6465131	8.60314462	1.813	.0004	.08062227
Personnel***	.04911622	10.0193183	-.211	.0010	12.2774040
Agency****	-2.69408405	4.75091997	.086	.0935	15.5331672

Summary of Marginal Effects for the Ordered Probability Model (Probit)

Variable	Y=00 Y=06	Y=01 Y=07	Y=02 Y=08	Y=03	Y=04	Y=05
CR-CALI	-1.5473 .3468	-1.4034 1.8032	-.3638 1.108	-.0008	.0049	.0523
CR-Auto	-1.5282 1.0807	-1.1548 -.2782	.0415 -.5743	.2026	.8504	1.3604
CR-Fire	-2.1005 1.7996	-1.9194 .0014	.0052 -.0103	.0781	.2048	1.9412
CR-PA	-1.3695 .8948	-.7945 .4077	-.6008 .0036	.0704	.4142	.9742
Personnel	-2.009 .4258	.0021 .0106	.1116 -1.3843	.2132	.3414	.4805
Agency	-.2928 .4696	-.1816 -.5613	.0913 -.2399	.2260	.0735	.4152

\* "CR" denotes the composition ratio of each line of insurance.

\*\* "PA" denotes personal accident insurance.

\*\*\* "Personnel" denotes the personnel expenses ratio.

\*\*\*\* "Agency" denotes the agency commission ratio.

Inverse relationships exist between the values of the coefficients of the explanatory variables and the efficiency performance of insurers. Thus, an increase in the ranking number implies deterioration of efficiency, i.e., if the coefficient of a certain variable has a positive value, the insurers' efficiency decreases as the variable increases, and vice-versa.

From the outputs tabled above, we mainly found the following:

1. Negative relationships exist between the composition ratios of four lines of insurance and the efficiency.
2. Personnel expense ratios appear not to affect on the efficiency performance.
3. No significance is observed between agency commission ratios and insurers' efficiency.

The marginal effect indicates the effect of the change of explanatory variables on the probability after the estimation, and it is also mentioned in Table 1. Negative values are observed in ranks 0 and 1 for the four lines of insurance, which implies the probability of being ranked at 0 or 1 declines when the composition ratio of any of the four lines of business is higher. Moreover, the positive values observed for greater ranking numbers imply that the probability of being ranked at such numbers increases when an insurer has a higher composition ratio of each line of insurance. These observations in marginal effects are well accorded with the first observation mentioned above.

There were no significant relationships observed between the efficiency performance and personnel expense ratios, which implies that the amount of personnel expenses to premium earned does not affect on the cost efficiency for insurers of Group A.

Moreover, no significant relationship exists between agency commission ratios and the efficiency. The efficiency performance of insurers of Group A does not depend on whether they utilize the agency channel or other distribution schemes.

#### 4.2. Analysis on Group B

We then conducted analyses on the Group B insurers and obtained the outputs presented below.

Table 2. Outputs from the Data of Group B

Variable	Coefficient	Standard Error	t-Value	P-Value	Mean
Constant	-6.57350766	1.79330188	-2.112	.0028	
CR-CALI	-5.55681197	1.69471212	-.074	.6487	.04283538
CR-Auto	-5.24518325	1.68455150	.135	.7472	.33325676
CR-Fire	-6.09342721	2.07482175	-6.254	.0000	.17787996
CR-PA	-4.12751681	1.31863362	.655	.4683	.30111194
Personnel	5.09176722	4.82346813	3.279	.0002	19.2802858
Agency	3.81067059	.04365822	.677	.9735	15.5362995

Summary of Marginal Effects for the Ordered Probability Model (Probit)

Variable	Y=00	Y=01	Y=02	Y=03	Y=04	Y=05
	Y=06	Y=07	Y=08	Y=09		
CR-CALI	-2.357	-1.6705	-1.2002	.0409	.4504	1.4608
	2.1681	1.0745	.0344	-.0014		
CR-Auto	4.2219	2.9423	-4.5162	-4.8316	-.2571	1.3687
	1.0705	.0104	-.0001	-.0087		
CR-Fire	-4.1056	-3.0164	-1.0559	.0761	1.2058	2.8095
	3.0576	1.0103	.0276	-.0089		
CR-PA	.0006	.0532	.0182	-.0495	-.025	-.0127
	-.0058	.0029	.008	.0101		
Personnel	.0209	.0003	-.0508	-.2148	-.5024	-.0031
	.0794	.1305	.2185	.3216		
Agency	-3.4216	-2.6436	-1.341	-.2346	.0669	.4135
	1.2621	1.5625	2.5113	1.8246		

From the outputs tabled above, we mainly found the following:

1. Composition ratios of CALI, automobile and personal accident insurances appear not to affect on the efficiency.
2. There is a negative relationship between the composition ratio of fire insurance and the efficiency.
3. Insurers appear to have higher efficiency when they have lower personnel expenses ratios.
4. No significance is observed between agency commission ratios and the efficiency performance.

In contrast with the outputs from Group A, composition ratios of CALI, automobile and personal accident insurances appear not to influence on the efficiency performance for insurers of Group B, as indicated by the first observation. This implies insurers with smaller size may not be able to ameliorate their efficiency by diversifying their business portfolios for these lines of insurance.

The second observation denotes that larger composition ratios of fire insurance negatively contribute

to the efficiency of this group of insurers. This is supported by the negative value of the marginal effect at ranks 0, 1 and 2 of fire insurance. Exposure units of fire insurance are relatively large due to the nature of this line of insurance, especially for commercial properties. In addition, each exposure unit is less independent since fire insurance policies generally cover losses from natural catastrophes including flood and typhoon. Active investments into this line of insurance may expose insurers of Group B to higher parameter uncertainty, which results in them possessing less capacity to earn surplus<sup>17)</sup>.

The third observation implies that Group B insurers may improve their cost efficiency by lowering personnel costs which have no influence on larger insurers.

The utilization of agency channel appears to have no relationship to the efficiency performance also for smaller insurers.

## 5. Summary and Conclusion

This study investigates the relationship between non-life insurers' selection of underwriting and distribution strategies and their efficiency performance in the Japanese market after the deregulation in 1996. We utilize the ordered probability model and choose the ranking number of efficiency as the independent variable and composition ratios of four major lines of insurance: CALL, automobile, fire and personal accident insurances; the agency commission ratios; and the personnel expenses ratios as explanatory variables.

Insurers under this study are categorized into two groups: Group A and Group B. Group A consists of nine domestic insurers who are relatively large in size with long operating history, hold diversified business portfolio by underwriting a variety of insurance lines, operate nationwide, and maintain relationships with insurance agencies even after the deregulation. Tokio Marine & Nichido Fire Insurance, Sompo Japan Insurance and Mitsui Sumitomo Insurance are the examples of this type of insurers. Group B includes insurers specializing in certain lines or in certain regions such as Daido Fire & Marine concentrating on Okinawa Prefecture, and JI Accident & Fire focusing on the personal accident insurance, as well as foreign-based insurers, life insurers' subsidiaries and new entrants from other industry segments such as Saison Automobile & Fire, Ace and Sumi-Sei General. Many of these insurers actively take the direct response approach. We expected to observe that the efficiency level itself would vary among individual insurers with different underwriting and distribution strategies, and that different factors/variables would affect their cost efficiency. Results of the analyses are summarized as the following Table 3.

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17) In addition, after the 1990s, the industry has repeatedly suffered from enormous losses caused by natural catastrophes, and this unfavorable environment may also exaggerate this tendency.

Table 3. Summary of the Results

Variables	Group A	Group B
Composition Ratio of Compulsory Auto	(-)*	
Composition Ratio of Auto	(-)	
Composition Ratio of Fire	(-)	(-)
Composition Ratio of Personal Accident	(-)	
Personnel Expenses Ratio		(-)
Agency Commissions Ratio		

\* Negative signs denote the existence of negative relationships between the efficiency and the variables.

From the results of the analysis on Group A consisting of relatively larger domestic insurers, we observed negative relationships between the composition ratio of each line of insurance and their efficiency. No significant relationship was observed between the efficiency performance and agency commission ratios. These findings imply that larger insurers can successfully ameliorate their efficiency performance by well diversifying their business portfolios, whereas they may undermine their efficiency by taking specializing strategies in the deregulated Japanese market. The selection of distribution channels does not significantly affect on the efficiency of this group of insurers.

The analysis on Group B consisting of relatively smaller insurers reveals that there are no significant relationships between the efficiency performance and composition ratios of CALI, automobile and personal accident insurances, but insurers with higher composition ratios of fire business tend to have poorer efficiency performance. We observed negative relationships between personnel expense ratios and efficiency. From these observations, we can suggest that, being different from Group A, the strategy to underwrite diversified portfolio does not necessarily contribute to the efficiency for this group of insurers, but they should not concentrate on the fire insurance business. Contrary to our expectations, utilization of agency channel does not influence on the efficiency, but the reduction of personnel expenses ratios may contribute to the efficiency performance more remarkably for insurers in Group B than those in Group A.

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## 損害保険企業の効率性とアンダーライティングおよび販売戦略

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### 要 旨

本研究は、損害保険企業のアンダーライティングおよび販売に関する戦略の違いが、その費用効率性にどのような影響を及ぼすのかを検証することを目的とする。1996年以降、わが国の損害保険市場は抜本的な規制緩和を経験し、それまで企業間で大きな違いがなかったアンダーライティング・販売戦略が多様化した。損害保険企業にとって重要であるこれらの戦略が、費用効率性に及ぼす影響を明らかにするために、わが国において損害保険事業を行う保険企業19社の1996年度から直近2006年度までの財務データを用い、パネルデータを構築した。分析にあたっては、オーダード・プロバビリティ・モデルを用いた。そのなかで、フィクスト・エフェクト・モデルにより費用効率性ランキングを導出し、これを被説明変数とした。説明変数には、アンダーライティング・販売戦略の違いを代理すると考えられる主要保険種目別保険料構成比、保険代理店手数料率および人件費率を含めた。検証の結果、費用効率性に影響を及ぼす要素が、保険企業の規模によって異なることが明らかとなった。すなわち、収入保険料規模が比較的大きく、規制緩和以前から長期にわたって事業を継続している国内保険企業は、特定の保険種目の保険料構成比が拡大すれば、費用効率性が低下する傾向が見られた。いっぽう、このような傾向は、新規参入者、ニッチ・アンダーライターおよび外国保険企業を含む比較的小規模の保険企業については、火災保険を除いて観測されなかった。しかし、これらの保険企業にとっては、人件費率の上昇が、費用効率性を損なうことがわかった。