“A comparative analysis of cooperative and business insurers in the Japanese insurance market”

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A comparative analysis of cooperative and business insurers in the Japanese insurance market

Abstract

In this paper, the authors examine competition in insurance markets containing both cooperative insurers (an organization similar to a mutual insurance company owned by some restricted membership) and business insurers (insurance companies owned by members in a mutual form or stockholders in a stock form). Although both types of insurers sell similar products, they display some unique characteristics. To start with, cooperative insurers only sell products to their restricted membership, whereas business insurers sell their products to any potential customers in the market. In addition, the operating costs of cooperative insurers are generally lower. To understand better these differences between cooperative and business insurers, the authors construct an economic model and conduct comparative statics to identify the characteristics of the equilibrium insurance premium.

Keywords: insurance, cooperative insurers, business insurers, insurance market, economic analysis, Japan.
JEL Classification: G22, L13, P13.

Introduction

According to the Insurance Business Act in Japan, insurance companies must choose between a mutual or stock form. In Japan, all nonlife insurance companies are stock, while three of the four major life insurance companies are mutual. However, apart from mutual and stock insurance companies (which we sometimes refer to collectively as business insurers), many other insurers, regulated by different laws and supervised by different agencies, operate in the Japanese insurance market. In particular, large cooperative insurers, such as JA Insurance (Japan Agricultural Cooperatives Insurance) and Zenrosai (National Federation of Workers and Consumers Insurance Cooperatives) have attracted attention as "outsiders" in the Japanese insurance market. For example, JA Insurance, an organization initially created to protect agriculture workers, potentially has a major impact on the Japanese insurance market because of the enormous amount of capital collected from agriculture workers. JA Insurance earns the largest premium income among the world's insurance cooperatives and mutual companies[1].

Although cooperative and business insurers share several characteristics, there are several key differences from an economic and legal perspective. For example, insurance cooperatives can only sell their products to their members, whereas insurance companies can sell their products to any potential customers in the market. Another example is that the operating costs of cooperative insurers are generally lower because they can more easily obtain the private information of policyholders through the cooperative union.

A number of studies have examined systems of cooperative insurance. For example, of the seminal studies by Cole (1891) and Barou (1936), Barou (1936) showed that cooperative insurance differed in terms of the characteristics of members and the appropriation of any surpluses[2]. Later, Gottlieb (2007) argued that the pricing policies of cooperative insurance societies in the 19th century were influenced by their members and suggested that the societies had been able to overcome information asymmetry among their members. Elsewhere, Gao and Meng (2009) showed that cooperative insurance schemes in health insurance attracted more members under Chinese medical reforms. Wagstaff et al. (2007) empirically analyzed how Chinese cooperative insurance affected the medical system in China. Maysami and Kwon (1999) discussed the regulation of takaful (Islamic) insurance from the perspective of cooperative insurance. Although legal and organizational differences hold between cooperative and business insurers, consumers have often been unable to distinguish between them. For instance, according to a survey report by the JA Kyosai Research Institute in 2012, consumers were more interested in the price and coverage of their insurance policies than from which insurer they were purchased. From the results of this report, we know that consumers are not very interested in the differences between insurers, at least from a legal or organizational perspective. In other words, consumers regard cooperative and business insurers as the same and therefore, select their insurance policies only in reference to their price and coverage.

However, cooperative and business insurers are not exactly the same. For example, because JA Insurance sells its insurance products only to agricultural workers, the structure of competition differs from that in business insurance. In the main, this restriction leads to a contraction of the scale and scope of

[1] See Table 17 on p. 41 in the World Co-operative Monitor (2013) for details. "Zenkyoren" in this table is the insurer of JA Insurance.

[2] See Barou (1936, pp. 124-126).

the market to which the insurer sells its products. However, this also provides the insurer with an advantage in terms of relatively lower selling costs because it already holds a significant amount of information on its members.

The purpose of this paper is to analyze market competition between cooperative and business insurers as a means of providing useful responses to the following two questions. First, what are the characteristics of market equilibrium in an insurance market including cooperative and business insurers? Second, what impact do exogenous conditions have on this market, including market size, the volume of selling costs, and uncertainty? In our response, we particularly address the exogenous conditions that are advantageous (disadvantageous) to cooperative (business) insurers.

We employ an economic approach to these questions for the following reasons. First, it easily allows us to show the effects of a change in exogenous conditions using comparative statics. Second, we can obtain general results not provided by classical insurance theory. The remainder of the paper is organized as follows. Section 1 introduces the economic model and derives the equilibrium. In section 2, we conduct the comparative statics. The final section provides some concluding remarks.

1. The model

Suppose there is one cooperative insurance company (insurer 1) and one business insurance company (insurer 2) in an insurance market. Assume also a division in this insurance market according to whether insurer 1 can sell its products. Hereafter, the market in which both (all) insurers can sell their products is "market A", while the market in which insurer 2 can only sell its products is "market N". For example, consider the case where insurer 1 is JA Insurance (a cooperative insurer). In this case, the agriculture workers who are members of JA Insurance are in market A, while all other consumers are in market N because JA Insurance cannot sell its products to non-agricultural workers. In contrast, insurer 2 can sell its products to all potential customers, including both agricultural and nonagricultural workers.

Given this, the demand functions in market A are:

$$q_1^A = \alpha^A - p_1 + \gamma p_2, \tag{1}$$

$$q_2^A = \alpha^A - p_2 + \gamma p_1, \tag{2}$$

and the demand function in market N is:

$$q_2^N = \alpha^N - p_2, \tag{3}$$

where q_i^j represents the level of quantity sold by insurer i (i = {1, 2}) in market j (j = {A, N}), α^j is the potential demand level in market j, p_i is the level of insurance premium decided by insurer i, and $\gamma \in (0,1)$. Note that insurer 2 cannot set a different level of the insurance premium for each market because Japanese Insurance Business Law prohibits differentiating insurance premiums in the absence of rational risk selection.

A value of $x_k \geq 0$ indicates the amount of insurance money (payout) for consumer k, where $x_k > 0$ is realized if the consumer k has an accident, and $x_k = 0$ if the consumer k does not have an accident. Importantly, both insurers are unable to know the exact amount when they sell their insurance because there is some uncertainty. Thus, they know only the form of the probability distribution for the payout of insurance. Assume that each amount of insurance each consumer receives is mutually independent with the same mean and variance. Further, assume the amount of insurance x_k is normally distributed $N(\mu, \sigma^2)$, where $\mu \equiv E[x_k]$ and $\sigma^2 \equiv E[(x_k - \mu)^2]$. $E[\bullet]$ denotes the operator of the expectation.

Both insurers have to expend selling costs when they sell their products. The selling cost functions are represented by $C_1 \equiv C_1(q_1^A)$ and $C_2 \equiv C_2(q_2^A + q_2^N)$, respectively, and assume $C_i^j = \partial C_i / \partial q_i^j > 0$ and $C_i^{jj} = \partial^2 C_i / \partial q_i^{j2} \geq 0$. This assumption implies that an increase in quantity leads to an increase in selling costs and that average selling costs are nondecreasing with quantity.

The profit function for each insurer, denoted Π_i, is shown as follows:

$$\Pi_1 = p_1 q_1^A - \sum_{k=1}^{q_1^A} x_k - C_1(q_1^A), \tag{4}$$

$$\Pi_2 = p_2(q_2^A + q_2^N) - \sum_{k=1}^{q_2^A + q_2^B} x_k - C_2(q_2^A + q_2^N). \tag{5}$$

We specify the utility function for each insurer as:

$$u_i = -exp(-r_i \Pi_i), \tag{6}$$

where r_i represents the degree of absolute risk aversion of insurer i and $r_i \geq 0$ because both insurers are assumed to be weakly risk-averse.

Using equation (6) and the assumption that the insurance payout follows a normal distribution, we derive the certainty equivalent for each insurer as:

$$CE_i = E[\Pi_i] - \frac{r_i Var[\Pi_i]}{2}, \tag{7}$$

where $Var[\bullet]$ represents the operator of the variance. Then, the expected profit in each insurer is:

$$E[\Pi_1] = p_1 q_1^A - C_1(q_1^A), \tag{8}$$

$$E[\Pi_2]=(p_2-\mu)(q_2^A+q_2^B)-C_2(q_2^A+q_2^B). \quad (9)$$

The variance in each insurer, denoted $Var\,[\Pi_i]$, can be computed as:

$$Var[\Pi_1]=Var\left[\sum_{k=1}^{q_1^A}x_k\right]=E\left[\left\{\sum_{k=1}^{q_1^A}(x_k-\mu)\right\}^2\right]=$$

$$=\sum_{k=1}^{q_1^A}E\left[(x_k-\mu)^2\right]=\sigma^2 q_1^A, \quad (10)$$

$$Var[\Pi_2]=\sigma^2(q_2^A+q_2^N). \quad (11)$$

Using equations (7) to (11), we show:

$$CE_1=\left(p_1-\mu-\frac{r_1\sigma^2}{2}\right)q_1^A-C_1(q_1^A)=\left(p_1-\mu-\frac{r_1\sigma^2}{2}\right)\times(\alpha^A-p_1+\gamma p_2)-C_1(\alpha^A-p_1+\gamma p_2), \quad (12)$$

$$CE_2=\left(p_2-\mu-\frac{r_2\sigma^2}{2}\right)(q_2^A+q_2^N)-C_2(q_2^A+q_2^N)=\left(p_2-\mu-\frac{r_2\sigma^2}{2}\right)\times$$
$$\times(\alpha^A+\alpha^N-2p_2+\gamma p_1)-C_2(\alpha^A+\alpha^N-2p_2+\gamma p_1). \quad (13)$$

Both insurers choose their insurance premium to maximize their own certainty equivalents. Thus, each optimal insurance premium is satisfied with the following first-order conditions:

$$\frac{\partial CE_1}{\partial p_1}=-2p_1^*+\gamma p_2^*+\alpha^A+\mu+\frac{r_1\sigma^2}{2}-C_1^A\frac{\partial q_1^A}{\partial p_1}=$$
$$=-2p_1^*+\gamma p_2^*+\alpha^A+\mu+\frac{r_1\sigma^2}{2}+C_1^A=0, \quad (14)$$

$$\frac{\partial CE_2}{\partial p_2}=-4p_2^*+\gamma p_1^*+\alpha^A+\alpha^N+2\mu+r_2\sigma^2-C_2^A\frac{\partial q_2^A}{\partial p_2}-$$
$$-C_2^N\frac{\partial q_2^N}{\partial p_2}=-4p_2^*+\gamma p_1^*+\alpha^A+\alpha^N+2\mu+r_2\sigma^2+2C_2^j=0, \quad (15)$$

where superscript "*" represents the optimal value. In addition, the second-order conditions are always satisfied because:

$$\frac{\partial^2 CE_1}{\partial p_1^2}=-2-C_1^{AA}<0, \quad (16)$$

$$\frac{\partial^2 CE_2}{\partial p_2^2}=-4-2C_2^{jj}<0, \quad (17)$$

$$|D|=(2+C_1^{AA})(4+2C_2^{jj})-\frac{\partial q_2^j}{\partial p_1}\frac{\partial q_1^j}{\partial p_2}(1+C_1^{AA})(1+2C_2^{jj})=$$
$$=(2+C_1^{AA})(4+2C_2^{jj})-\gamma^2(1+C_1^{AA})(1+2C_2^{jj})>0. \quad (18)$$

2. Comparative statics

We conduct comparative statics to shed light on the characteristics of each optimal insurance premium.
(1) Average insurance money (μ):

By using the implicit function theorem, we derive the following matrix equation from equations (14) and (15).

$$\begin{pmatrix}-(2+C_1^{AA}) & \gamma(1+C_1^{AA})\\ \gamma(1+2C_2^{jj}) & -(4+2C_2^{jj})\end{pmatrix}\begin{pmatrix}dp_1^*\\ dp_2^*\end{pmatrix}=\begin{pmatrix}-1\\-2\end{pmatrix}d\mu. \quad (19)$$

Using Cramer's rule, the authors compute the derivatives $dp_1^*/d\mu$ and $dp_2^*/d\mu$ as follows:

$$\frac{dp_1^*}{d\mu}=\frac{\begin{vmatrix}-1 & \gamma(1+C_1^{AA})\\ -2 & -(4+2C_2^{jj})\end{vmatrix}}{\begin{vmatrix}-(2+C_1^{AA}) & \gamma(1+C_1^{AA})\\ \gamma(1+2C_2^{jj}) & -(4+2C_2^{jj})\end{vmatrix}}=\frac{2\gamma(1+C_1^{AA})+2C_2^{jj}+4}{|D|}>0, \quad (20)$$

$$\frac{dp_2^*}{d\mu}=\frac{\begin{vmatrix}-(2+C_1^{AA}) & -1\\ \gamma(1+2C_2^{jj}) & -2\end{vmatrix}}{\begin{vmatrix}-(2+C_1^{jj}) & \gamma(1+C_1^{AA})\\ \gamma(1+2C_2^{jj}) & -(4+2C_2^{jj})\end{vmatrix}}=\frac{2(2+C_1^{AA})+\gamma(1+2C_2^{jj})}{|D|}>0. \quad (21)$$

Equations (20) and (21) indicate that an increase in average insurance money leads to an increase in both optimal insurance premiums. This result is intuitive because we can interpret the average insurance money as a constant average cost. Comparing equations (20) and (21), we find:

$$\frac{dp_1^*}{d\mu}\mathop{\gtreqless}\frac{dp_2^*}{d\mu}\Rightarrow 2(1-\gamma)(C_2^{jj}-C_1^{AA})+\gamma\mathop{\gtreqless}0. \quad (22)$$

Equation (22) shows that $C_2^{jj}\geq C_1^{AA}$ is a sufficient condition to realize $dp_1^*/d\mu > dp_2^*/d\mu$. From this result, we simply find that $dp_1^*/d\mu > dp_2^*/d\mu$ when the selling cost of insurer 1 is cheaper than that of insurer 2 and the form of both cost functions is quadratic. This holds because the selling cost, such as the underwriting cost in cooperative insurance, is cheaper than with business insurance, given the advantage of the former in terms of private information.

(2) Variance of the insurance money (σ^2):

The matrix equation is shown as:

$$\begin{pmatrix}-(2+C_1^{AA}) & \gamma(1+C_1^{AA})\\ \gamma(1+2C_2^{jj}) & -(4+2C_2^{jj})\end{pmatrix}\begin{pmatrix}dp_1^*\\ dp_2^*\end{pmatrix}=\begin{pmatrix}-\frac{r_1}{2}\\-r_2\end{pmatrix}d\sigma^2. \quad (23)$$

By using the Cramer's rule, then:

$$\frac{dp_1^*}{d\sigma^2}=\frac{\begin{vmatrix}-\frac{r_1}{2} & \gamma(1+C_1^{AA})\\ -r_2 & -(4+2C_2^{jj})\end{vmatrix}}{\begin{vmatrix}-(2+C_1^{AA}) & \gamma(1+C_1^{AA})\\ \gamma(1+2C_2^{jj}) & -(4+2C_2^{jj})\end{vmatrix}}=\frac{r_2\gamma(1+C_1^{AA})+r_1(2+C_2^{jj})}{|D|}>0, \quad (24)$$

$$\frac{dp_2^*}{d\sigma^2}=\frac{\begin{vmatrix}-\left(2+C_1^{AA}\right) & -\frac{r_1}{2}\\ \gamma\left(1+2C_2^{jj}\right) & -r_2\end{vmatrix}}{\begin{vmatrix}-\left(2+C_1^{jj}\right) & \gamma\left(1+C_1^{AA}\right)\\ \gamma\left(1+2C_2^{jj}\right) & -\left(4+2C_2^{jj}\right)\end{vmatrix}}=\frac{r_2\left(2+C_1^{AA}\right)+\frac{r_1}{2}\gamma\left(1+2C_2^{jj}\right)}{|D|}>0. \quad (25)$$

Equations (24) and (25) imply that an increase in the variance of the insurance money leads to an increase in both optimal insurance premiums. This result is again intuitive because an increase in the variance of insurance money leads to an increase in the risk premium, and ultimately an increase in the average cost per sales quantity. However, we cannot decide which of $dp_1^*/d\sigma^2$ and $dp_2^*/d\sigma^2$ is larger because both derivatives depend on both the degree of absolute risk aversion and the derivatives of the sale cost functions. To consider this simply, we identify two special cases. The first is where both degrees of absolute risk aversions are identical, that is, $r \equiv r_1 = r_2$. In this case, we find:

$$\frac{dp_1^*}{d\sigma^2}\overset{>}{\underset{<}{=}}\frac{dp_2^*}{d\sigma^2}\Rightarrow\frac{r}{2}\left\{2(1-\gamma)\left(C_2^{jj}-C_1^{AA}\right)+\gamma\right\}\overset{>}{\underset{<}{=}}0. \quad (26)$$

Equation (26) shows that $C_2^{jj} \geq C_1^{AA}$ is a sufficient condition to realize $dp_1^*/d\sigma^2 > dp_2^*/d\sigma^2$. In addition, we know that this condition is the same as where the average insurance money changes. This means that the difference in selling cost leads to a difference in the reflection of the insurance premium when the variance of the insurance money changes.

The second special case is where both derivatives of the sales cost functions are the same, that is, $C_i^{jj} \equiv C_1^{AA} = C_2^{jj}$. In this case, we find:

$$\frac{dp_1^*}{d\sigma^2}\overset{>}{\underset{<}{=}}\frac{dp_2^*}{d\sigma^2}\Rightarrow\left\{2-\gamma+(1-\gamma)C_i^{jj}\right\}(r_1-r_2)+\gamma\frac{r_1}{2}\overset{>}{\underset{<}{=}}0. \quad (27)$$

Equation (27) indicates that $r_1 \geq r_2$ is the sufficient condition to realize $dp_1^*/d\sigma^2 > dp_2^*/d\sigma^2$. Thus, if we can assume that the degree of absolute risk aversion is a decreasing function of scale and cooperative insurance is smaller than business insurance, this result implies that the reflection of the insurance premium in cooperative insurance is generally more sensitive than in business insurance when the variance of the insurance money changes.

(3) Degree of absolute risk aversion (r_i):

First, consider the case where r_1 changes. The matrix equation is:

$$\begin{pmatrix}-\left(2+C_1^{AA}\right) & \gamma\left(1+C_1^{AA}\right)\\ \gamma\left(1+2C_2^{jj}\right) & -\left(4+2C_2^{jj}\right)\end{pmatrix}\begin{pmatrix}dp_1^*\\ dp_2^*\end{pmatrix}=\begin{pmatrix}-\frac{\sigma^2}{2}\\ 0\end{pmatrix}dr_1. \quad (28)$$

Then, by Cramer's rule, we have:

$$\frac{dp_1^*}{dr_1}=\frac{\begin{vmatrix}-\frac{\sigma^2}{2} & \gamma\left(1+C_1^{AA}\right)\\ 0 & -\left(4+2C_2^{jj}\right)\end{vmatrix}}{\begin{vmatrix}-\left(2+C_1^{AA}\right) & \gamma\left(1+C_1^{AA}\right)\\ \gamma\left(1+2C_2^{jj}\right) & -\left(4+2C_2^{jj}\right)\end{vmatrix}}=\frac{\sigma^2\left(2+C_2^{jj}\right)}{|D|}>0, \quad (29)$$

$$\frac{dp_2^*}{dr_1}=\frac{\begin{vmatrix}-\left(2+C_1^{AA}\right) & -\frac{\sigma^2}{2}\\ \gamma\left(1+2C_2^{jj}\right) & 0\end{vmatrix}}{\begin{vmatrix}-\left(2+C_1^{jj}\right) & \gamma\left(1+C_1^{AA}\right)\\ \gamma\left(1+2C_2^{jj}\right) & -\left(4+2C_2^{jj}\right)\end{vmatrix}}=\frac{\frac{\sigma^2}{2}\gamma\left(1+2C_2^{jj}\right)}{|D|}>0. \quad (30)$$

Second, consider the case in which r_2 changes. The matrix equation is:

$$\begin{pmatrix}-\left(2+C_1^{AA}\right) & \gamma\left(1+C_1^{AA}\right)\\ \gamma\left(1+2C_2^{jj}\right) & -\left(4+2C_2^{jj}\right)\end{pmatrix}\begin{pmatrix}dp_1^*\\ dp_2^*\end{pmatrix}=\begin{pmatrix}0\\ -\sigma^2\end{pmatrix}dr_2. \quad (31)$$

Then, by Cramer's rule, we have:

$$\frac{dp_1^*}{dr_2}=\frac{\begin{vmatrix}0 & \gamma\left(1+C_1^{AA}\right)\\ -\sigma^2 & -\left(4+2C_2^{jj}\right)\end{vmatrix}}{\begin{vmatrix}-\left(2+C_1^{AA}\right) & \gamma\left(1+C_1^{AA}\right)\\ \gamma\left(1+2C_2^{jj}\right) & -\left(4+2C_2^{jj}\right)\end{vmatrix}}=\frac{\sigma^2\gamma\left(1+C_1^{AA}\right)}{|D|}>0, \quad (32)$$

$$\frac{dp_2^*}{dr_2}=\frac{\begin{vmatrix}-\left(2+C_1^{AA}\right) & 0\\ \gamma\left(1+2C_2^{jj}\right) & -\sigma^2\end{vmatrix}}{\begin{vmatrix}-\left(2+C_1^{jj}\right) & \gamma\left(1+C_1^{AA}\right)\\ \gamma\left(1+2C_2^{jj}\right) & -\left(4+2C_2^{jj}\right)\end{vmatrix}}=\frac{2\sigma^2\left(1+C_1^{AA}\right)}{|D|}>0. \quad (33)$$

The above comparative statics have two key implications. First, we can easily confirm that both optimal insurance premiums increase. In other words, the optimal insurance premium increases even if only the rival insurer's degree of absolute risk aversion increases. Second, although both optimal insurance premiums increase, the degree of increase in the optimal insurance premium differs. Because $\sigma^2(2 + C_1^{AA}) > (\sigma^2\gamma/2)(1 + 2C_1^{AA})$ and $\sigma^2\gamma(1 + C_1^{AA}) < \sigma^2(1 + C_1^{AA})$, we conclude that the change in optimal insurance premium of the insurer thatchanges its absolute risk aversion is always larger than that of insurer that does not change its absolute risk aversion.

(4) Potential demand in each market (α^j):

First, consider the case where α^A changes. In this case, the matrix equation is:

$$\begin{pmatrix}-\left(2+C_1^{AA}\right) & \gamma\left(1+C_1^{AA}\right)\\ \gamma\left(1+2C_2^{jj}\right) & -\left(4+2C_2^{jj}\right)\end{pmatrix}\begin{pmatrix}dp_1^*\\ dp_2^*\end{pmatrix}=\begin{pmatrix}-\left(1+C_1^{AA}\right)\\ -\left(1+2C_2^{jj}\right)\end{pmatrix}d\alpha^A \quad (34)$$

By Cramer's rule, we have:

$$\frac{dp_1^*}{d\alpha^A}=\frac{\begin{vmatrix}-(1+C_1^{AA}) & \gamma(1+C_1^{AA})\\ -(1+2C_2^{ij}) & -(4+2C_2^{ij})\end{vmatrix}}{\begin{vmatrix}-(2+C_1^{AA}) & \gamma(1+C_1^{AA})\\ \gamma(1+2C_2^{ij}) & -(4+2C_2^{ij})\end{vmatrix}}=\frac{(1+C_1^{AA})\{2(2+C_2^{ij})+\gamma(1+2C_2^{ij})\}}{|D|}>0, \quad (35)$$

$$\frac{dp_2^*}{d\alpha^A}=\frac{\begin{vmatrix}-(2+C_1^{AA}) & -(1+C_1^{AA})\\ \gamma(1+2C_2^{ij}) & -(1+2C_2^{ij})\end{vmatrix}}{\begin{vmatrix}-(2+C_1^{ij}) & \gamma(1+C_1^{AA})\\ \gamma(1+2C_2^{ij}) & -(4+2C_2^{ij})\end{vmatrix}}=\frac{(1+2C_2^{ij})\{2+C_1^{AA}+\gamma(1+C_1^{AA})\}}{|D|}>0. \quad (36)$$

Equations (35) and (36) imply that an increase in the potential demand in market A leads to an increase in both optimal insurance premiums. This result is intuitive because both insurers can sell their insurance products in market A. In addition, from equations (34) and (35), we know:

$$\frac{dp_1^*}{d\alpha^A}\underset{<}{\overset{>}{=}}\frac{dp_2^*}{d\alpha^A}\Rightarrow 2+3C_1^{AA}-2C_2^{ij}\underset{<}{\overset{>}{=}}0. \quad (37)$$

Equation (37) indicates that $C_1^{AA} \geq C_2^{ij}$ is the sufficient condition to realize $dp_1^*/d\alpha^A > dp_2^*/d\alpha^A$. However, whether this condition is actually satisfied remains unclear. This means the reflection of the insurance premium in cooperative insurance when the potential demand in market A changes may be smaller than that in business insurance, even though cooperative insurance is restricted to selling its products in market A.

Next, consider the case where α^N changes. In this case, the matrix equation is:

$$\begin{pmatrix}-(2+C_1^{AA}) & \gamma(1+C_1^{AA})\\ \gamma(1+2C_2^{ij}) & -(4+2C_2^{ij})\end{pmatrix}\begin{pmatrix}dp_1^*\\ dp_2^*\end{pmatrix}=\begin{pmatrix}0\\ -(1+2C_2^{ij})\end{pmatrix}d\alpha^N. \quad (38)$$

By Cramer' rule, we have:

$$\frac{dp_1^*}{d\alpha^N}=\frac{\begin{vmatrix}0 & \gamma(1+C_1^{AA})\\ -(1+2C_2^{ij}) & -(4+2C_2^{ij})\end{vmatrix}}{\begin{vmatrix}-(2+C_1^{AA}) & \gamma(1+C_1^{AA})\\ \gamma(1+2C_2^{ij}) & -(4+2C_2^{ij})\end{vmatrix}}=\frac{\gamma(1+C_1^{AA})(1+2C_2^{ij})}{|D|}>0, \quad (39)$$

$$\frac{dp_2^*}{d\alpha^N}=\frac{\begin{vmatrix}-(2+C_1^{AA}) & 0\\ \gamma(1+2C_2^{ij}) & -(1+2C_2^{ij})\end{vmatrix}}{\begin{vmatrix}-(2+C_1^{ij}) & \gamma(1+C_1^{AA})\\ \gamma(1+2C_2^{ij}) & -(4+2C_2^{ij})\end{vmatrix}}=\frac{(2+C_1^{AA})(1+2C_2^{ij})}{|D|}>0. \quad (40)$$

Equations (39) and (40) imply that an increase in potential demand in market N leads to an increase in both optimal insurance premiums. This result is very intuitive for insurer 2, but not intuitive for insurer 1 because insurer 2 can only sell its products in market N. This result shows that insurer 1 has an incentive to increase its optimal insurance premium when the potential demand in market N increases and the optimal insurance premium of insurer 2 increases because both insurance premiums are strategic complements. However, any change in the optimal insurance premium of insurer 2 is always larger than that of insurer 1 because $\gamma(1 + C_1^{AA})(1+2C_2^{ij}) < (2 + C_1^{AA})(1+2C_2^{ij})$.

Conclusions

In this paper, we investigated competition in insurance markets containing both cooperative and business insurers. We constructed a model and conducted comparative statics to identify the characteristics of the equilibrium insurance premium. Our main results are as follows. First, an increase in average insurance money leads to an increase in the optimal insurance premiums of both insurers when we interpret the average insurance money as a constant average cost. Second, an increase in the variance of insurance money leads to an increase in the optimal insurance premiums of both insurers when an increase in the variance of insurance money leads to an increase in the risk premium, and ultimately an increase in the average cost per sales quantity. Third, any change in the optimal insurance premium of the insurer that changes its absolute risk aversion is always larger than that of the insurer that does not change its absolute risk aversion. Finally, an increase in the potential demand in the cooperative insurance market leads to an increase in both optimal insurance premiums when both insurers sell their insurance products in the cooperative insurance market.

However, we do identify some limitations with our model. First, we implicitly assume that the cooperative insurer initially decided to sell in the restricted insurance market, thus our model is unable to ascertain why the cooperative insurer restricted the scope of the insurance market in the first instance. Second, in our model we are unable to identify competition among cooperative insurers and/or business insurers. This is important, as there are typically many cooperative and business insurers in insurance markets. To better reflect real-world insurance markets, it would then be necessary to increase the number of cooperative and business insurers in our model (from one of each) to confirm the effects of competition among cooperative (business) insurers.

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