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Abstract

This paper examines transition in the level of competition in the Japanese life insurance industry over the last ten years. We estimate the first order condition for profit maximizing insurance oligopolies to obtain the degree of non-competition and collusion. Estimation results suggest: 1) mutual companies, like stock companies, seek to maximize their own profits rather than pay out dividends to policyholders, 2) the degree of non-competition has fallen since 1995, and 3) the degree of non-competition and collusion among incumbent firms are higher compared with that of the whole industry.

JEL Classification Number: G22, L13, L21

Keywords: Life insurance, Degree of competition, Collusion, Japan

1. Introduction

The purpose of this paper is to examine whether the Japanese life insurance industry has become more competitive in the last ten years. The financial liberalization, initiated in the 1970s, has not resulted in increased competition in traditional banking, securities, and insurance industries (see Ikeo, 1995 and Horiuchi, 1999). In particular, liberalization in insurance industry is behind that of the other financial industries. Thus the level of competition and economic efficiency of the life insurance industry has been considered low.[1] In 1996, a New Insurance Industry Law was enforced; it resulted in the creation of eleven subsidiaries of non-life insurance companies, which began doing business in the life insurance industry -- the number of life insurance companies jumped to 41 instantaneously. In November of the same year, the Prime Minister Hashimoto declared the commencement of Financial Big Bang, and by June of 1997, the insurance council submitted a report that outlined the anticipated schedule of the liberalization for the following four years. Although it is controversial whether the tempo of the scheduled liberalization is quick enough, such a movement towards liberalization unambiguously suggests improvement of the competition in the life insurance industry. This paper tries to confirm this suggestion.

Tsutsui (1990) examined a transition of the competition in the life insurance industry from the end of the Second World War to 1986, using the industrial organization concepts of ‘market structure’ and ‘market performances’. Tsutsui (1990) concluded that transition of market structure and performances since 1980 suggested increase of competition. Considering that he found signs of liberalization in the data until 1986, we may find more vivid changes in the level of competition in a more recent sample.

[1] Chuma *et al.* (1993) estimate the technical efficiency of Japanese life insurance companies.

The original Insurance Industry Law was enacted in 1939 and remained intact throughout the postwar period. It was the final step of the transition to a system in which premium rates, dividend rates, and solicitations were regulated. New entry has been strictly regulated since the Second World War, leading to the maintenance of the so-called "20 firms system". Indeed, no entry had been allowed until December 1975, when Seibu-All State obtained a business license (see Iguchi, 1996). Revision of the Law in 1996 aimed to keep up with a possible transition from the regulated system to a liberalized one.

The new Law permits entry by establishing subsidiaries of non-life insurance companies. Due to the Law, eleven life insurance subsidiaries of non-life insurance companies were established in 1996. In 1997, the number of new entry firms since 1975 reached 21. The logical question is the following: Does this expanded number of firms imply a considerable increase in competition in the life insurance industry?

Although the number of the new entries is quite large, the share of the new entry firms is trivial. Transition of the share of the assets of the new entry firms to the total assets is shown in Figure 1. Although the share has been growing since 1986, it was still less than 1.5% in 1997. If the new entry firms are remained as only fringe firms, their effect on competition may be limited.

According to 'market structure-performance hypothesis', if the market concentration decreases as the results of the new entry, the degree of competition should increase. To investigate this point, it is possible to examine the market concentration. The Herfindahl index does this by taking the total assets as a proxy for firm size. Its results are shown in Figure 2. The Herfindahl index decreases from 1986 until 1991, but only slightly. In 1950, the Herfindahl index was at 0.1, well below the recent level. What is unexpected is that the Herfindahl index increases in 1996 and

1997, when extensive new entry occurred. Thus, there is no evidence that the market concentration decreased substantially in this period.

While the fact that many firms made entries in 1996 suggests improvement of competition, the Herfindahl index suggests that on the contrary the degree of competition is unchanged. We will examine which is really the case by conducting an econometric analysis. This paper takes more theoretical approach than Tsutsui (1990) and directly estimates the degree of competition. Specifically, we assume that the insurance companies conduct oligopolistic quantity competition. Estimating the regression equations with panel data from 1986 to 1997, we make clear a transition of the degree of competition in the period.

The rest of the paper is organized as follows. In the next section, we derive regression equations to elucidate the behavior of mutual and stock companies and to estimate the degree of competition. Section 3 is devoted to a presentation of estimation results. Section 4 summarizes our conclusions.

2. Model

2.1 Objective of mutual insurance companies

In this section, we derive a model for an estimation of the degree of competition, assuming that N firms in the life insurance industry conduct quantity competition.[2] First, let us introduce the variables used in this paper.

$q_{i,t}$: policies in force of firm i at period t

[2] As for a survey of empirical studies on the degree of competition, see Martin (1993) and Bresnahan (1989).

$$Q_t \equiv \sum_{j=1}^{N} q_{i,t}$$

$I_{i,t}$: premium income of firm i at period t

$Z_{i,t}$: claims paid by firm i at period t

$D_{i,t}$: dividends paid by firm i at period t

$A_{i,t}$: outstanding assets of firm i at period t

$r_{i,t}$: yields of assets of firm i at period t

$C_{i,t}$: operating costs of firm i at period t

Then, profits $p_{i,t}$ of firm i at period t is:

$$\begin{aligned} p_{i,t} &= I_{i,t} - Z_{i,t} - D_{i,t} - C_{i,t}(q_{i,t}) + r_{i,t} A_{i,t} \\ &\equiv P_t(Q_t) q_{i,t} - C_{i,t}(q_{i,t}) + r_{i,t} A_{i,t}, \end{aligned} \tag{1}$$

where $P_t(Q_t) \equiv \dfrac{I_{i,t} - D_{i,t} - Z_{i,t}}{q_{i,t}}$ is the inverse demand function for life insurance, and $C_{i,t}(q_{i,t})$ is the cost function of firm i. Here, we assume that dividends and the mean of claims to be paid are known to policyholders, so that they regard net premium as the price of a policy.[3] Subtracting claims paid at the definition of the price of an insurance policy implies that the policyholders buy reduction of the risk of future income variation due to their death with this price.

The stock insurance company i chooses $q_{i,t}$ to maximize the profits, given $A_{i,t}$ and $r_{i,t}$.[4] The first order condition of the profit maximization is

[3] In reality, dividends and claims will be paid in the future periods. In our one period analysis, this aspect is disregarded.
[4] We assume that profits gained at period t are added into assets and are invested at period $t+1$.

(2) $$\frac{\partial p_{i,t}}{\P q_{i,t}} = P_t + \frac{dP_t}{dQ_t} m_{i,t} q_{i,t} - MC_{i,t} = 0,$$

where $MC_{i,t} \equiv \dfrac{\partial C_{i,t}}{\partial q_{i,t}}$ and $m_{i,t} \equiv \dfrac{\partial Q_t}{\partial q_{i,t}}$. Now, assuming that $m_{i,t}$ is common for all the firms and rewriting it m_t, equation (2) becomes

(3) $$R_{i,t} = MC_{i,t} q_{i,t} + \frac{m_t}{h_t} R_{i,t} MS_{i,t},$$

where $h_t \equiv -\dfrac{P_t}{Q_t}\dfrac{dQ_t}{dP_t}$ is the price elasticity, $MS_{i,t} \equiv \dfrac{q_{i,t}}{Q_t}$ is the market share of firm i, and $R_{i,t} \equiv P_t q_{i,t} = I_{i,t} - Z_{i,t} - D_{i,t}$.

Life insurance companies sell various kinds of policies, so that even if the policy in force is identical for two companies, the price, and therefore $R_{i,t}$, differs depending on the composite of policies. In order to eliminate the effect of this composition of policies, we add the ratio of group insurance $G_{i,t}$ and the ratio of saving insurance $L_{i,t}$ to explanatory variables (see Tsutsui *et al.*, 1992). Thus, the regression equation becomes

(3') $$R_{i,t} = MC_{i,t} q_{i,t} + \frac{m_t}{h_t} R_{i,t} MS_{i,t} + a_1 G_{i,t} + a_2 L_{i,t}.$$

The signs of a_1 and a_2 are not known *a priori*.[5] We estimate (3') together with the cost function because marginal cost, *MC*, is not observable. We assume a translog cost function:

(4) $$\ln C_{i,t} = (b_{0,i} + b_{0,t}) + b_{1,t}\left(\ln q_{i,t} - \overline{\ln q_t}\right) + b_2\left(\ln q_{i,t} - \overline{\ln q_t}\right)^2 + a_3 G_{i,t} + a_4 L_{i,t},$$

[5] An increase in saving life insurance results in an increase in premium income. It also leads to an increase in the amount of policy paid, however, so that the sign of a_2 is not determined.

where $\overline{\ln q_t} \equiv \frac{1}{N}\sum_{i=1}^{N}\ln q_{i,t}$. Input prices are suppressed because of the data availability. We allow for time-variant intercepts $b_{o,t}$, firm-specific intercepts $b_{o,i}$, and firm-specific slopes $b_{1,i}$. Time-variant slopes are tried, but they are not included in the final estimation because they are not significant. Expected sings of a_3 and a_4 are negative and positive, respectively (see Tsutsui *et al.*, 1992). Marginal cost is

$$(5) \qquad MC_{i,t} = \frac{C_{i,t}}{q_{i,t}}\frac{\partial \ln C_{i,t}}{\partial \ln q_{i,t}} = \frac{C_{i,t}}{q_{i,t}}\left[b_{1,t} + 2b_2\left(\ln q_{i,t} - \overline{\ln q_t}\right)\right]$$

Therefore, equation (3') now becomes

$$(3'') \qquad R_{i,t} = b_{1t}C_{i,t} + 2b_2\left(\ln q_{i,t} - \overline{\ln q_t}\right)C_{i,t} + \frac{m_t}{h_t}MS_{i,t}R_{i,t} + a_1G_{i,t} + a_2L_{i,t}.$$

We estimate equations (3") and (4) simultaneously, putting the restriction on the parameters over the equations.

Most of the incumbent life insurance companies are mutual companies. Because legal owners of mutual companies are policyholders, dividends are not costs, but what the companies should pursue. Thus, mutual insurance companies may maximize the surplus defined in equation (1) plus dividends.[6] In this case, assuming that $D_{i,t}$ is proportional to $q_{i,t}$, the first order condition becomes:

$$(6) \qquad \tilde{R}_{i,t} = MC_{i,t}q_{i,t} + \frac{m_t}{h_t}R_{i,t}MS_{i,t},$$

where $\tilde{R}_{i,t} \equiv P_t q_{i,t} + D_{i,t} = I_{i,t} - Z_{i,t}$. Following the same procedure as the above, we estimate

[6] Note that the surplus is attributed to policyholders of mutual companies. Here, we disregard the fact that

(6’) $\tilde{R}_{i,t} = b_{1t} C_{i,t} + 2b_2 \left(\ln q_{i,t} - \overline{\ln q_t} \right) C_{i,t} + \frac{m_t}{h_t} MS_{i,t} R_{i,t} + a_1 G_{i,t} + a_2 L_{i,t}$

together with equation (4).

Many people question that the mutual insurance companies are really regulated by policyholders, and argue that the mutual companies do not act differently from stock companies (see Komiya, 1994). On the other hand of the argument is that mutual companies are less efficient because the supervision by policyholders is weaker than by stockholders.[7] Therefore, it remains controversial whether mutual life insurance companies operate for the advantage of policyholders, or they seek only surplus.[8] We will investigate which supposition is closer to the reality by comparing equations (3”) and (6’).

2.2 Degree of non-competition

In what follows, we develop a model assuming that mutual companies maximize their profits. Then we relax the assumption, and obtain results by substituting $R_{i,t}$ in the left-hand side of the obtained equations with $\tilde{R}_{i,t}$.

Let us define m_t multiplied with market share by the variable $l_{i,t}$. Thus, $l_{i,t} \equiv m_t MS_{i,t} \equiv \frac{\partial Q_t}{\partial q_{i,t}} \frac{q_{i,t}}{Q_t}$. Defining $\overline{MS}_t \equiv \frac{1}{N} \sum_{j=1}^{N} MS_{i,t} = \frac{1}{N}$ and $\overline{l}_t \equiv m_t \overline{MS}_t$, $\overline{l}_t$ is determined with the number of firms and conjectural variations, which represents the degree of non-competition (Bresnahan, 1982). For example, $\overline{l}_t = 0$ corresponds to the perfect competition, and

policyholders change over time, so that transfer problem of the surplus between policyholders emerges.

[7] McKenzie (2000) reports that rate of return equation does not differ between mutual and stock companies, while cost function does.

$\overline{l}_t = 1$, to a monopoly. In Cournot competition, when the number of firms is n, $\overline{l}_t = 1/n$. In the simultaneous estimation of (3”) and (4), we obtain the estimate of m_t/h_t, but m_t cannot be identified. Thus, we evaluate the possible transition of m_t, assuming that h_t is constant over the estimation period.

2.3 Degree of collusion

In order to identify m_t, we conduct another analysis, putting a restriction on the conjectural variations (Clarke and Davies, 1982, and Alley, 1993). Specifically, we assume that when firm i increases its production by a certain rate, the other firms $j \neq i$ increase a-times $(0 < a_t < 1)$ of that rate. Thus, for all i and for all $j \neq i$,

(7) $$\frac{\Delta q_{j,t}}{q_{j,t}} = a_t \frac{\Delta q_{i,t}}{q_{i,t}}.$$

If a_t equals to unity, (7) means that firm i predicts that other firms respond to an increase of firm i so as to keep the share of every firm unchanged. On the contrary, if a_t equals to zero, it means that firm i predicts that other firms do not respond at all to its increase. This model corresponds to a cooperative game, in which a_t represents the degree of collusion. The former case is interpreted as the perfect collusion, and the latter corresponds to non-cooperative Cournot competition.

Assuming that the changes are infinitesimal, equation (7) can be rewritten as

(8) $$\frac{\P q_{j,t}}{\partial q_{i,t}} = a_t \frac{q_{j,t}}{q_{i,t}}.$$

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[8] Surplus is accumulated inside the company and can be spent in various ways by managers.

Summing up this over all $j \neq i$, equation (8) becomes $\frac{\partial Q_t}{\partial q_{i,t}} - 1 = \alpha_t (\frac{Q_t}{q_{i,t}} - 1)$, so that we obtain

(9) $\mu_{i,t} \; MS_{i,t} = \alpha_t + (1-\alpha_t) MS_{i,t}$.

When $\alpha_t = 0$, $\mu_{i,t} = 1$, corresponding to the case of Cournot competition.

Assuming that $\mu_{i,t}$ is constant over i, and substituting (9) into (3”), we obtain

(10) $$R_{i,t} - MC_{i,t} q_{i,t} = \frac{\alpha_t}{\eta_t} R_{i,t} + \frac{1-\alpha_t}{\eta_t} MS_{i,t} R_{i,t} + a_5 G_{i,t} + a_6 L_{i,t}.$$

Therefore, first we estimate equation (4) to calculate the marginal cost, *MC*. Then, using this estimate, we regress equation (10) to estimate α_t and η_t.

3. Estimation Results

Estimation period is from 1986 to 1997, and the samples are restricted to ‘domestic corporations’ defined by Insurance Industry 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 $L_{i,t}$, which are taken from *Statistics of Life Insurance Business in Japan* edited by Insurance Research Institute.

3.1 Do mutual companies maximize profits or dividends?

First, let us examine which equation, (3”) or (6’) better describe the behavior of mutual insurance companies. Constructing

(11) $$\tilde{R}_{i,t} = b_{1t} C_{i,t} + 2b_2 \left(\ln q_{i,t} - \overline{\ln q_t} \right) C_{i,t} + \frac{\mu_t}{\eta_t} MS_{i,t} R_{i,t} + a_1 G_{i,t} + a_2 L_{i,t} + bD,$$

(3”) is derived when $b = 1$, and (6’) is derived when $b = 0$. So, equations (3”) and (6’) constitute a non-nested hypothesis.

We apply the double log likelihood ratio test (DLLR), in which we construct a general specification, i.e. (11), which includes the two equations as nested hypotheses. Then we conduct two likelihood ratio tests, (3”) against (11) and (6’) against (11), and compare the results. The estimation method used is three-stage least squares, and the instrumental variables are $G_{i,t}$, $L_{i,t}$, $\left(\ln q_{i,t-1} - \overline{\ln q_{t-1}}\right)^2$, $d_i\left(\ln q_{i,t-1} - \overline{\ln q_{t-1}}\right)$, $d_t MS_{i,t-1} R_{i,t-1}$, $R_{i,t-1}$, $MS_{i,t-1}$, $D_{i,t-1}$, and constants. The variables d_t and d_i are respectively the time and firm dummies.

The test results are in Table 1. When mutual companies are taken as samples, the specification that they maximize dividends plus profits is rejected at a 5% significance level, while the hypothesis that they maximize profits is not rejected. The tests with the stock companies bring about similar results. Thus, we conclude that both mutual and stock companies seek for only profits, rather than dividends plus profits. The behavior of these two types of companies does not differ, at least, with respect of their objectives.

3.2 Results of the basic analysis

Given the results of the former subsection, we conduct the following analyses assuming that the both mutual and stock companies maximize their profits. We define the two models, which we wish to estimate. The first one, described by equations (3”) and (4), shall henceforth be called the estimation of non-competition degree. The second, given by equations (10) and (4) will be called the estimation of collusion degree.

Results of three-stage least squares estimation of non-competition degree are in Table 2. In the estimation, we use $G_{i,t}$, $L_{i,t}$, $\left(\ln q_{i,t-1} - \overline{\ln q_{t-1}}\right)^2$, $\ln q_{i,t-1} - \overline{\ln q_{t-1}}$, $d_i\left(\ln q_{i,t-1} - \overline{\ln q_{t-1}}\right)$, $d_t\, MS_{i,t-1}\, R_{i,t-1}$, $R_{i,t-1}$, d_t, and constants as instrumental variables.

The model fits well: the determination coefficient of (3”) is over 0.99 and that of the translog cost function is over 0.95. The coefficient representing the degree of competition, $\bar{l}_t / h_t$, takes on the value of 0.25-0.29 from 1986 to 1994, and thereafter decreases remarkably to 0.11 in 1997. Thus, we conclude that life insurance industry has become more competitive since 1995.

Table 3 presents the results of estimation of collusion degree. In this estimation, different from Table 2, we first estimate equation (4) alone and construct the estimates of the marginal costs. Then, (10) is estimated with instrumental variables method. The index of collusion, a_t, is significantly positive for all years, rejecting the hypothesis of no collusion (i.e. Cournot competition). While the value of a_t does not reject the hypothesis of ‘perfect collusion (a_t=1)’ until 1996, it decreases since 1992, and rejects the hypothesis in 1997. It seems that the decline has been accelerated since 1995. The demand elasticity, h_t, is significantly positive and takes on the value between 0.88 and 1.18.

Both results of Tables 2 and 3 reveal that the life insurance industry have become more competitive since 1995, implying that this conclusion is robust for these two methods. The New Insurance Industry Law was passed in the Diet and promulgated in 1995. The insurance companies probably started various reformulations, including the preparation of the establishment of their subsidiaries in 1995, to get ready for the enforcement of the Law in the next year. The results reasonably reflect this fact.

3.3 Competition among 20 incumbent firms

In the previous subsection, we conduct the analysis using all firms in the industry as samples; however, Tsutsui (1990) reports that the transition to the liberalization becomes ambiguous when the sample is restricted to the incumbent 20 companies. This is plausible because incumbent firms are probably not quick enough in responding to a new competitive environment brought about by a new entry. Thus, it is interesting to investigate whether the degree of non-competition and collusion of 20 incumbent firms are higher than the whole samples.

The results of estimation of degree of non-competition with the data of 20 incumbents are essentially similar to those of Table 2. In Figure 3, we plot $\bar{l}_t / h_t$ for the cases of all firms and 20 incumbents. Looking at the Figure, we find that while the pattern of the transition is similar each other, they are different with respect to the following two points:

1) The value of $\bar{l}_t / h_t$ is higher for the case of 20 incumbent firms throughout the period except 1986, and

2) While $\bar{l}_t / h_t$ began to fall since 1995 for the case of all firms, that for 20 incumbent firms began in 1996 and was not as dramatic as the case of all firms.

These results suggest that the competition among 20 incumbent firms has become stronger since 1996, but not in comparison to competition among new entry firms.

In Figure 4, we plot a_t for the cases of all firms and 20 incumbents. The degree of collusion sharply rises in the late 1980s and then declines consecutively since 1989. Although this spike of a_t in the bubble period may reflect some change in the behavior of 20 incumbent firms, the fact that a_t exceeds unity is difficult to interpret from viewpoint of the degree of collusion.[9] Since 1993, a_t takes the value less than unity and consistently declines, rejecting $a_t = 1$ in 1997. This implies that competition among 20 incumbents is getting stronger, at least, since 1993. Moreover, the fact that a_t of 20 incumbent firms is larger than that of all firms implies that competition among incumbent firms is weaker than among all firms.

4. Conclusions

In this paper, we examine a transition of the degree of competition in the Japanese life insurance industry for these ten years. We first investigate whether the life insurance companies in Japan seek for profits or dividends. Then, estimating the first order condition of the profit maximization together with the cost function, we obtain the estimates of the degree of non-competition and collusion. Our conclusions obtained from the estimation results are summarized as follows.

1) Mutual companies, like stock companies, seek for maximizing profits rather than dividends to policyholders,

2) The degree of non-competition for all firms has fallen since 1995, when the new Insurance Industry Law was promulgated, and

3) The degree of non-competition and collusion among incumbent 20 firms are higher compared with those of the whole industry.

Needles to say, this paper suffers from various problems. First, in estimation of non-competition degree, we cannot infer the level of the non-competition -- even if its transition is

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[9] $a_t = 1$ is not rejected, however, for these periods.

inferred by the assumption of constant price elasticity.[10] Second, the estimates of cost function may be biased because of the lack of the input price data. Third, the model we employed is static one. Extension to a dynamic framework is a future agenda. Finally, we assume quantity competition to derive equations for estimation. This assumption is restrictive, and it is desirable to derive theoretically the degree of non-competition corresponding to various types of competition and examine which type of competition best explains reality.

[10] There are other methods to estimate the degree of non-competition. The method of Bresnahan (1982) and Lau (1982) uses the time-series data, however, and does not fit to the investigation of the short-term transition of the degree of non-competition. The method of Panzar and Rosse (1987) requires data of input prices, which are not available to us.

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Table 1 Results of the Double Log Likelihood Ratio Tests of the Objectives of Mutual and Stock Life Insurance Companies

	Mutual companies	Stock companies
(3") against (11): p-values	0.796	0.530
(6') against (11): p-values	0.045	0.028

Note: (3") and (6') represent models of the maximization of profits and maximization of dividend plus profits, respectively. (11) is a general specification that includes (3") and (6') as special cases.

Table 2 Estimates of Degree of Non-competition: All Firms

	1986	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
μ / η	6.479	6.606	7.302	7.460	7.193	7.131	6.900	6.794	6.894	6.414	6.419	4.742
t-value	16.094	17.080	18.088	17.565	14.845	14.207	17.332	18.348	18.055	19.300	17.044	18.066
number of firms	23	24	25	25	26	27	27	27	27	29	40	40
$\bar{l}_t / h_t$	0.282	0.275	0.292	0.298	0.277	0.264	0.256	0.252	0.255	0.221	0.160	0.119
R squared of (3")	0.994											

Note: Equations (3”) and (4) are jointly estimated by three-stage least squares.

Table 3 Estimates of Degree of Collusion: All Firms

	1986	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
a	0.961	0.951	0.962	0.963	0.981	0.992	0.972	0.952	0.924	0.879	0.841	0.828
t-value	5.375	6.468	7.473	6.934	6.172	5.933	6.444	6.904	6.528	7.483	6.878	7.895
?	0.948	0.945	0.961	0.969	0.994	1.012	0.996	0.980	0.959	0.921	0.894	0.887
t-value	6.567	7.844	8.827	8.142	7.279	7.003	7.661	8.256	7.839	9.184	8.575	10.774
number of firms	23	24	25	25	26	27	27	27	27	29	40	40
R squared of (10)	0.999											

Note: Equation (10) is estimated by instrumental variables method.

Figure 1　Share of the Assets of New Entry Firms to the Total Assets

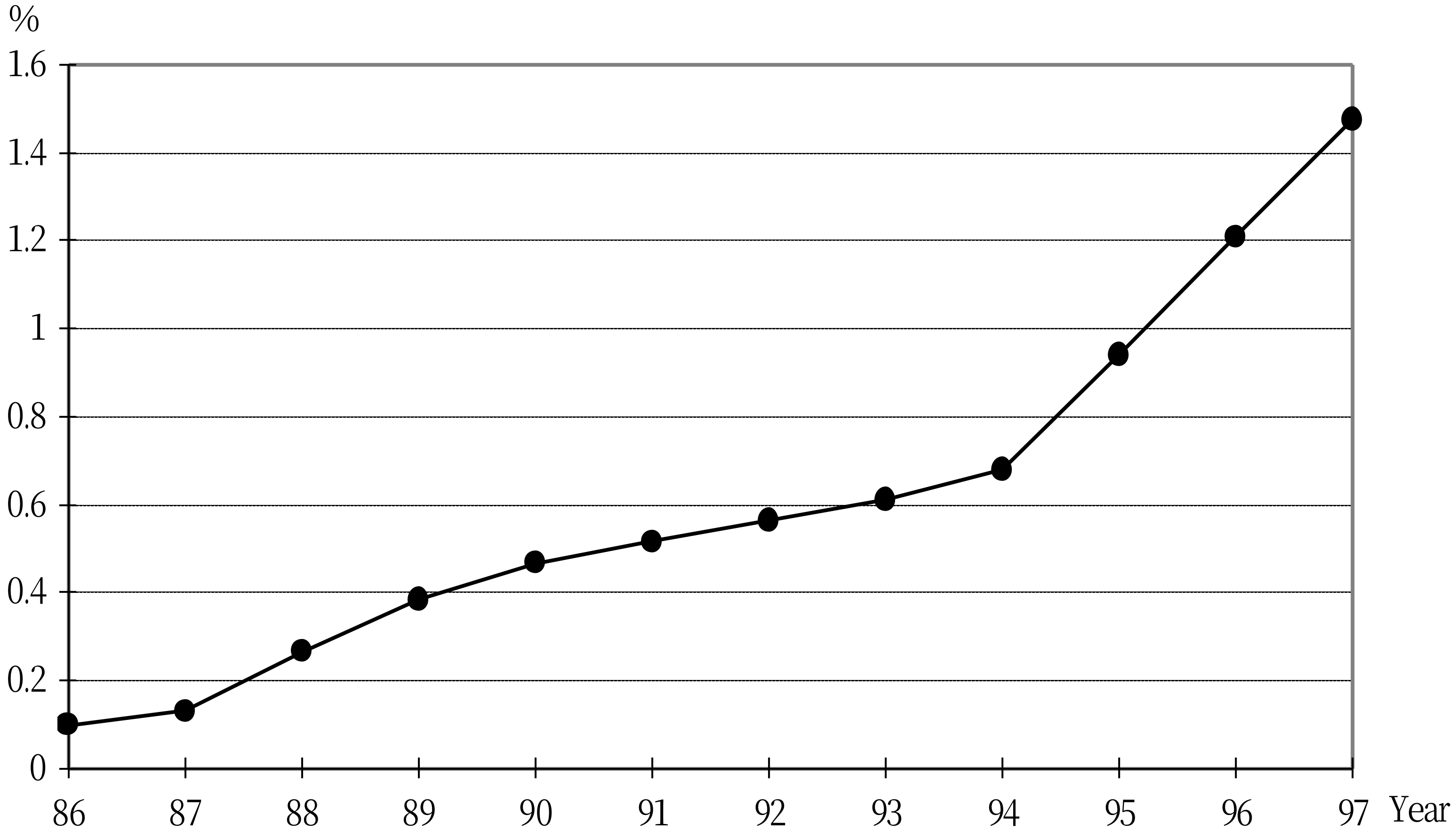

Figure 2 The Herfindahl Index (HI)

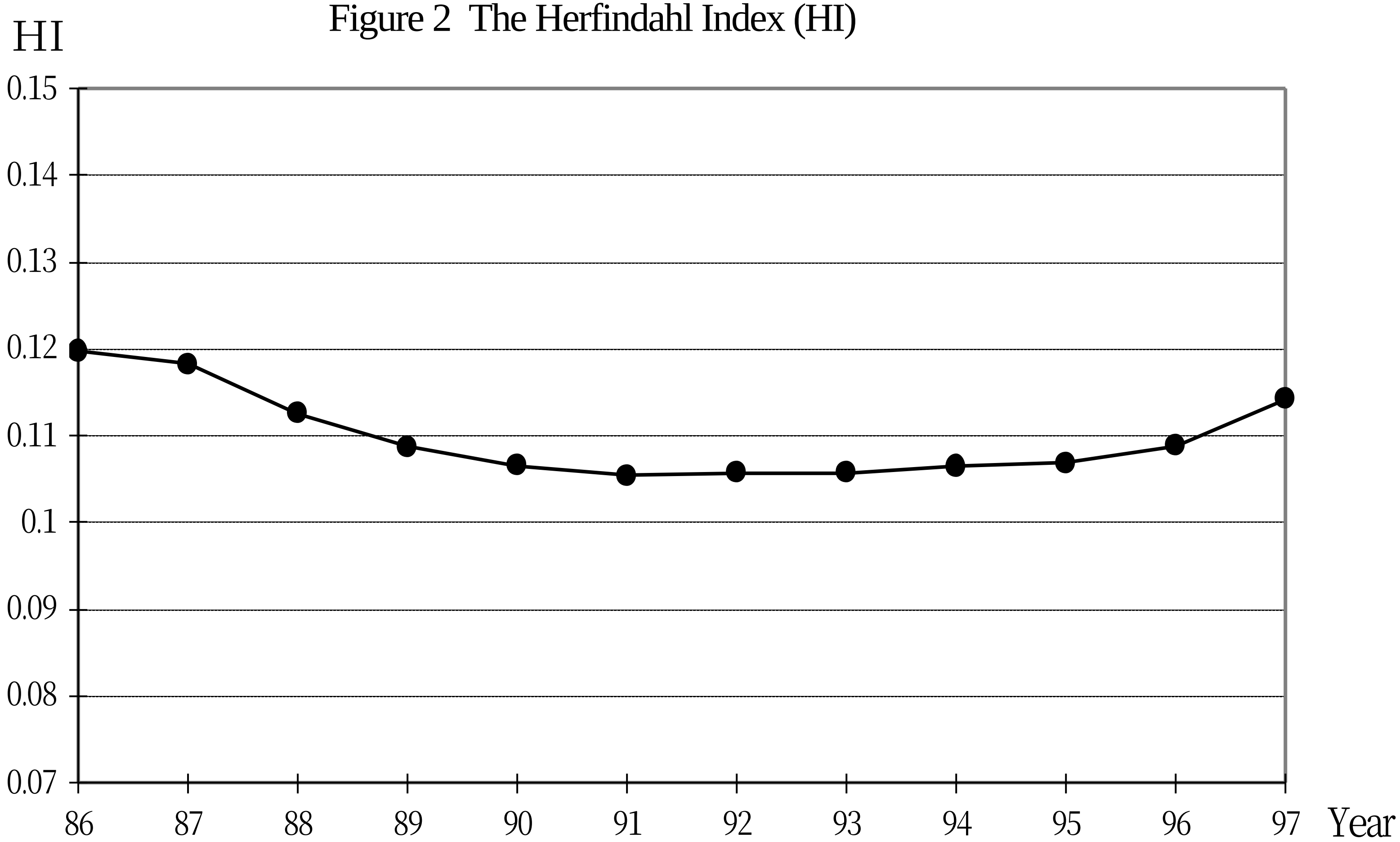

Figure 3 Transition of Degree of Non-Competition $(\bar{l}_t / h_t)$

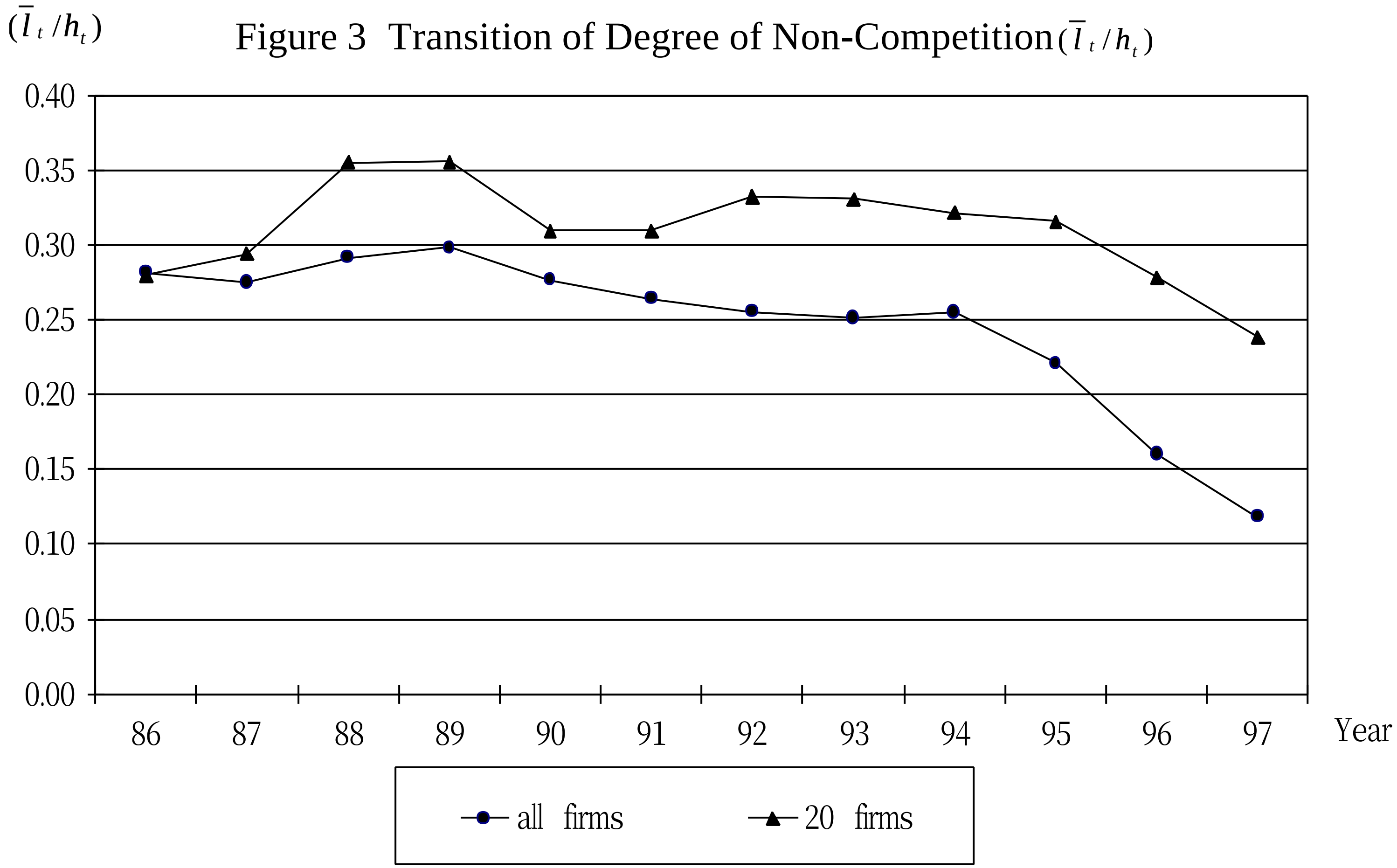

Figure 4 Transition of Degree of Collusion (a)