〔論　　　　文〕

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Competition in the Japanese Life Insurance Industry*

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This paper examines the change that has taken place in the level of competition in the Japanese life insurance industry over the period of 1986-2002. In order to obtain the degree of noncompetition and collusion, we estimated the first-order condition for profit-maximizing insurance oligopolies. The estimation results suggested the following: (1) Not only stock companies but also mutual companies maximize their own profits rather than pay out dividends to policyholders; (2) competition has increased since 1995; (3) competition was promoted by the revision of the Insurance Business Law and the failures of the insurance companies; and (4) in the recent years, competition has been more lax than in the prewar period. The results suggest that it is preferable to further promote this deregulation in order to increase the benefits of increased competition.

1 Introduction

This paper aims to examine whether or not the Japanese life insurance industry has become more competitive during the period of 1986-2002.[1)] Perfect competition yields a market structure outcome that maximizes social welfare, while imperfect competition yields social welfare loss. Thus, it would appear that the deregulation that promotes competition results in an improvement of social welfare. However, the financial liberalization introduced in the 1970s has not resulted in an increased competition in the traditional banking, securities, and insurance industries (see Ikeo, 1995; Horiuchi, 1999). In particular, liberalization in the insurance industry is lagging behind that of the other financial industries. As a result, the level of competition and the economic efficiency of the life insurance industry have been considered low.[2)]

The Insurance Business Law was passed in 1995 and went into effect in 1996.[3)] This resulted in the formation of 11 life insurance subsidiaries of nonlife insurance companies. The number

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1) Note that in Japan, separate companies execute nonlife and life insurance businesses.

2) Chuma et al. (1993) examined the technical efficiency of Japanese life insurance companies. They reported that efficiency differs substantially between insurance companies and that it does not depend on the form of the company, i.e., whether it is a mutual or stock company.

3) For more details about this topic, see Yamori and Okada (2007).

of life insurance companies increased immediately from 29 to 41. In November of the same year, Prime Minister Hashimoto declared the commencement of the Financial Big Bang, and in June 1997, the Insurance Council submitted a report that outlined the anticipated schedule of liberalization for the following four years. Although there is debate as to whether the pace of the scheduled liberalization was sufficiently quick, such a movement toward liberalization unambiguously suggests that competition in the life insurance industry is improving. This paper attempts to confirm this suggestion.

With regard to the competitiveness in the Japanese life insurance industry, Tsutsui (1990) examined the change that occurred in the competition in the industry from the end of the Second World War till 1986, using the industrial organization concepts of market structure and market performance. He concluded that the change in the market structure and performance since 1980 suggested an increase in competition. It is possible that changes in the level of competition in more recent years have been more prominent.

This paper adopts an approach that is more theoretical than that of Tsutsui (1990) and directly estimates the degree of competition. Utilizing the regression equations with panel data from 1986 to 2002, we clearly establish that there has been a change in the degree of competition during the abovementioned period. One of the advantages of the estimation method used in this paper is that by using panel data, the estimates of the degree of competition for each year can be obtained. This enables an investigation of the short-term changes that occurred in the degree of competition.[4] On the other hand, the method proposed by Bresnahan (1982) and Lau (1982) reveals only the average degree of competition for a long period because it uses aggregated time series data.

In addition to measuring the degree of competition after 1986, we examine whether the aim of the mutual insurance companies differs from that of stock insurance ones. Furthermore, we analyze the competition before the Second World War in order to evaluate the current competition based on comparison.[5]

The remainder of this paper is organized in the following manner. Section 2 summarizes the recent status of the Japanese life insurance industry. In section 3, we derive the regression equations to clarify the behavior of mutual and stock companies and to estimate the degree of competition. The estimation results are presented in section 4. Finally, the concluding remarks are provided in section 5.

2 Japanese Life Insurance Industry from 1986 to 2002

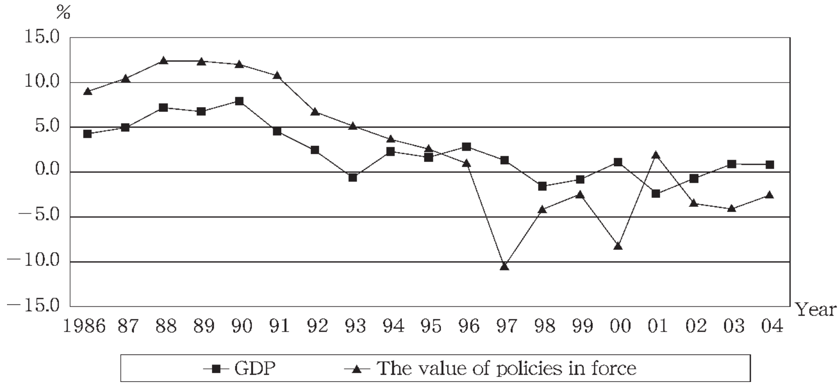
2.1 Life insurance business during the bubble economy and the Heisei depression

The period from 1986 to 2002 —— analyzed in this paper —— extends over the period of the

4) The method of Panzar and Rosse (1987) enables us to estimate the degree of competition for each year. However, it requires data on input prices for each insurance firm, which is not available to us.

5) Especially before the 1920s, competition among firms was very severe through virtually no entry regulation, rising of dividend rates, and various sales channels such as insurance agency, field salesperson, and business trip with in-house doctor. Moreover, there were even hostile takeovers through share purchase (see Yoneyama, 1997 ; Tsutsui et al., 2004).

Figure 1 The GDP Growth Rate and the Growth Rate of the Value of Policies in Force in the Life Insurance Industry



Source: NIKKEI NEEDS Macro data file for the nominal GDP growth rate and *Statistics of Life Insurance Business in Japan* for the growth rate of the value of policies in force.

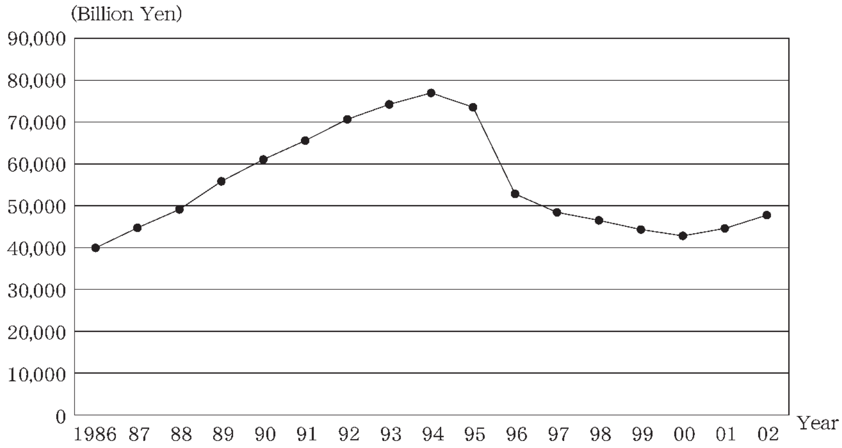
bubble economy and the long stagnation. The purpose of this analysis is to evaluate (1) the extent to which liberalization proceeded during these 17 years and (2) how the noncompetitive situation, which was dominant throughout the postwar period, changed. It should be noted that the dramatic shifts in the Japanese business conditions over these 17 years, in fact, do not conceal a long-term structural change, if such a change exists.

In the late 1980s, the Japanese economy enjoyed a boom, the so-called "bubble economy." However, after the stock price bubble burst in 1990 and the land price bubble burst in 1991, the Japanese economy fell into a long period of stagnation known as the "Heisei depression." In Figure 1, we illustrate the nominal GDP growth rate and the growth rate of the value of policies in force in the entire life insurance industry. The GDP growth rate has been close to zero since 1992. While it rose temporarily in 1995 and 1996, it fell to a negative figure in 1998 and remained in the negative thereafter, with the exception of the year 2000. Figure 1 shows that the contrast between the boom in the late 1980s and the depression in the 1990s is even more pronounced in the life insurance industry. Specifically, while the annual growth rate of the value of policies in force was over 10% in the late 1980s, it declined and reached −10% in 1997 and remained in the negative in the consecutive years, with the exception of 2001.

In Figure 2, we illustrate the value of policies in force per firm in the life insurance industry between 1986 and 2002. This index maintained an upward trend and doubled between 1986 and 1994, and then it started to decrease. It fell sharply in 1996 when extensive new entry occurred, and then it shows a slight decline until 2000 mainly because of a decrease in the value of policies in force. And a slight increase in 2001 and 2002 is mainly due to a temporary increase in the value of policies in force and a decrease in the number of companies because of some mergers, respectively. As a result, the value of policies in force per firm in recent years was almost at the same level as that which existed from 1986 to 1988, which was almost half compared with its peak level in 1994.

Reflecting these severe business conditions, several insurance companies, including medium-sized ones such as Nissan, Toho, Daihyaku, Taisho, Chiyoda, Kyoei, and Tokyo Life, went

Figure 2 The value of Policies in Force per Firm in the Life Insurance Industry



Source: *Statistics of Life Insurance Business in Japan.*

bankrupt during the fiscal years 1997–2000.

2.2 New entry and exit

The original Insurance Business Law was established in 1939 and remained intact throughout the postwar period.[6] This enactment was the final step in the transition to a system in which premium rates, dividend rates, and solicitations were regulated. The entry of new firms was strictly regulated following the Second World War, leading to the maintenance of the so-called "20 firms system." Indeed, no new entry was allowed until December 1975, when Seibu-All State obtained a business license (see Iguchi, 1996). The revision of the Law in 1996 was aimed at keeping pace with an expected transition from the regulated system to a liberalized one.

In the postwar period, financial institutions, banking, securities, and insurance companies, were segregated from one another. Although in 1993 banks and securities companies were allowed to enter into each other's domain by creating subsidiaries, the insurance sector remained isolated from the other industries. Deposit interest rates were thoroughly deregulated in 1993 and 1994, and the trade commissions for stocks trading were deregulated in 1998 and 1999. However, the rates of nonlife insurances were not deregulated until 1998,[7] and the premium and dividend rates of the life insurance industry remained under the control of the authorities. Essentially, the insurance industry remained unaffected by the financial liberalization of the 1980s and 1990s; hence, it has remained uncompetitive.

The most remarkable change in the life insurance industry resulted from the revision of the

6) Japan's first Insurance Business Law went into effect in 1900 to cope with illicit activities and financial difficulties in the industry, and the authority made it a principle to grant a virtually-unlimited license to insure, which lacked distinct regulation of authority. However, going on a war footing, authorities began to permit the change from competition to co-operative system. In 1939, it was completely revised, and authority had general and extensive regulatory power (see Yoneyama, 1997 ; Tsutsui et al., 2004).

7) An automobile insurance with differentiated premium rates was approved in 1997. Further, the obligation for members to use the premium rates calculated by the rating organizations was abolished in 1998, with a 2-years probation period.

Insurance Business Law. The new law permitted mutual entry between life and nonlife companies through the establishment of subsidiaries.[8] And the merger of the parent nonlife insurance companies led to the merger of their life insurance subsidiaries.[9]

In sum, between 1975 and 2002, more than 20 new firms entered the market and seven firms exited it. These changes resulted in an increase in the number of life insurance companies from 1975 to 1999; however, this number decreased from 1999 to 2002. In view of these new entrants, the following question arises: Does this change in the number of firms reflect a change in the level of competition in the life insurance industry?

2.3 SCP hypothesis or ES hypothesis?

According to the market structure—conduct—performance (SCP) hypothesis, if the market concentration decreases as the result of a new entry, the degree of competition should increase. This hypothesis predicts that the more concentrated the market, the less competitive it becomes. So, higher concentration tends to lead to more undesirable market performance such as larger profits and higher prices (Gilbert, 1984; Freixas and Rochet, 1997). Therefore, let us investigate the manner in which the market concentration changed during the 17-year period. In order to do so, we use the Herfindahl index, taking the premiums as a proxy for firm size.[10] The index decreases from 0.11 to 0.10 during the 1986-1989 period, albeit only slightly. Unexpectedly, although extensive new entry occurred in 1996, the Herfindahl index increases only after 1996 and reaches a peak of 0.12 in 2000. Thus, there is no evidence that the market concentration decreased substantially in this period.

If we were to rely upon the standard SCP hypothesis, the increase in the Herfindahl index after 1996 suggests a decrease in the degree of competition, so that it seems to contradict the large number of new entrants in 1996, which suggests an improvement in the level of competition. The efficiency—structure (ES) hypothesis proposed by Demsetz (1973), as is often used as an alternative hypothesis to the SCP hypothesis, on the other hand, predicts that more efficient companies will have lower costs, enabling them to better compete and increase their market shares, which may in turn increase market concentration. That is, concentrated market arises as a result of efficient firms gaining larger market share through competition.[11] Hence, under this hypothesis, an increase in the Herfindahl index from the latter half of the 1990s is caused by an increase in competition. As two hypotheses have different implications about an increase in market concentration, we conducted a regression analysis to determine which

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8) After the new Insurance Business Law was enacted in 1996, there were some deregulations. The life insurance companies as well as the nonlife companies were permitted to enter into the third sector of insurance —— represented by medical and personal accident insurance —— from 2001, although foreign-affiliated and small and medium-sized firms had been already permitted. Moreover, over-the-counter sale of insurance products at banks was permitted in 2001.

9) For example, in April 2001, Nippon Fire Partner Life and Koa Life merged into Nipponkoa Life, and Chiyoda-Kasai-Ebisu Life and Dai-Tokyo Happy Life merged into Aioi Life. Mitsui Mirai Life and Sumitomo Yu-Yu Life merged into Mitsui Sumitomo Kaijo Life in October 2001.

10) Herfindahl index is defined as the sum of the squares of the market shares of each firm within the industry. The value ranges from 0 to 1. If a single firm monopolizes the market, this value equals one. Meanwhile, lower values mean lower concentration.

11) As for an explanation of ES hypothesis in a textbook, see e.g. Martin (1993).

scenario is really the case in section 4.4.

3 Model

3.1 Basic model

In this section, we derive a model to estimate the degree of competition.[12] First, let us introduce the variables used in this paper. $q_{i,t}$ is the value of the policies in force, $Q_t \equiv \sum_{i=1}^{N} q_{i,t}$, $I_{i,t}$ is the premium income, $Z_{i,t}$ represents the claims paid, $D_{i,t}$ represents the dividends paid, $A_{i,t}$ is the outstanding assets, $r_{i,t}$ represents the yields of assets, P_t is the net premium, and $C_{i,t}$ is the operating costs. Subscripts i and t represent firm i and period t. Subsequently, we define the profits $\pi_{i,t}$ of firm i at period t as

$$\pi_{i,t} = P_t(Q_t)\, q_{i,t} - C_{i,t}(q_{i,t}) + r_{i,t} A_{i,t} - \Delta RSV_{i,t}, \tag{1}$$

where $P_t(Q_t) = \dfrac{I_{i,t} - Z_{i,t} - D_{i,t}}{q_{i,t}}$ is the inverse demand function for life insurance, $C_{i,t}(q_{i,t})$ is the cost function of firm i, and $\Delta RSV_{i,t}$ represents the change in the reserve of firm i.[13] Here, we assume that policyholders regard the amount of the difference between the total amount paid to insurer and the total amount received from insurer as the price of a policy and that the dividends and the mean of claims to be paid are known to the policyholders.[14]

The insurance company i is supposed to choose $q_{i,t}$ to maximize the profits, given $A_{i,t}$, $r_{i,t}$, and $\Delta RSV_{i,t}$.[15] From the first-order condition of the profit maximization, we obtain the following:[16]

$$R_{i,t} = MC_{i,t} q_{i,t} + \frac{\mu_t}{\eta_t} R_{i,t} MS_{i,t}, \tag{2}$$

where $MC_{i,t} \equiv \dfrac{\partial C_{i,t}}{\partial q_{i,t}}$ is the marginal cost, $\eta_t \equiv -\dfrac{P_t}{Q_t}\dfrac{dQ_t}{dP_t}$ is the price elasticity, $MS_{i,t} \equiv \dfrac{q_{i,t}}{Q_t}$ is the market share of a firm, and $R_{i,t} \equiv P_t q_{i,t} = I_{i,t} - Z_{i,t} - D_{i,t}$.[17] Following Bresnahan (1989), $\mu_{i,t} \equiv \dfrac{\partial Q_t}{\partial q_{i,t}}$ is assumed to be common for all firms and is denoted as μ_t. We introduce a new index, $\lambda_t \equiv \dfrac{q}{Q}\dfrac{\partial Q}{\partial q}$, which is an elasticity associated with μ_t, and therefore convenient for an evaluation of the magnitude. Note that $\lambda_t = \mu_t \overline{MS} = \mu_t / n_t$, where $\overline{MS_t}$ and n denote average market share and the number of firms at period t, respectively. $\lambda_t = 0$ corresponds to perfect competition and $\lambda_t = 0$, to a monopoly. In Cournot competition, $\lambda_t = 1/n$ (Bresnahan, 1982). Thus, our final goal

12) For a survey of empirical studies on the degree of competition, see Martin (1993) and Bresnahan (1989).

13) The change in the reserve corresponds to the provision for policy reserves, which is an item of ordinary expenses. Although the change in the reserve leaves money to the insurer in this period, we assume that equal sum of money will be paid out to policyholders.

14) In reality, dividends and claims will be paid in future periods. In our one-period analysis, this aspect is disregarded.

15) Mutual insurance companies might follow other purposes, which will be analyzed in section 4.1.

16) We assume that profits gained at period t are added into assets and are invested at period $t+1$.

17) Here, subtracting claims paid in the definition of the revenue for insurance firms implies that, with this cost, the policyholders can buy a reduction of future income variation for their families.

is to estimate λ_t, which we name the degree of noncompetition.

Indeed, notwithstanding we derive equation (2) assuming quantity competition, λ_t in equation (2) can be interpreted from broader views including Bertrand competition, repeated games, and so on. In other words, various values of λ_t are considered to correspond to various equilibria (Bresnahan 1989). This interpretation is immune from the criticism that conjectural variation except for Cournot competition, $\lambda_t = 1/n$, does not constitute an equilibrium, and therefore should not be observed. For example, any values between 0 and 1 is supported by a repeated game whose one-shot game is perfect competition.

Data for $R_{i,t}$, $q_{i,t}$, and $MS_{i,t}$ are available, but the marginal cost, $MC_{i,t}$, is not. Thus, we need to estimate a cost function, of which we assume the translog type as follows.

$$\begin{aligned} \mathrm{In} C_{i,t} = {} & b_{0,t} + b_{0,i} + b_{1,i}\overline{\ln q_{i,t}} + b_2(\overline{\ln q_{i,t}})^2 + b_3 \ln w_t + b_4 \ln p_t + b_5(\ln w_t)^2 + b_6(\ln p_t)^2 \\ & + a_1 G_{i,t} + a_2 L_{i,t}, \end{aligned} \tag{3}$$

where w is the wage rate of the finance and insurance industries, p is the deflator of fixed capital formation,[18] and the variable with upper bar is the deviation from its mean.[19] As the data of w and p for each firm are not available, we use the industry's average value for them, which changes only over years. We allow for time-variant intercepts, $b_{0,t}$, firm-specific intercepts, $b_{0,i}$, and firm-specific slopes, $b_{1,i}$. The ratio of group insurance, $G_{i,t}$, and the ratio of saving insurance, $L_{i,t}$, are added to the cost function to eliminate the effect of the composition of various kinds of policies.[20] The expected signs of a_1 and a_2 are negative and positive, respectively.[21]

From the equation (3), the following marginal cost function is derived:

$$MC_{i,t} = \frac{C_{i,t}}{q_{i,t}}(b_{1,t} + 2b_2\overline{\ln q_{i,t}}). \tag{4}$$

Substituting this, we can rewrite equation (2) as follows:

$$R_{i,t} = b_{1,i}C_{i,t} + 2b_2\overline{\ln q_{i,t}}C_{i,t} + \gamma_t MS_{i,t}R_{i,t} + a_3 G_{i,t} + a_4 L_{i,t} + a_5 GDP_t + a_6 IBL_t, \tag{5}$$

where $\gamma_t \equiv \frac{\mu_t}{\eta_t}$, $b_{1,i}$, b_2, γ_t, a_3, a_4, a_5, and a_6 are unknown parameters to be estimated.

$G_{i,t}$ and $L_{i,t}$ are added to the equation to eliminate the effect of the composition of various kinds of policies. The annual GDP growth rate, GDP_t, is also added to control the effect of the business conditions. Another control variable used is a dummy variable for the Insurance Business Law, IBL_t, which takes the value of 0 from 1986 to 1995 and 1 from 1996 onward. The expected signs of a_5 and a_6 are positive and negative, respectively, because the revenues are expected to be higher in good business conditions and lower in a situation in which a new law

18) The fixed capital formation is defined as the formation of fixed assets of the whole economy that are used for production over one year.

19) Using the deviations from the means in the translog function is a convention to avoid possible multicolinearity.

20) Group insurance is that which is bought by a company or group whose constituent member is insured. Saving insurance is a savings-based program in which the insurance is paid on the condition that the insured will remain alive for a predetermined period.

21) Tsutsui et al. (1992) show that group insurance is cheaper than the other types of insurance by simplifying paperwork. Furthermore, Tsutsui et al. (1992) show that the cost of saving insurance is almost two-and-a-half times higher than that of insurance against a death or disease.

promoting free entry is enacted.[22] The signs of a_3 and a_4 are not known *a priori*.[23] We simultaneously estimate equations (3) and (5).

According to this estimation, while we obtain the estimate of $\gamma_t \equiv \frac{\mu_t}{\eta_t}$, μ_t and λ_t cannot be identified. In order to get the estimates of demand elasticity, η_t, we introduce the degree of collusion, which is explained in the next section.[24]

3.2 Degree of collusion

In addition to degree of competition, we introduce another concept of degree of collusion, putting a restriction on the conjectural variations (Clarke and Davies, 1982; Alley, 1993). The purpose of this analysis is two folds: the one is to get the estimate of the demand elasticity, η_t, which enables us to indentify the degree of non-competition, λ_t. However, the estimation of the degree of collusion *per se* has its original importance. Although the collusion and the non-competition are related each other via equation (6) as shown below, they are different concepts, so that they may show different outcomes.

Before proceeding to the introduction, let us justify the concept of collusion, even if it is based on conjectural variation. The concept of conjectural variation is popular in both applied theoretic and empirical industrial organization. Theorists of industrial organization, however, take a skeptical view of its *ad hoc* assumptions about the conduct of firms, its lack of a game-theoretical foundation, and the forcing of dynamics into an essentially static model in which the strategy space and time horizon of the underlying game are only loosely defined (Fellner, 1949; Friedman, 1983, p.110; and Tirole, 1989, pp.244–245). However, Dockner (1992), Cabral (1995), and Pfaffermayr (1999) showed that the concept of conjectural variation can be supported by a consistent theoretical foundation, if it is considered as a reduced form of a dynamic game.[25] Their findings can be employed to justify a static conjectural variations analysis for both modeling dynamic interactions and estimating the degree of oligopoly power. In accordance with this viewpoint, we believe that the use of the static model is rationalized by considering it as a reduced form of a dynamic game.

In order to derive the concept of collusion, we assume that when firm i increases its production by a certain rate, the other firms $j \neq i$ increase α times $(0 < \alpha_t < 1)$ of that rate.

22) As the dependent variable appears on the right-hand side, this is true if $\gamma_t MS_{i,t}$ is small.

23) An increase in the savings life insurance results in an increase in the premium income although it also leads to an increase in the amount of the policy paid; hence, the sign of a_4 cannot determined.

24) Another way to get η_t is to estimate the demand function for life insurance, as Uchida and Tsutsui (2005) did for Japanese banking industry. The reason why we do not follow them is that life insurance companies operate nationwide, so that each firm does not face different demand functions. Thus, it is impossible to estimate η_t annualy.

25) Using an infinite horizon adjustment cost model, Dockner (1992) demonstrated that any steady state closed-loop (subgame-perfect) equilibrium will coincide with static conjectural variation equilibrium with nonzero conjectures. Cabral (1995) proved that in linear oligopolies, and for an open set of values of the discount factor, there exists an exact correspondence between the conjectural variation solution and the solution of a quantity-setting repeated game with minimax punishments during T periods. Pfaffermayr (1999) followed the idea proposed by Cabral (1995) and demonstrated that the conjectural variation model can be interpreted as the joint-profit-maximizing steady-state, which is a reduced form of a price-setting supergame in a differentiated product market under optimal punishment strategies.

Thus, for all i and for all $j \neq i$

$$\frac{\partial q_{j,t}}{\partial q_{i,t}} = \alpha_t \frac{q_{j,t}}{q_{i,t}}. \tag{6}$$

In (6), if α_t equals unity, it implies that firm i predicts that the other firms will respond to an increase in its production in order to keep the share of every firm unchanged. Alternatively, if α_t equals zero, it suggests that firm i predicts that the other firms will not at all respond to its increase in production. This model corresponds to a cooperative game, in which α_t represents the degree of collusion. The former case is interpreted as perfect collusion and the latter corresponds to noncooperative Cournot competition.

Summing up (6) over all $j \neq i$ and assuming that $\mu_{i,t}$ is constant over i, we obtain the following:

$$\mu_t MS_{i,t} = \alpha_t + (1-\alpha_t) MS_{i,t}. \tag{7}$$

When $\alpha_t = 0$, $\lambda_t = 1/n_t$, corresponding to the case of Cournot competition, and when $\alpha_t = 1$, $\lambda_t = 1$, to the case of a monopoly. Substituting (7) into (5), we obtain the following:[26]

$$R_{i,t} = b_{1,i} C_{i,t} + 2b_2 \overline{\ln q_{i,t}} C_{i,t} + \frac{\alpha_t}{\eta_t} R_{i,t} + \frac{1-\alpha_t}{\eta_t} MS_{i,t} R_{i,t} + a_7 G_{i,t} + a_8 L_{i,t} + a_9 GDP_t + a_{10} IBL_t, \tag{8}$$

where $b_{1,i}$, b_2, α_t, η_t, a_7, a_8, a_9, and a_{10} are unknown parameters to be estimated. We simultaneously estimate equations (8) and (3). A merit of this estimation is that it is possible to obtain the degree of collusion and demand elasticity separately.

4 Estimation Results

4.1 Data

Our estimation period is from 1986 to 2002, and the samples are restricted to domestic corporations as defined by the Insurance Business Law. Data used for the estimation are $I_{i,t}$, $Z_{i,t}$, $D_{i,t}$, $q_{i,t}$, $C_{i,t}$, $G_{i,t}$, and $L_{i,t}$, taken from *Statistics of Life Insurance Business in Japan*, edited and published by the Insurance Research Institute, and w_t, p_t, and GDP_t, taken from the NIKKEI NEEDS Macro data file. Further, the fixed effects model is adopted in the analysis below because of the following two reasons. First, although we can control for insurance characteristics such as the ratio of group insurance $G_{i,t}$ and the ratio of saving insurance $L_{i,t}$, there are several other factors that are difficult to observe but can affect a life insurance's cost and revenues such as the ability of a CEO or an insurance salesperson. Since the insurance products were almost alike in Japan because of the regulation, the differences in revenues between companies are largely attributable to the differences in the insurance salesperson's ability or the related skill-training program. A fixed effects model can capture the unobserved heterogeneity in the firm-specific levels. Second, a fixed effects model always provides statistically consistent results although it may not be the most efficient model to run.

Table 1 provides the descriptive statistics for our analysis. Although this paper does not

26) Although the dependent variable appears on the right-hand side, this equation is valid because the sum of the coefficients of $MS_{i,t}R_{i,t}$ and $R_{i,t}$ are restricted to unity.

Table 1 Summary Statistics

Variable	Explanation	Mean	Standard deviation	Minimum	Maximum
q	Value of policies	53,672,857	89,274,241	1,458	458,589,493
I	Premium income	840,801	1,251,510	54	6,274,645
Z	Claim paid	243,801	391,979	0	2,450,697
C	Operating costs	65,783	117,924	0	770,666
D	Dividends paid	119,284	178,711	327	906,443
L	Ratio of saving insurance	0.272	0.155	0.000	0.766
G	Ratio of group insurance	0.018	0.065	0.000	0.554
GDP	Annual GDP growth rate	2.383	3.049	−2.433	7.834

Note: q, I, Z, C, and D are measured in one million yen. L and G are ratios. GDP is a percentage.

present yearly data to save space, the scale of the life insurance business fell dramatically in the latter half of the 1990s. For example, although the mean of both q and I increased by about 90% and 40%, respectively, from 1986 to 1994, these decreased by about 40% from 1994 to 2002. Further, L and G decreased as a general trend during the entire period.

4.2 Do mutual companies maximize profits or dividends?

A problem arises when we apply the models explained in the previous section to the life insurance industry in Japan. Since most of the life insurance companies in postwar Japan have been mutual companies,[27] one might question whether the models in the previous section that assume profit maximization apply to the reality.

On the other hand, although mutual companies legally issue no shares and are owned by policyholders, many people believe that mutual insurance companies are in fact not controlled by policyholders and that mutual companies behave no differently from stock companies (see Komiya, 1994). However, it is not yet clear whether or not mutual life insurance companies operate to the advantage of policyholders, or if they only seek profits. We will investigate which situation is closer to reality by making a comparison of the first order condition between the stock companies and mutual companies.

Two ownership structures —— mutual and stock —— coexist in the life insurance industry because life insurance began as mutual aid. Since the legal owners of mutual companies are policyholders, the dividends are not regarded as costs but represent the main objective that the companies should pursue. Thus, mutual insurance companies may maximize the surplus defined in equation (1) plus dividends.[28] In this case, assuming that dividends paid, $D_{i,t}$, is proportional to the values of the policies in force, $q_{i,t}$, the first order condition of maximizing $\pi_{i,t}+D_{i,t}$ becomes

27) Out of the 23 firms existing in 1986, 16 were mutual companies. In recent years, however, it has been argued that stock companies have a more flexible organizational style, and consequently, mutual companies are contemplating conversion to stock companies. Daido Life converted to a stock company on April 1, 2002.

28) Here, we disregard the fact that policyholders change over time and the problem of the transfer of surplus between policyholders emerges.

Table 2 Results of the Double Log Likelihood Ratio Tests of the Objectives of Mutual and Stock Life Insurance Companies

	Mutual companies	Stock companies
(5) against (10): p-values	0.376	0.347
(9) against (10): p-values	0.000	0.037

Note: (5) and (9) represent models of the maximization of profits and the maximization of dividends plus profits, respectively. (10) is a general specification that includes (5) and (9) as special cases.

$$\tilde{R}_{i,t}=b_{1,i}C_{i,t}+2b_2\overline{\ln q_{i,t}}C_{i,t}+\frac{\mu_t}{\eta_t}MS_{i,t}R_{i,t}+a_3G_{i,t}+a_4L_{i,t}+a_5GDP_t+a_6IBL_t, \tag{9}$$

where $\tilde{R}_{i,t}\equiv P_tq_{i,t}+D_{i,t}=I_{i,t}-Z_{i,t}$.

We examine which of the two equations, (5) or (9), better describes the behavior of mutual insurance companies. To this end, let us construct

$$\tilde{R}_{i,t}=b_{1,i}C_{i,t}+2b_2\overline{\ln q_t}C_{i,t}+\frac{\mu_t}{\eta_t}MS_{i,t}R_{i,t}+a_3G_{i,t}+a_4L_{i,t}+a_5GDP_t+a_6IBL_t+\beta D_{i,t}, \tag{10}$$

and then, (5) is derived when $\beta=1$, and (9) is derived when $\beta=0$. Therefore, equations (5) and (9) constitute a non-nested hypothesis.

We apply the double log likelihood ratio test in which we construct a general specification, i.e., (10), which includes the two equations as nested hypotheses. Subsequently, we conduct two likelihood ratio tests, (5) against (10) and (9) against (10). Then, we compare the results. We adopt the three-stage least squares estimation method.[29] The number of observations for each year varies from 24 to 41. The total number of observations is 536.

The test results are presented in Table 2. When the stock companies are taken as samples, the specification that they maximize dividends plus profits is rejected at the 5% significance level; however, the hypothesis that they maximize profits is not rejected. The same results are obtained when the mutual companies are taken as samples. Thus, we conclude that both mutual and stock companies seek only profits, rather than dividends plus profits. The behavior of these two types of companies does not differ, at least with respect to their objectives.

4.3 Results of the basic analysis

Given the results of the former subsection, we conduct the following analyses assuming that both mutual and the stock companies maximize their profits. The two models estimated are defined as follows. The first model, described by equations (3) and (5), shall henceforth be referred to as the estimation of the degree of noncompetition. The second model, given by equations (3) and (8), will be called the estimation of the degree of collusion.

The result of the three-stage least squares estimation of the degree of collusion is shown in Table 3.[30] Since the determination coefficients of both equations are over 0.99, we can state

29) With regard to the likelihood ratio test of (5) against (10), the instrumental variables are $G_{i,t-1}$, $L_{i,t-1}$, GDP_{t-1}, $(\overline{\ln q_{t-1}})^2$, $d_i\overline{\ln q_{t-1}}$, $d_{t-1}MS_{i,t-1}R_{i,t-1}$, $\overline{\ln p_{t-1}}$, $\overline{\ln w_{t-1}}$, $(\overline{\ln p_{t-1}})^2$, $(\overline{\ln w_{t-1}})^2$, d_t, $D_{i,t-1}$, and constants. The variables d_t and d_i are the time and firm dummies, respectively. Regarding the likelihood ratio test of (9) against (10), the instrumental variables are $G_{i,t-1}$, $L_{i,t-1}$, $(\overline{\ln q_{t-1}})^2$, $d_{t-1}MS_{i,t-1}R_{i,t-1}$, $\overline{\ln p_{t-1}}$, $\overline{\ln w_{t-1}}$, $(\overline{\ln p_{t-1}})^2$, $(\overline{\ln w_{t-1}})^2$, d_i, d_t, and constants.

30) In the estimation, we use $G_{i,t-1}$, $L_{i,t-1}$, GDP_{t-1}, $(\overline{\ln q_{t-1}})^2$, $d_i\overline{\ln q_{t-1}}$, $d_{t-1}R_{i,t-1}$, $d_{t-1}MS_{i,t-1}R_{i,t-1}$, $\overline{\ln p_{t-1}}$, $\overline{\ln w_{t-1}}$, $(\overline{\ln p_{t-1}})^2$, $(\overline{\ln w_{t-1}})^2$, $R_{i,t-1}$, $MS_{i,t-1}$, d_t, d_i, and constants as instrumental variables.

Table 3 Estimates of the Degree of Collusion

Parameter	Estimate	P-value	Parameter	Estimate	P-value
α_{1986}	1.008	[.000]	η_{1986}	1.055	[.000]
α_{1987}	0.989	[.000]	η_{1987}	1.040	[.000]
α_{1988}	1.062	[.000]	η_{1988}	1.105	[.000]
α_{1989}	1.073	[.000]	η_{1989}	1.123	[.000]
α_{1990}	1.080	[.000]	η_{1990}	1.149	[.000]
α_{1991}	1.081	[.000]	η_{1991}	1.161	[.000]
α_{1992}	0.995	[.000]	η_{1992}	1.069	[.000]
α_{1993}	0.943	[.000]	η_{1993}	1.021	[.000]
α_{1994}	0.929	[.000]	η_{1994}	1.010	[.000]
α_{1995}	0.866	[.000]	η_{1995}	0.950	[.000]
α_{1996}	0.855	[.000]	η_{1996}	0.949	[.000]
α_{1997}	0.842	[.000]	η_{1997}	0.932	[.000]
α_{1998}	0.798	[.000]	η_{1998}	0.898	[.000]
α_{1999}	0.762	[.000]	η_{1999}	0.859	[.000]
α_{2000}	0.786	[.000]	η_{2000}	0.875	[.000]
α_{2001}	0.719	[.000]	η_{2001}	0.815	[.000]
α_{2002}	0.719	[.000]	η_{2002}	0.822	[.000]
a_1	−0.593	[.000]	b_2	0.053	[.000]
a_2	−0.170	[.407]	b_3	−30.994	[.247]
a_7	-1.521×10^4	[.008]	b_4	−8.115	[.381]
a_8	3.776×10^4	[.011]	b_5	150.161	[.240]
a_9	−648.865	[.165]	b_6	−69.278	[.354]
a_{10}	-3.814×10^3	[.071]			
R^2 for (3)	0.997				
R^2 for (8)	0.999				

Note: The results of the simultaneous estimation of equations (3) and (8) have been presented. The estimates of $b_{o,t}$, $b_{o,i}$, and $b_{1,i}$ have not been shown due to space constraints. The number of observations is 536. The estimated equations are as follows:

$$\ln C_{i,t} = b_{0,t} + b_{0,i} + b_{1,i}\overline{\ln q_{i,t}} + b_2(\overline{\ln q_{i,t}})^2 + b_3\overline{\ln w_t} + b_4\overline{\ln p_t} + b_5(\overline{\ln w_t})^2 + b_6(\overline{\ln p_t})^2 + a_1 G_{i,t} + a_2 L_{i,t}. \qquad (3)$$

$$R_{i,t} = b_{1,i}C_{i,t} + 2b_2\overline{\ln q_{i,t}}C_{i,t} + \frac{\alpha_t}{\eta_t}R_{i,t} + \frac{1-\alpha_t}{\eta_t}MS_{i,t}R_{i,t} + a_7G_{i,t} + a_8L_{i,t} + a_9GDP_t + a_{10}IBL_t. \qquad (8)$$

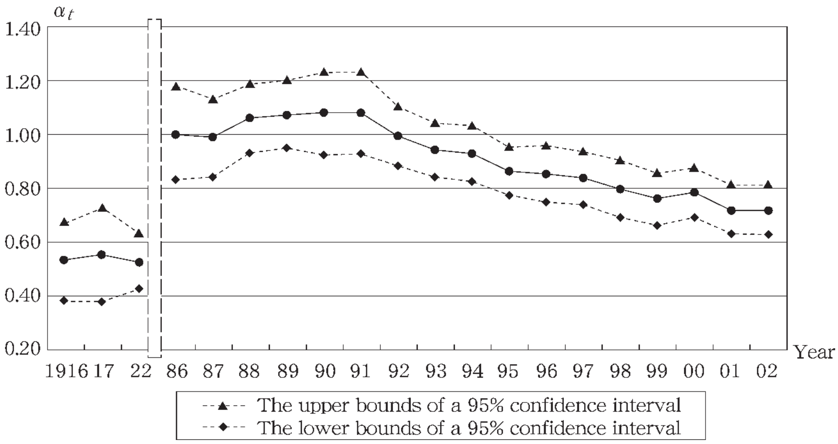
that the model fits well.

The estimates of the degree of collusion, α_t, are close to unity and highly significant, implying that the market was close to perfect collusion and that Cournot competition was rejected. Further, the estimates of the demand elasticity, η_t, are close to unity and decrease over the sample period.

The estimates of the degree of collusion, α_t, are depicted in Figure 3 together with their 95% confidence interval. α_t remains almost at the same level around unity until 1991, and then falls sharply, reaching 0.7 in 2002. The degree of collusion does not reject perfect collusion until 1994; however, it rejects it thereafter. However, the value of α_t suggests that the competition is still lax. Although α_t rejects perfect collusion at the 5% significance level after 1995, it is still far from Cournot competition.

Let's take a look at the results of the other variables. In equation (8), The coefficient of the group insurance, a_7, has a significantly negative sign, while the coefficient of the saving insurance, a_8, has a positive sign. Group insurance has a significant negative coefficient in the cost function, as expected, whereas the coefficient of the saving insurance is insignificant.

Figure 3 Estimates of the Degree of Collusion (α_t)



Note: The estimates are based on the simultaneous estimation of equations (3) and (8).

Notably b_2 is positive and highly significant. Estimates of $b_{1,t}$ are all positive, and 32 of the 46 $b_{1,t}$ are significant at the 5% level.[31] Input prices are insignificant in the cost function.

Table 4 presents the result of the three-stage least squares estimation of the degree of noncompetition.[32] Since the determination coefficient of equation (5) is over 0.99 and that of the translog cost function, (3), is 0.84, we can state that the model fits well.

γ_t are all highly significant, taking on the value of around seven. The estimates of degree of noncompetition, λ_t, which is calculated that γ_t divided by the estimates of η_t from the estimation of the collusion are shown in Figure 4 as well as in the rightmost column of Table 4. Looking at the figure, we notice that it rejects monopoly ($\lambda_t=1$) as well as Cournot oligopoly ($\lambda_t=1/n$) throughout the period. Further, it should be noted that the outcome for the degree of collusion also suggested the rejection of the Cournot oligopoly.

In the estimation of the first-order condition, (5), the coefficient of the saving insurance, a_4, is significantly positive. However, the coefficient of group insurance is not significant. Further, a_1 are a_2 not significant in the cost function, implying that a difference in the type of insurance does not affect costs. b_2, which appears in both (3) and (5), is positive and highly significant. And the coefficients of $\ln w_t$ and $\ln p_t$ and their squared terms are all insignificant, which may be caused because of lack of individual data for them.

The result for the degree of collusion is consistent with the results for the degree of noncompetition in that the insurance industry gradually became competitive over the entire observation period. Thus, it is robust for these indexes that in recent years in particular competition has improved. However, the patterns are somewhat different. The degree of

31) In order to avoid problems resulting from the singularities of the data or derivatives, in this estimation, we assume that the six firms that exist only for two years in our samples have the same firm-specific intercepts, $b_{0,i}$, and firm-specific slopes, $b_{1,i}$.

32) In the estimation, we use $G_{i,t-1}$, $L_{i,t-1}$, GDP_{t-1}, $(\overline{\ln q_{t-1}})^2$, $d_i\overline{\ln q_{t-1}}$, $d_{t-1}MS_{i,t-1}R_{i,t-1}$, $\overline{\ln p_{t-1}}$, $\overline{\ln w_{t-1}}$, $(\overline{\ln p_{t-1}})^2$, $(\overline{\ln w_{t-1}})^2$, $R_{i,t-1}$, $MS_{i,t-1}$, d_t, d_i, and constants as instrumental variables.

Table 4 Estimates of the Degree of Noncompetition

Parameter	Estimate	P-value	λ_t
γ_{1986}	7.262	[.000]	0.318
γ_{1987}	7.060	[.000]	0.305
γ_{1988}	6.855	[.000]	0.303
γ_{1989}	6.808	[.000]	0.306
γ_{1990}	7.233	[.000]	0.302
γ_{1991}	7.040	[.000]	0.293
γ_{1992}	6.848	[.000]	0.258
γ_{1993}	6.811	[.000]	0.243
γ_{1994}	6.838	[.000]	0.242
γ_{1995}	6.817	[.000]	0.206
γ_{1996}	6.518	[.000]	0.148
γ_{1997}	6.434	[.000]	0.148
γ_{1998}	6.464	[.000]	0.146
γ_{1999}	6.287	[.000]	0.132
γ_{2000}	6.394	[.000]	0.130
γ_{2001}	6.370	[.000]	0.129
γ_{2002}	6.508	[.000]	0.143
a_1	0.092	[.977]	
a_2	-1.963	[.646]	
a_3	1.441×10^4	[.578]	
a_4	5.257×10^5	[.000]	
a_5	6.224×10^3	[.000]	
a_6	-5.394×10^3	[.434]	
b_2	0.364	[.000]	
b_3	-325.059	[.614]	
b_4	-92.281	[.680]	
b_5	1.580×10^3	[.609]	
b_6	-803.889	[.659]	
R^2 for (3)	0.835		
R^2 for (5)	0.993		

Note: The results of the simultaneous estimation of equations (3) and (5) have been presented. The estimates of $b_{0,t}$, $b_{0,i}$, and $b_{1,i}$ have not been shown due to space constraints. The number of observations is 536. λ_t is obtained by using the estimates of $\gamma_t (\equiv \mu_t/\eta_t)$ and η_t presented in Table 3. We calculate μ_t by multiplying γ_t by η_t, and then, λ_t is calculated by multiplying μ_t by $\overline{MS_t}$. The estimated equations are as follows:

$$\ln C_{i,t} = b_{0,t} + b_{0,i} + b_{1,i}\overline{\ln q_{i,t}} + b_2(\overline{\ln q_{i,t}})^2 + b_3\overline{\ln w_t} + b_4\overline{\ln p_t} + b_5(\overline{\ln w_t})^2 + b_6(\overline{\ln p_t})^2 + a_1 G_{i,t} + a_2 L_{i,t}. \quad (3)$$

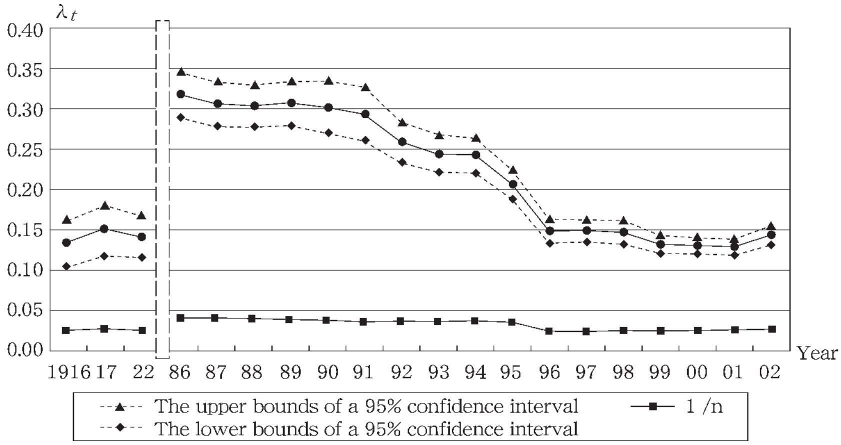
$$R_{i,t} = b_{1,i}C_{i,t} + 2b_2\overline{\ln q_{i,t}}C_{i,t} + \gamma_t MS_{i,t}R_{i,t} + a_3 G_{i,t} + a_4 L_{i,t} + a_5 GDP_t + a_6 IBL_t. \quad (5)$$

collusion remained constant until 1991, and then decreased monotonically. On the other hand, the degree of noncompetition decreased moderately until 1994, and fell sharply in 1995 and 1996, to become stagnant thereafter. Although we cannot judge which pattern is more reliable, we think that this difference probably reflects the difference in the concept of collusion and noncompetition.

4.4 Factors contributing to the increase in the competitiveness

In this subsection, let us attempt to find out how the degrees of collusion and noncompetition are dependent on the various elements. Here, we consider the effect of deregulation, i.e., the

Figure 4 Estimates of the Degree of Noncompetition (λ_t)



Note: λ_t is obtained by using the estimates of $\gamma_t(\equiv\mu_t/\eta_t)$ and η_t presented in Table 3. We calculate μ_t by multiplying γ_t by η_t, and then, λ_t is calculated by multiplying μ_t by $\overline{MS_t}$. The line of 1/ n corresponds to Cournot oligopoly.

promulgation of the Insurance Business Law and the change of policy that ended the convoy system and allowed the failure of insurance firms. In addition, we consider the variables representing business conditions (composite index) and market concentration (Herfindahl index). The regression equation is as follows:

$$Y_t = A_0 + A_1 CIX_t + A_2 HI_t + A_3 DIL_t + A_4 DFAIL_t + u_t, \quad Y = \alpha \ or \ \lambda. \tag{11}$$

Here, *CIX* is the composite index of the business conditions, *HI* is the Herfindahl index, *DIL* is a dummy variable that represents the competitive pressure resulting from the evident new entries due to the revision of Insurance Business Law, which takes the value of 1 in 1995 and 1996, and 0 otherwise, and *DFAIL* is a dummy variable that represents the failure of insurance companies, which takes the value of 1 in the fiscal years 1997-2000, and 0 otherwise.

If these new policies significantly affect competition, A_3 and A_4 are negative. We cannot predict the sign of the business conditions *a priori*. The coefficient of the Herfindahl index will be positive, if the structure—conduct—performance hypothesis applies, and negative if the efficiency—structure hypothesis holds (Demsetz, 1973, Berger, 1995).

The estimation results are presented in Table 5. The results for the degree of collusion are shown in the left-hand side columns. The coefficient of the composite index is positive, but insignificant. The coefficient of the Herfindahl index is significantly negative, supporting the efficiency—structure hypothesis. This means that the Herfindahl index rose after 1995 because the insurance companies became more efficient. A_3 and A_4, which represent the effect of policy measures, are negative, but not significant.[33)]

The results of noncompetition, λ, are presented in the right-hand side columns. All the signs

33) The revision of the Insurance Business Law induced a remarkable increase in the number of firms; hence, we estimated equation (11) replacing *DIL* with the net change in their number. The coefficient was negative, but insignificant.

Table 5 Causes of the Progress of Competition

Dependent variable	α		λ	
Variable	Coefficient	P-value	Coefficient	P-value
Constant	1.551	[.020]	0.628	[.107]
CIX	0.004	[.269]	0.001	[.731]
HI	−9.625	[.019]	−4.401	[.070]
DIL	−0.105	[.128]	−0.053	[.209]
DFAIL	−0.086	[.155]	−0.077	[.048]
R^2	0.585		0.503	

Note: We regress the degree of collusion (α) and degree of noncompetition (λ). *CIX* is the composite index of the business conditions, *HI* is the Herfindahl index, *DIL* is a dummy variable that represents the competitive pressure resulting from the evident new entries due to the revision of Insurance Business Law, which takes the value of 1 in 1995 and 1996, and 0 otherwise, and *DFAIL* is a dummy variable that represents the failure of insurance companies, which takes the value of 1 in the fiscal years 1997-2000, and 0 otherwise. The number of observations is 17. The estimated equation is as follows:

$$Y_t = A_0 + A_1 CLX_t + A_2 HI_t + A_3 DIL_t + A_4 DFAIL_t + u_t, \quad Y = \alpha \ or \ \lambda. \tag{11}$$

of the coefficients for λ are the same with those for α. A significantly negative coefficient of the Herfindahl index for λ supports the efficiency—structure hypothesis. Unlike the results for α, the coefficients of *DFAIL* are significantly negative for λ; this implies that the abolition of the convoy administration made the insurance industry more competitive. Further, the composite index does not have an effect on competition.

4.5 Comparison with the prewar period

It is believed that in the prewar period, the competition between life insurance companies was quite severe (Tsutsui et al., 2004). Premium and dividend rates were not regulated until 1937; moreover, the sales staff activity (in terms of insurance solicitation) was not restricted until 1931. Insurance companies attempted to mitigate the competition by means of different premium—dividend schemes in 1917-1937 (Tsutsui et al., 2000).

Therefore, it is interesting to investigate whether the current degree of competition is as great as it was in the prewar period. We estimated the degrees of noncompetition and collusion using cross-section data for 1916, 1917, and 1922, when the competition was quite fierce. w_t and the p_t values were not an obligatory inclusion because of cross-sectional regression. Furthermore, $G_{i,t}$, $L_{i,t}$, and GDP_t were omitted from our estimations because of the absence of data.

In Figure 3, we present the degree of collusion for the abovementioned years, which is about 0.5 and is lower than that for the recent years; this suggests that the current degree of competition is still weaker than what it was during the prewar period.

In Figure 4, we present the degree of noncompetition. λ_t is 0.143 in 2002 and 0.134 in 1916, suggesting that the degree of noncompetition prior to 1996 is much higher than that which existed during the prewar period, but thereafter it became almost at the same level as the prewar level. Thus, both Figures 3 and 4 indicate that while the degree of competition up to the early 1990s was quite far from the situation during the prewar period, the current degree of competition is approaching it.

5 Conclusions

In this paper, we examined the change in the degree of competition in the Japanese life insurance industry during the period 1986-2002. First, we investigated whether Japanese life insurance companies —— both stock and mutual —— seek profits or dividends. Subsequently, estimating the first-order condition of profit maximization, together with the cost function, we obtained the estimates of the degrees of noncompetition and collusion. Further, we attempted to determine the factors that contributed to the increase in the competitiveness and compared this competitiveness with that which existed during the prewar period. The conclusions obtained from the estimation results are summarized as follows:

1) Both stock and mutual companies seek to maximize profits rather than profits plus dividends to policyholders.

2) The estimation of the degree of collusion reveals that competition has improved monotonically since 1992. The degree of collusion does not reject perfect collusion until 1994; however, thereafter, it is rejected.

3) The degree of noncompetition steadily fell until 1996, and has remained almost unchanged thereafter. Further, during the years 1995 and 1996, it fell sharply; this was when the new Insurance Business Law was promulgated and enforced.

4) The Herfindahl index has a positive correlation with the degree of competition, as predicted by the efficiency—structure hypothesis.

5) The degree of collusion in the later years is greater than what it was in the prewar period, suggesting that there still remains more room for competition.

Let us compare the results of this paper with those that are available for the competitiveness of other Japanese financial industries. Uchida and Tsutsui (2005), using an approach similar to the one applied in this paper, considered the Japanese banking industry and estimated the degree of competition from 1974 to 2000. They found that the market had become more competitive in the 1970s, and suggested that the city banks faced perfect competition during the mid-1990s. Estimating the Panzar-Rosse H-statistic, Tsutsui and Kamesaka (2005) found that the Japanese securities industry was in monopolistic competition equilibrium in the 1980s and late 1990s and was in monopoly equilibrium in the early 1990s. In view of these findings, life insurance in Japan seems to be a less competitive industry than banking. Competition in the banking sector improved in the late 1970s, whereas it improved in the life insurance sector only during the late 1990s and did not reach perfect competition. However, this result should not be surprising because the insurance industry is still regulated. Therefore, it is preferable to further promote deregulation in the life insurance industry in order to increase the benefits of increased competition.

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