# The Nightmare of the Leader: The Impact of Deregulation on an Oligopoly Insurance Market

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**Abstract:** This paper explores the impact of deregulation of licensing on an oligopoly insurance market. We show that deregulation of licensing in a Stackelberg-type oligopoly market may not have any impact on the leader's output if the number of firms increases but the market structure remains. On the other hand, if the market structure is reorganized because of the deregulation of licensing, the leader's output could be significantly reduced after deregulation. By using the unique data of the insurance market in Taiwan, this paper provides further empirical evidence to demonstrate that the deregulation of a Stackelberg-type oligopoly insurance market reduces the outputs of the market leader more than those of the market followers. [Keywords: deregulation, insurance, Stackelberg, Cournot, oligopoly market, competition, market leader, market followers.]

## INTRODUCTION

Numerous studies have investigated the influence of deregulation on the insurance industry. Deregulation may take several forms, such as allowing foreign companies to enter the market (deregulation of licensing), price liberalization, or lower requirements for minimum capital or reserve.[1] Joskow (1973) and Hiebert (1978) showed that regulation changes influence market structure and competition. Harrington (1984) and Pauly, Kunreuther, and Kleindorfer (1986)[2] investigated the influence of rate regulation on the auto insurance market and found prior approval to have a

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*Journal of Insurance Issues*, 2003, **26**, 1, pp. 15–28.

negative impact in general on average prices. Barrors (1996) reported that firms behaved more competitively and changed their market conduct after price liberalization. In addition, using the empirical data from European countries, Finsinger and Schmid (1994) suggested that regulation interventions have a major impact on insurance price, market share, and concentration. However, relatively few studies have investigated the effect of deregulation of licensing in the insurance market. This paper intends to fill that gap.

The deregulation of licensing has been commonly debated in many developing countries. In most cases, the local firms under a government's protection may enjoy certain advantages because the market is not competitive enough. Thus, they are generally reluctant to give up this government protection, while the government faces strong pressure from other countries requesting access to the domestic market. One of common reasons raised by local firms against the deregulation of licensing is that it may crowd out relatively small local firms. However, these arguments sound more like excuses and are seldom carefully investigated.

It is reasonable to believe that the deregulation of licensing may have a certain impact on the market shares of original firms. Does it have a greater impact, however, for the market leader or the followers? In many regulated markets, there usually exist a number of large firms and several small ones. Although they are on equal footing when the market is deregulated, they may not share the same fate after deregulation. In general, the side opposed to deregulation of licensing frequently argues that it may cause bankruptcies of small firms, while the proposing side may argue that the deregulation of licensing may create more niches in the market and may even benefit smaller local firms.

In 1988, Taiwan opened its insurance market to foreign insurance companies.[3] Before that, there had been eight insurance companies in Taiwan, with Cathay Insurance Co. controlling more than 50 percent of the insurance market share for many years. Typically, the insurance market in Taiwan before 1988 was a Stackelberg-type oligopoly market, with one market leader and several market followers. Following the deregulation of licensing, many large international insurers—such as Metropolitan, Prudential, Aetna, and Cigna—established branches in Taiwan. Most of the foreign companies entering Taiwan's insurance market were at least as large as Cathay Insurance Co. Thus, the insurance market after deregulation[4] became extremely competitive, and the market structure could be completely changed.

One possible change is that the market could be transformed from a Stackelberg-type oligopoly to a Cournot-type oligopoly. In a Cournot model, firms choose outputs simultaneously, with each firm choosing its

output so as to maximize its profits, given its beliefs about the other firms' choices. In a Stackelberg model, one firm leads by setting its output, and the other firms follow. When the leader chooses an output, it will take into account how the followers will respond. Much of the literature has investigated the relationship between output and price in the Cournot-type and Stackelberg-type oligopolies. In a simple Stackelberg duopoly model, the equilibrium price is lower than that in a Cournot model and the total output is larger than in a Cournot model (Levin, 1988). However, Anderson and Engers (1992) showed that in a hierarchical Stackelberg model—in which several firms choose outputs sequentially—it is not necessarily true that the leader's profit in the Stackelberg duopoly will be more than that of a Cournot duopolist. Church and Ware (1996) showed that incumbent firms must expand their output and lower their prices to deter potential entrants. Hann and Maks (1996) also considered a two-period, entry-deterrence model and suggested that if the original incumbent acted as a Stackelberg leader at the time of entry, post-entry profit for the entrant would be lower than in the case of a Cournot duopoly model.

Another possible change after deregulation of licensing is that the market could be transformed from a Stackelberg-type oligopoly with one leader to one with multiple leaders. When there are multiple leaders in a Stackelberg-type oligopoly, some firms lead by setting the output level, and some other firms follow. When leaders choose their outputs, they will anticipate how the followers will respond, but will also play a game like a Cournot-type oligopoly among themselves.

The literature has documented in theory that the market leader in a Stackelberg-type oligopoly market can use its own marketing strategies to enjoy better profits and may maintain a greater market share than in a Cournot-type oligopoly. It is also straightforward that, in a Stackelberg-type oligopoly, the market leader could benefit more in the market with only one leader rather than multiple leaders. However, relatively few researchers have been able to collect appropriate data to investigate this proposition. We believe the experience of the Taiwan insurance market deregulation is a unique opportunity to examine empirically the impact of market structure on an oligopoly market. By using the unique panel data of the insurance market both before and after the deregulation of licensing in Taiwan, we show that the deregulation of a Stackelberg-type oligopoly insurance market will have a greater impact on the output of the market leader than on that of the market followers.

In this paper, we utilize two oligopoly models—a Stackelberg model and a Cournot model—to explore the quantitative relationship between price and output both before and after the deregulation of licensing. We also use data from the Taiwanese life insurance market to examine the

impact of deregulation of licensing on an oligopoly market. In particular, we find that the new written premium, new written policy, and market share of the market leader decreased significantly with respect to other insurance companies after the deregulation of licensing.

# THE MODEL

## Before Deregulation of Licensing

Consider a Stackelberg-type oligopoly life insurance industry with $n$ firms (firm 1 is the leader and firms 2, 3, …, $n$ are followers) producing homogeneous[5] outputs that are sold at the same price $P$. We also assume that the marginal cost of firm $i$ is constant. Assume that the profit of firm $i$, $\pi_i$, is defined as

$$\pi_i = pQ_i - CQ_i, \tag{1}$$

where $Q_i$ denotes the output of firm $i$, and $C$ denotes the firm's marginal cost.[6]

Further assume that the demand for insurance is downward-sloping[7] and can be expressed as

$$P = a - bQ_1 - b\sum_{i=2}^{n} Q_i, \tag{2}$$

where $a$ and $b$ are constants.

Based on the reaction of the followers, firm 1 chooses its quantity to maximize its own profit.

Since the followers choose their quantity to maximize their own profit, given the quantity of firm 1, the reaction functions of firms 2, 3, …, $n$ are given by equation (1):

$$Q_2 = Q_3 = \cdots = Q_n = \frac{a - bQ_1 - C}{nb}. \tag{3}$$

The profit-maximization problem for the leader then becomes:

$$\underset{Q_1}{Max} \quad PQ_1 - CQ_1 = \underset{Q_1}{Max} \left\{ a - bQ_1 - \frac{(n-1)(a - bQ_1 - c)}{n} \right\} Q_1 - CQ_1 \ . \tag{4}$$

We can solve $Q_1^*$ from equation (4):

$$Q_1^* = \frac{a - C}{2b}. \tag{5}$$

Substituting $Q_1^*$ into equation (3), we can solve $Q_2^*$, $Q_3^*$, …, $Q_n^*$:

$$Q_2^* = Q_3^* = \ldots = Q_n^* = \frac{a - C}{2nb}. \tag{6}$$

## After Deregulation of Licensing

We assume that the market structure is completely changed after the deregulation of licensing. Two cases of transformation are discussed: Case 1—from a Stackelberg oligopoly to a Cournot oligopoly—and Case 2—from a Stackelberg oligopoly with one leader to a Stackelberg oligopoly with multiple leaders. These two cases intend to provide possible, but not exclusive, explanations to show that market leader could suffer more than the market follower after the deregulation of licensing. From Equation (5), we find that the optimal output of the leader is not influenced by the number of firms in the market. Thus, the deregulation of licensing may not have any impact at all on the leader if only the number of firms increases but the market structure remains after the deregulation of licensing. In the following two cases, however, we intend to demonstrate that the deregulation of licensing could cause more damage to the market leader if the market structure changes.

## Case 1—A Cournot–Type Oligopoly

We assume that $m$ firms enter into the industry after deregulation and the post-entry market structure becomes a Cournot competition. Now there are $m + n$ firms in the life insurance industry. Because, under the Cournot model, each firm chooses its output so as to maximize its profit given its beliefs about the other firms' choices, the profit-maximization problems for firms 1, 2, …, $m + n$ thus become:

$$\underset{Q_i}{Max} \left\{ a - b \sum_{i=1}^{m+n} Q_i \right\} Q_i - CQ_i \quad . \tag{7}$$

We can solve $Q_2^*, Q_3^*, \ldots, Q_{m+n}^*$ from equation (7):

$$Q_1^* = Q_2^* = \ldots = Q_{m+n}^* = \frac{a-C}{(m+n+1)b}. \quad (8)$$

Compare the equilibrium before and after the deregulation of licensing. If the number of the entry is in a specific range $(n-1>m)$, then the outputs of followers after deregulation are more than those before deregulation. At the same time, the leader's output after deregulation is less than before deregulation. This shows that after a Stackelberg-type oligopoly market changes to a Cournot-type oligopoly market, the market leader will have a greater impact than the market followers will. Although the condition $(n-1>m)$ may alter when a different setting is employed in the model, the major result—that deregulation from a Stackelberg-type oligopoly market to a Cournot-type oligopoly market may have a greater impact on the market leader—still remains.

## Case 2—A Stackelberg–Type Oligopoly with Multiple Leaders

In this case, we consider the market after deregulation of licensing as an oligopoly market with multiple leaders and multiple followers rather than a Cournot-type oligopoly market. We also assume that $m$ firms enter into the industry after deregulation, and the post-entry market structure becomes a Stackelberg–type oligopoly with multiple leaders. Assume $k$ firms in the life insurance industry are leaders. Thus, there are $m+n-k$ firms that are followers. Let $Q_i^L$ and $Q_j^F$ denote the outputs of the leader $i$ and the followers $j$. Since the followers choose their quantity to maximize their own profit, given the quantities of the leaders, the reaction functions of following firms are given by equation (9):

$$Q_j^F = \frac{a - b\sum_{i=1}^{k} Q_i^L - C}{(m+n-k+1)b}. \quad (9)$$

We can solve $Q_i^L$ by a Cournot game and given equation (9):

$$Q_i^L = \frac{a-C}{(k+1)b}. \quad (10)$$

Substituting $Q_i^L$ into equation (9), we can solve $Q_j^F$:

$$Q_j^F = \frac{a-c}{(m+n-k+1)(k+1)b}. \tag{11}$$

Comparing equations (5) and (6) to equation (10), we may find that the original market leader's output decreases, whereas some original followers' output may increase if they become the market leaders after the deregulation of licensing.

## DATA AND METHODOLOGY

In this study we collected panel data from 1981 to 1997[8] for eight local insurance companies that existed both before and after the deregulation of licensing in Taiwan: Life Insurance Department of CTC, Taiwan Life Insurance Co., Chinfon Life Insurance Co., Cathay Life Insurance Co., China Life Insurance Co., Nan Shan Life Insurance Co., Kuo Hua Life Insurance Co., and Shin Kong Life Insurance Co. We performed a panel of linear regression models to test the proposition with different insurance output (dependent variables), including total new written premium, number of new written policies, and market share. For the independent variables in the regression models, we employed dummy variables to examine the fixed effect of each company and the timing of deregulation. To investigate whether deregulation of licensing reduces the leader's output more than the followers', we employ a fixed effect rather than a random effect to control for variation among firms and through time. The estimated coefficients of the dummy variables in the fixed effect serve to test the hypothesis of our theory. In addition, we added two control variables for the demand for insurance [ln(GDP)] and the size effect [ln(firm's asset)]. Previous papers, such as Mossin (1968), have suggested that the demand for insurance is highly correlated to an individual's wealth. Thus, we use [ln(GDP)] to control the increase in insurance demand caused by an increase in wealth. On the other hand, firm size has been recognized as one of the key factors that influence a firm's decision in the insurance industry. To investigate the difference between the market leader and the followers, we use [ln(firm's asset)] to control the size effect. Moreover, we further adopted the cross-product interaction terms to investigate the impact of deregulation. The panel of linear regression models (three models) is as follows:

$$\log(Y_{it}) = \alpha_0 + \alpha_1 X_{1it} + \alpha_2 X_{2it} + \sum_{i=1}^{m} \beta_i D_{it} + \gamma D_{0t} +$$

$$\delta_1 X_{1it} D_{0t} + \delta_2 X_{2it} D_{0t} + \sum_{i=1}^{m} \phi_i D_{it} D_{0t} + \mu_{it}$$

where $Y_{it}$ = new written premium for company $i$ in year $t$ in Model 1
= number of new written policies for company $i$ in year $t$ in Model 2
= market share[9] for company $i$ in year $t$ in Model 3

$X_{1it}$ = control variable for insurance demand [ln(GDP)] for company $i$ in year $t$.

$X_{2it}$ = control variable for firm size [ln(firm's assets)] for company $i$ in year $t$.

$D_{0t}$ = dummy variable to control the timing of the deregulation of licensing in year $t$. The dummy variable is equal to 1 for the year after 1988 and equal to zero if otherwise.

$D_{it}$ = dummy variable to control the fixed effect of company $i$ in year $t$. We use 7 dummies to indicate insurance companies; the base is the second-largest firm, Shin Kong Life. We define these dummy variables such that $D_1$ ($D_2$, $D_3$, $D_4$, $D_5$, $D_6$, and $D_7$) is equal to 1 for Life Insurance Department of CTC (Taiwan Life Insurance Co., Chinfon Life Insurance Co., Cathay Life Insurance Co., China Life Insurance Co., Nan Shan Life Insurance Co., and Kuo Hua Life Insurance Co.) and equal to zero if otherwise.

The summary of the basic statistics for the numerical variables used in the regression analysis is illustrated in Table 1.

## EMPIRICAL FINDINGS

Tables 2 and 3 report the market share of the eight local insurance companies before and after the deregulation of licensing. In general, we find that before 1988, Cathay Life on average controlled about 50 percent of the insurance market share; Shin Kong Life, the second-largest firm, controlled about 27 percent of the market share in Taiwan. After the deregulation of licensing, Cathay Life's market share was reduced to only 29 percent and that of Shin Kong Life to 16 percent. From Tables 2 and 3, we also find that, after the deregulation of licensing, most of the original

**Table 1.** Summary of Basic Statistics for the Numerical Variables ($N$ = 136)

| Variable | Mean | Std Dev | Minimum | Maximum |
|---|---|---|---|---|
| New Written Premium | 4888091 | 6787852 | 55017 | 33077449 |
| New Written Policy | 183037 | 249652 | 1088 | 984524 |
| Market Share | 0.1178 | 0.1489 | 0.0044 | 0.5875 |
| Ln(GDP) | 15.178 | 0.488 | 14.383 | 15.916 |
| Ln(Assets) | 16.468 | 1.793 | 13.425 | 20.428 |
| $D_0$ | 0.5882 | 0.4940 | 0.000 | 1.0000 |
| $D_1$ (TCT) | 0.1250 | 0.3319 | 0.000 | 1.0000 |
| $D_2$ (Taiwan Life) | 0.1250 | 0.3319 | 0.000 | 1.0000 |
| $D_3$ (Chinfon Life) | 0.1250 | 0.3319 | 0.000 | 1.0000 |
| $D_4$ (Cathay Life) | 0.1250 | 0.3319 | 0.000 | 1.0000 |
| $D_5$ (China Life) | 0.1250 | 0.3319 | 0.000 | 1.0000 |
| $D_6$ (Nan Shan) | 0.1250 | 0.3319 | 0.000 | 1.0000 |
| $D_7$ (Kuo Hua) | 0.1250 | 0.3319 | 0.000 | 1.0000 |

local insurance companies (CTC, Taiwan Life, Cathay Life, Kuo Hua Life, and Shin Kong Life) lost their market share, but several others (Chinfon Life, China Life, and Nan Shan Life) did not. It is worth noting that after the deregulation of licensing, the market leader—Cathay Life Co.—lost the greatest market share to the new entrants, which gained 22 percent of the market share between 1988 and 1997.

From Tables 2 and 3, we find some partial evidence to support our assumption that the market structure could be changed after the deregulation of licensing. Before 1988, Cathay Life controlled about 50 percent of the market share. Thus, it is reasonable to assume that the market is a Stackelberg-type oligopoly with one leader. In 1997, Cathay Life controlled only 29.3 percent of the market share, while Nan Shan Life and Shin Kong Life controlled 15.6 percent and 16.3 percent, respectively. In addition, new entrants, as a whole, controlled 22.2 percent. By comparing the market shares gained by the new-entry firms and those reduced for the original leader, we find the influence of deregulation not only helping the existing non-leader firms to gain the market shares, but also helping the new-entry firms to gain market shares. Thus, our empirical results seem to support that, following the deregulation of licensing, the insurance market became a Stackelberg-type oligopoly with multiple leaders in Taiwan. In addition,

**Table 2.** Market Share Before the Deregulation of Licensing (in %)

| Company/Year | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|
| CTC | 1.5 | 1.4 | 2.5 | 2.9 | 5.2 | 3.6 | 3.3 |
| Taiwan Life | 1.1 | 1.3 | 1.4 | 1.9 | 2.9 | 4.5 | 4.2 |
| Chinfon Life | 0.8 | 0.7 | 0.7 | 0.7 | 0.9 | 0.9 | 0.9 |
| Cathay Life | 58.8 | 55.3 | 53.4 | 56.0 | 47.8 | 41.6 | 47.1 |
| China Life | 1.9 | 1.9 | 2.1 | 2.0 | 2.4 | 2.6 | 2.0 |
| Nan Shan Life | 3.5 | 3.3 | 3.3 | 3.5 | 5.2 | 8.4 | 8.5 |
| Kuo Hua Life | 5.2 | 5.3 | 4.9 | 4.8 | 5.4 | 8.1 | 6.7 |
| Shin Kong Life | 27.2 | 30.8 | 31.7 | 28.2 | 30.2 | 30.3 | 27.3 |

**Table 3.** Market Share After the Deregulation of Licensing (in %)

| Company/Year | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|---|---|---|
| CTC | 2.6 | 1.4 | 1.6 | 1.9 | 2.0 | 2.1 | 2.8 | 2.6 | 2.2 | 1.9 |
| Taiwan Life | 2.8 | 3.5 | 2.9 | 3.2 | 3.5 | 3.6 | 3.3 | 2.8 | 4.9 | 5.0 |
| Chinfon Life | 0.8 | 0.4 | 0.5 | 0.7 | 1.0 | 1.2 | 1.1 | 1.2 | 1.5 | 2.4 |
| Cathay Life | 49.8 | 47.1 | 47.4 | 41.4 | 40.7 | 39.6 | 36.5 | 33.5 | 29.3 | 29.3 |
| China Life | 2.0 | 3.5 | 3.3 | 3.1 | 3.0 | 2.7 | 2.7 | 2.9 | 3.1 | 2.5 |
| Nan Shan Life | 9.6 | 9.3 | 10.7 | 14.2 | 15.8 | 17.0 | 16.2 | 16.8 | 17.5 | 15.6 |
| Kuo Hua Life | 6.4 | 6.2 | 6.8 | 7.1 | 6.3 | 5.4 | 5.3 | 4.9 | 4.4 | 4.8 |
| Shin Kong Life | 24.8 | 26.4 | 24.0 | 24.1 | 22.7 | 21.6 | 19.4 | 16.3 | 16.1 | 16.3 |
| Other new entrants | 1.2 | 2.2 | 2.8 | 4.3 | 5.0 | 6.8 | 12.7 | 19.0 | 21.0 | 22.2 |

we also find that the market shares of the new-entry firms and the existing non-leader firms increased gradually. This implies that there exists a time lag for the market to convert from Stackelberg type to Cournot type after deregulation.[10]

To further test our theory and prediction, we employ regression models to carefully investigate the empirical results by using panel data. For the regression analysis, three versions of the linear models were estimated. To examine the robustness of the regression, the outputs of insurance

**Table 4.** OLS Regression Results for Models 1–3

| | Model 1 New Written Premium | | Model 2 New Written Policies | | Model 3 Market Share | | |
|---|---|---|---|---|---|---|---|
| Dependent Variable | Parameter | T-Stat | Parameter | T-Stat | Parameter | T-Stat | VIF |
| Constant | –5.059 | –3.04*** | –5.469 | –2.43*** | –4.492 | –2.72*** | |
| $D_0$ | 8.637 | 3.99*** | 14.888 | 5.08*** | 6.196 | 2.89*** | 2521.7 |
| $D_1$ (CTC) | –2.0601 | –6.00*** | –3.2701 | –7.04*** | –2.1249 | –6.24*** | 28.6 |
| $D_2$ (Taiwan Life) | –2.0455 | –3.79*** | –4.3499 | –5.96*** | –2.1524 | –4.02*** | 70.8 |
| $D_3$ (Chinfon Life) | –3.0196 | –5.06*** | –5.0589 | –6.27*** | –3.1386 | –5.30*** | 86.5 |
| $D_4$ (Cathay Life) | 0.4074 | 2.13** | 0.6430 | 2.49*** | 0.4355 | 2.30** | 8.9 |
| $D_5$ (China Life) | –2.0450 | –3.67*** | –4.0414 | –5.36*** | –2.1557 | –3.90*** | 75.5 |
| $D_6$ (Nan Shan Life) | –1.3916 | –3.23*** | –2.9279 | –5.02*** | –1.4755 | –3.45*** | 45.2 |
| $D_7$ (Kuo Hua Life) | –1.2536 | –3.23*** | –2.5664 | –4.89*** | –1.3281 | –3.45*** | 36.5 |
| ln(GDP) | 2.2547 | 4.73*** | 3.5418 | 5.49*** | 0.4335 | 0.92 | 119.4 |
| ln(Assets) | 0.2055 | 1.07 | –0.2849 | –1.10 | 0.1662 | 0.87 | 261.6 |
| $D_0$*$D_1$ | 1.2147 | 2.29** | 2.5301 | 3.53*** | 1.2069 | 2.30** | 42.5 |
| $D_0$*$D_2$ | 1.8214 | 2.64*** | 3.7925 | 4.06*** | 1.8511 | 2.71*** | 71.9 |
| $D_0$*$D_3$ | 2.5216 | 2.76*** | 4.856 | 3.93*** | 2.5130 | 2.77*** | 126.4 |
| $D_0$*$D_4$ | –0.3549 | –1.33 | –0.8631 | –2.38** | –0.3548 | –1.34 | 10.8 |
| $D_0$*$D_5$ | 1.3589 | 2.04** | 3.3389 | 3.71*** | 1.4050 | 2.13** | 67.0 |
| $D_0$*$D_6$ | 1.6814 | 3.49*** | 3.3383 | 5.12*** | 1.7310 | 3.62*** | 35.1 |
| $D_0$*$D_7$ | 0.9673 | 2.00** | 2.4051 | 3.67*** | 0.9918 | 2.07** | 35.5 |
| ln(GDP)*$D_0$ | –2.1058 | –3.35*** | –3.9344 | –4.62*** | –1.6871 | –2.70*** | 8542.1 |
| ln(Assets)*$D_0$ | 0.4615 | 1.77* | 1.1267 | 3.19*** | 0.4678 | 1.81* | 1445.2 |
| $R^2$ | $R^2$ = 97.5% | | $R^2$ = 96.1% | | $R^2$ = 96.3% | | |

*** significant at 1 percent level of significance.
** significant at 5 percent level of significance.
* significant at 10 percent level of significance.

companies were measured by new written premium, number of new written policies, and market share in models 1, 2, and 3, respectively. Table 4 reports the estimated parameters of the test equations and the corresponding t-statistics. In addition, testing for multicollinearity indicated that these assumptions of regression were not violated. A variance inflation factor test was used for multicollinearity. The Run Test was also consistent with the hypothesis that no serial correlation was present at the 5 percent level of significance in the estimated equation.

In our theoretical model (Case 2), we predict that, if the deregulation of licensing changes the market structure, some original firms (followers) may gain greater market share, whereas the market leader may lose some of its market share. From Table 4 we find that the dummy variable $D_0$ is

significantly positive in all of the models. This means that the deregulation of entry improves the new written premium, number of new written policies, and market share of the original firms as a whole. This evidence supports the idea that the deregulation of licensing may not be bad news for some of the original firms, as predicted by our theory. Moreover, in models 1, 2, and 3, the coefficients of $D_4$, Cathay Life Insurance (the market leader), are significantly positive, whereas the coefficients of the other firms ($D_1$ $D_2$ $D_3$ $D_5$ $D_6$ $D_7$) are all significantly negative. This means that before deregulation, Cathay Life Insurance Co. controlled a greater market share, sold more policies, and collected more premiums than any of the other firms, including the second-largest firm (Shin Kong Life), in the market. Furthermore, in models 1, 2, and 3, the coefficients of interaction term $D_4$*$D_0$ are negative, whereas the coefficients of the interaction terms for the other companies are all significantly positive. Interestingly, and as predicted by the theory, this result implies that, after deregulation, compared to the second-largest firm (Shin Kong Life), the new written premium, the number of new written policies, and the market share of Cathay Life Insurance Co. decreased, whereas those of other firms increased. It is worth noting that from the magnitude of the coefficients on the interaction terms we find that in general the increase magnitude of the output for other firms is greater than the decreased magnitude of Cathay Life Insurance Co. This result confirms that after deregulation the market leader faced greater competition from the new entrants and stood to lose its leadership advantage. This demonstrates that deregulation may completely change the market structure—i.e., the market leader may lose its market share, but the market followers may not. Thus, it also implies that after deregulation the differences of output between the eight domestic companies were smaller than they were before deregulation.

## CONCLUSIONS AND POLICY IMPLICATIONS

This paper explores the impact of licensing deregulation on the insurance industry. By using unique data for the insurance market in Taiwan, this paper provides empirical evidence to support the premise that the deregulation of a Stackelberg-type oligopoly insurance market reduces the output of the market leader more than that of the market followers. Our empirical results also provide evidence to demonstrate that the market structure could change after the deregulation of licensing. We show that, after the deregulation of licensing, the insurance market in Taiwan transformed from a Stackelberg-type oligopoly with one leader to one with multiple leaders and that there exists a time lag for such a conversion. In

general, we find that after deregulation, the new written premium, new written policies, and market share of the market leader decreased significantly with respect to the other insurance companies. In addition, we also find that after deregulation, the differences in new written premium, new written policies, and market share between the eight domestic companies in Taiwan were smaller than they were before deregulation.

## NOTES

[1] For a comprehensive overview, see Finsinger and Pauly (1985).

[2] Pauly, Kleindorfer, and Lelindorfer (1986) extended Harrington's study by taking into account the quality variation and found similar results.

[3] In 1988 the government first allowed U.S. insurance companies to set up their branches in Taiwan. In 1992, the Taiwan government opened its insurance market completely to foreign insurance companies.

[4] We note that the insurance premium, the requirements of minimum capital, and insurance reserve after the deregulation of license are still highly regulated in Taiwan.

[5] This assumption is made for the sake of simplicity. The major results of the paper remain even if the assumption is relaxed.

[6] For the sake of simplicity, we assume that each firm has the same marginal cost and, therefore, the optimal solution of each firm is the same. The major results of the paper remain even if the assumption is relaxed.

[7] The major results of this paper remain when the demand function for insurance is not linear.

[8] Up to 1997, there were 31 life insurance companies in Taiwan, with 16 domestic insurers and 15 foreign ones.

[9] The market share is calculated by dividing the new written premium of an individual firm by that of the total firms. The market share after deregulation accounts for the new entrants.

[10] We appreciate that referees point out this critical remark.

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