CARE MANAGER AND MORAL HAZARD IN LONG-TERM CARE INSURANCE SYSTEM*

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Abstract

Developing the extensive game modeled by Ma and McGuire (1997), this paper analyzes a long-term care insurance system wherein a care manager devises a care plan, and a care provider takes care of the beneficiary according to that plan. The care manager, as the first mover in the game, determines the quantity of care service for the beneficiary, while the provider, the follower, chooses the effort level of the care (or the "quality") that is not contractible. In the principal-agent relationship, a moral hazard problem in terms of the effort of the provider might arise. This paper examines whether the insurance and reimbursement system can control the incentive of the agent to implement the socially optimal solution. Further, the paper introduces penalty systems by monitoring where the care manager monitors the benefit level provided by the provider ex post to resolve the moral hazard problem. The results show that the separation of care management and care provision might create some serious problems in this system.

Key words: care manager, long-term care insurance system, moral hazard, supply-side cost sharing, penalty system

1　Introduction

Long-term care is becoming increasingly important in modern developed countries, which have aging populations that are growing rapidly. One of the most important political issues will be the design of long-term care insurance systems. While Germany and Japan introduced universal long-term care insurance systems as social insurance systems, there are many differences between them, as summarized in Campbell, Ikegami, and Gibson (2010). In addition to the list of differences pointed out by these researchers, we find another signifi-

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cant difference in terms of their implementation: the care manager. Japan integrates care managers into the long-term care insurance system, while Germany does not.[1] In fact, a care manager plays a major role in the Japanese system.[2] The care manager devises the care plan in order to specify the care that will be provided, arranges for a care provider for the beneficiary, and supervises the care process. The provider must be a different agent from the care manager. The separation of planning and provision of care would create a moral hazard. On the contrary, the care manager as a monitor can solve this problem.

Developing the extensive game modeled by Ma and McGuire (1997), this paper analyzes the long-term care insurance system, wherein the care manager devises a care plan and the care provider takes care of the beneficiary according to that plan. Although the basic model is based on the physician-patient relationship, which has been modeled in many works in the field of health economics, it is distinctive in the following aspects. First, the quantity of care is determined by the care manager, not the provider or the consumer. The care manager contracts with the provider for the quantity, and the provider, corresponding to the physician of preceding models, must follow the manager. In this sense, the care manager and the provider establish a principal-agent relationship. Second, both the care manager and the provider are assumed to be "imperfect agents" who consider the benefit brought about by the care in addition to their own profit because of their professional aptitude.[3] Thus, the copayment that the consumer must bear would play a key role in this situation. Finally, the care manager monitors and assesses the performance of the provider. After the monitoring, the provider's effort is still ambiguous but the care manager can estimate the level of the benefit generated from the care by, for example, a consumer complaint.[4] When the generated level is observed to be under the expected level, either the care manager or the provider is penalized. The present paper examines this penalty system.

The main finding of this paper is as follows. In the long-term care system, the moral hazard problem arises because the effort of the provider is low and the care quantity is not adequate. The supply-side cost sharing rule according to which the provider might bear the cost of care partially cannot be used as a policy instrument. On the contrary, copayment to the consumer is useful for avoiding the moral hazard. Further, penalty to the provider might be useful when copayment is not effective, whereas penalty to the care manager is futile.

Among preceding studies, Ellis and McGuire (1986) analyze a cost-based reimbursement system wherein the physician is assumed to be interested in both the hospital's profit and the

1 Gibson and Redfoot (2007) suggest that there is debate for system reform in Germany, which includes the introduction of a care manager. According to them, care managers will be integrated into local support centers, with a guideline of 100 beneficiaries per care manager (p. 51).

2 Detailed descriptions of the long-term care system in Japan are provided in Ikegami (1997); Campbell and Ikegami (2000); Matsuda and Yamamoto (2001); Ikegami and Campbell (2002); and Campbell, Ikegami, and Gibson (2010).

3 We can interpret this characteristic of the objective functions of the care manager and the provider as a "reduced form" for the situation wherein they compete for the consumer. In this case, the penalty can be interpreted as the potential loss due to the dissatisfaction of consumers. The situation then becomes similar to the model in Section 3.3 in McGuire (2000).

patient's benefit. We follow this assumption of imperfect agency. Ellis and McGuire (1990) discuss the same problem by using a bargaining solution of care quantity between the physician and the patient. We are grateful to Ma and McGuire (1997) for the basic framework of the model. Their model assumes that the physician's decision on the degree of effort is made before the patient chooses the purchased quantity of medical service. However, while the effort is assumed to not be verifiable, the physician can virtually commit to his/her effort in the subgame played by the physician and the patient. Ma and McGuire (1997) provide several interpretations for this setting but, in our judgment, it is natural to assume that the effort is chosen after the quantity is determined. Revising the model, we can compare these results.

The rest of this paper is organized as follows. In Section 2, the framework of the model is presented. In Section 3, the basic results are described in order to understand the moral hazard problem. To solve this problem, the concept of penalty systems is introduced in Section 4. In Section 5, the optimal copayment is analyzed, and in Section 6, a discussion of the implications is presented. Finally, Section 7 provides concluding remarks.

2 Analytical model

In the model described below, there are three main players: care manager, provider, and insurer. The care manager is supposed to design the care plans and hold a contract with a provider who is licensed for long-term care. The provider visits and takes care of the beneficiary, or consumer, to execute the plan designed by the care manager.[5] The care is characterized by two elements: quantity and quality. The quantity can be contractible and specified in the "scheme drawing" that the care manager makes for the provider. For example, the provider is supposed to visit the consumer twice a week and help him/her take a bath, as a part of the care-giving service. Because such services can be observed by all parties, the provider must fulfill his/her obligations written on the contract scheme. On the contrary, the quality of care may not be contractible; it may depend on how much effort the provider makes to satisfy the consumer through the service. For example, the efforts would involve kindness, eagerness, and diligence. The insurer creates an insurance system for the consumer and a reimbursement system for both the care manager and the provider in order to maximize the consumer's utility subject to the budget constraints.

2.1 Consumer's utility and welfare

Care benefits the consumer through two inputs: quantity (τ) and effort (ε).[6] Let

4 In fact, care managers in Japan have a duty to visit the consumers in the contracts at least once per month. If low performance is observed, the care manager is required to rewrite his/her care plan or change the provider for the consumer.

5 We presumably consider home care rather than institutional care. That is, the provider is assumed to engage in his/her regular activities in the elderly person's home.

6 We use letters to denote variables, following the approach of Ma and McGuire (1997).

$F(\tau, \varepsilon)$ denote the benefit production function that is monetary-equivalent. The function is assumed to have a unique maximum point with respect to τ and ε. In the special case used in this model, the benefit takes the following quadratic form:

$$F(\tau, \varepsilon)=a\tau+b\varepsilon-\frac{1}{2}(\tau^2+2d\tau\varepsilon+\varepsilon^2), \tag{1}$$

where we assume $a>0$, $b>0$, and $0<d^2<1$. The last assumption implies that the "own effect" dominates the "cross effect" of the inputs on the benefit. Parameter d determines whether the inputs, τ and ε, are substitutes or complements. When $d>0$ ($F_{\tau\varepsilon}<0$), these inputs are substitutes, and when $d<0$ ($F_{\tau\varepsilon}>0$), they are complements. For any τ and ε, the value of $F(\tau, \varepsilon)$ is assumed to be bound to s, the monetary equivalent of the disability that elderly people face in the activities of daily living. That is, full insurance ($F(\tau, \varepsilon)=s$) does not exist in this model.

The consumer must pay insurance premium $\alpha \geq 0$ to the insurer. If an elderly person is eligible for long-term care, he/she receives the following welfare:

$$W=w-\alpha-\beta\tau-s+F(\tau, \varepsilon), \tag{2}$$

where w is the initial income, α is the insurance premium, and β is the copayment per unit of care. The premium must be paid before the consumer's physical condition is revealed. Suppose that the probability that the consumer requires care is p; accordingly, the probability that he/she does not require care is $1-p$. Hence, the expected utility of the consumer is

$$EU=pU[w-\alpha-\beta\tau-s+F(\tau, \varepsilon)]+(1-p)U(w-\alpha). \tag{3}$$

One important assumption in this model is that both the care manager and the provider are "imperfect agents" of the consumer. That is, they are concerned about not only their own profits but also the consumer's welfare. Therefore, their objective functions must include the consumer's welfare W in Equation. (2). Hereafter, we write this value as $W(\tau, \varepsilon, \alpha, \beta)$, holding w, s, and p fixed.

2.2 Care manager

The care manager is supposed to design the care plan. In this model, he/she determines the quantity of care that is provided by the provider. Thus, the quantity, τ, is contractible. The insurer pays reimbursement ρ^0 to the care manager for his/her work. The cost for drawing up the plan is c^0. Therefore, the care manager maximizes a weighted sum of his/her profit and the consumer's utility; given a weight, $\phi^0 \in (0, 1)$, his/her objective function is $\Gamma(\tau, \varepsilon, \alpha, \beta) \equiv (1-\phi^0)(\rho^0-c^0)+\phi^0 W(\tau, \varepsilon, \alpha, \beta)$. Note that in this model, the consumer (or his/her family) does not determine anything about care.

2.3 Provider

The provider executes the plan that the care manager designs for the consumer and makes an effort ε to provide care. Consider a supply-side cost sharing rule where he/she might bear the cost of care partially. Let c denote the cost per unit of care. The insurer pays the provider in two ways: a fixed fee ρ for a consumer and a reimbursement $\delta+c$ per unit of care. The reimbursement δ can be either positive or negative, but it is natural to assume $\delta \geq -c$. His/her revenue is $\rho + \delta\tau$. In addition, he/she bears the cost of effort, $G(\varepsilon)$ ($G(0)=0$, $G'>0$, and $G''>0$). The provider maximizes a weighted sum of his/her profit and the consumer's benefit with weight $\phi \in (0, 1)$. Therefore, the objective function is

$$(1-\phi)[\rho + \delta\tau - G(\varepsilon)] + \phi W(\tau, \varepsilon, \alpha, \beta).$$

For simplicity, we assume $G(\varepsilon) = \varepsilon^2/2$.

2.4 Insurer

The insurer chooses a care manager and delegates him/her to the management of care. Then, he/she maximizes the consumer's utility subject to the budget constraint for insurance and zero-profit constraints. The budget constraint requires that the insurance premium must equal the expected value of the reimbursements to both the care manager and the provider minus the copayment:

$$\alpha = p[\rho^0 + \rho + (\delta + c - \beta)\tau]. \tag{4}$$

The zero-profit constraints are

$$\rho^0 - c^0 = 0, \tag{5}$$
$$\rho + \delta\tau - G(\varepsilon) = 0. \tag{6}$$

The insurer chooses $(\alpha, \beta, \rho^0, \rho, \delta)$ in his/her problem.

2.5 Timeline

The model is described as a four-stage game as follows. In the first stage, the insurer chooses the insurance system for the consumer and the reimbursement system for the care manager and the provider. For the insurance, he/she determines premium α and copayment β. He/she also specifies ρ^0 as the reimbursement for the care manager and ρ and δ for the provider. In the second stage, "Nature" determines the consumer's physical condition with probability p. In the third stage, the care manager chooses the quantity of care specified in the care plan for the consumer. The care plan is then offered to the provider, who cannot reject it or make a counterproposal. In the final stage, the provider chooses his/her effort level.

3 Basic results and moral hazard

3.1 Second-best solution

First, as the benchmark case, we derive the second-best solution. It is the solution in the regime where the effort is contractible; the care manager can choose the optimal level of effort to maximize his/her objective function.[7]

7 We use these terms in keeping with Ma and McGuire (1997). In this usage, the first-best solution in the model must be the set of optimal τ, ε, α, β, ρ^0, ρ, and δ to maximize the consumer's utility in Equation. (3), given the budget constraints. We will not derive the solution in this paper because of the analytical diffculty.

In this case, the care manager can specify both the quantity and the effort in the contract with the provider and then solve the following problem:

$$\max_{\tau,\varepsilon} \Gamma(\tau,\varepsilon,\alpha,\beta) = (1-\phi^0)(\rho^0 - c^0) + \phi^0 W(\tau,\varepsilon,\alpha,\beta). \tag{7}$$

Let β^{SB} denote the copayment determined by the insurer in the first stage in the second-best regime. Given the copayment, β^{SB}, the optimal quantity and effort can be derived as follows:

$$\tau^{SB} = \frac{1}{1-d^2}(a - bd - \beta^{SB}), \tag{8}$$

$$\varepsilon^{SB} = \frac{1}{1-d^2}(b - ad + \beta^{SB} d). \tag{9}$$

Note that if copayment β^{SB} is larger, the quantity must be smaller. In this model, the care manager is concerned about the consumer's budget constraint, which induces him/her to sacrifice a part of the benefit of care for the consumer's out-of-pocket payment. In turn, a greater effort must compensate for smaller quantity in order to maintain the level of benefit in the case of substitutes ($d>0$); however, a smaller effort is needed for smaller quantity in the case of complements ($d<0$).

3.2 Third-best solution

Next, we examine the third-best regime where the quantity is contractible between the care manager and the provider, but the effort is not.

Formally, the solution can be derived through backward induction as follows. The fourth stage's solution for the provider's effort is chosen according to the quantity specified in the care plan. The solution can be written as $\varepsilon(\tau)$. In the third stage, the care manager maximizes $\Gamma(\tau,\varepsilon(\tau),\alpha,\beta) = (1-\phi^0)(\rho^0 - c^0) + \phi^0 W(\tau,\varepsilon(\tau),\alpha,\beta)$ with respect to τ. Hence, given a copayment denoted by β^{TB}, the care manager obtains the solutions for quantity and effort:

$$\tau^{TB} = \frac{1}{1-\mu d^2}(a - \mu bd - \beta^{TB}), \tag{10}$$

$$\varepsilon^{TB} = \frac{\phi}{1-\mu d^2}(b - ad + \beta^{TB} d), \tag{11}$$

where $\mu = (2-\phi)\phi$. (The derivation is shown in Appendix A.)

We will now comment on this result. The third-best quantity and effort in this model depend on β^{TB}, the copayment determined by the insurer, but they do not depend on δ, the margin over the cost reimbursed for the provider. That is, the insurer cannot implement either quantity or effort by choosing the reimbursement. This is a main difference between this model and the model of Ma and McGuire (1997), where the insurer can choose δ to control the quantity and effort. In this model, the care manager, as the leader of the game, determines the quantity whose cost is borne (partly) by the provider, not by the care manager him/herself. Hence, the only policy instrument for the insurer in this model is copayment β.

If the copayment is not used as a policy instrument, the second-best solution cannot be achieved in the third-best regime. We obtain the following result.

Proposition 1: Suppose $\beta^{TB}=\beta^{SB}$. Then, if the quantity and effort are substitutes ($d>0$), the optimal quantity in the third-best regime is larger than that in the second-best regime ($\tau^{SB}<\tau^{TB}$), and if they are complements, the optimal quantity in the third-best regime is smaller than that in the second-best regime ($\tau^{SB}>\tau^{TB}$). The optimal effort in the third-best regime is smaller than that in the second-best regime ($\varepsilon^{SB}>\varepsilon^{TB}$), regardless of substitution between quantity and effort.

These results are common in the literature on health economics in terms of physician agency. In the third-best regime, the provider has a chance to exhibit opportunistic behavior when choosing the level of effort whose cost must be borne by him/herself. This is the moral hazard problem in the model. In this problem, the provider is expected to make a small effort. Without the copayment system (i.e., $\beta^{SB}=\beta^{TB}=0$), the effort level must be smaller than the level expected in the second-best regime. Figure 1 illustrates the mechanism of the moral hazard in the case of substitutes ($d>0$). The slope of the reaction curve in the third-best regime, $\varepsilon(\tau)=\phi(b-d\tau)$, is less steep than that of the first-order condition in terms of the effort in the second-best regime, $\varepsilon(\tau)=b-d\tau$. This results in $\varepsilon^{SB}>\varepsilon^{TB}$ and $\tau^{SB}<\tau^{TB}$. Thus, especially in the case of substitutes, the moral hazard problem might be serious for two causes: over-quantity and under-effort. Over-quantity of care creates a financial crisis for the insurance budget, and under-effort leads to the loss of consumers' confidence in the insurance system. Again, the supply-side cost sharing rule cannot work in this case. The insurer may use the copayment for the consumer to tackle these problems.

The next proposition asserts that the copayment cannot resolve the moral hazard perfectly. (The proof is given in Appendix B.)

Proposition 2: There does not exist copayment β^{TB} such that the second-best solution is achieved in the third-best regime for either substitutes or complements. That is, there exists no β^{TB} such that τ^{SB} and $\varepsilon^{SB}=\varepsilon^{TB}$ for any case.

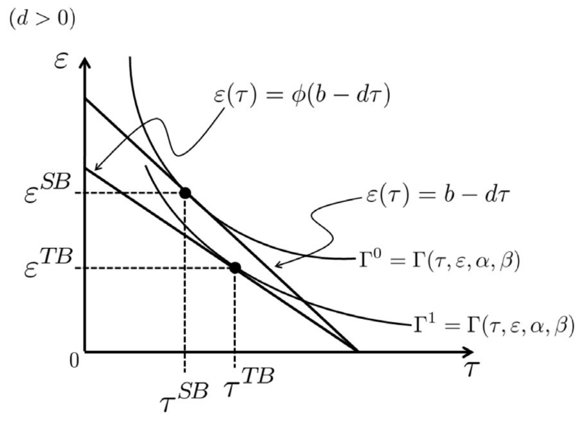

Figure 1: Solution patterns on three regions. ($\beta^{SB}=\beta^{TB}$)

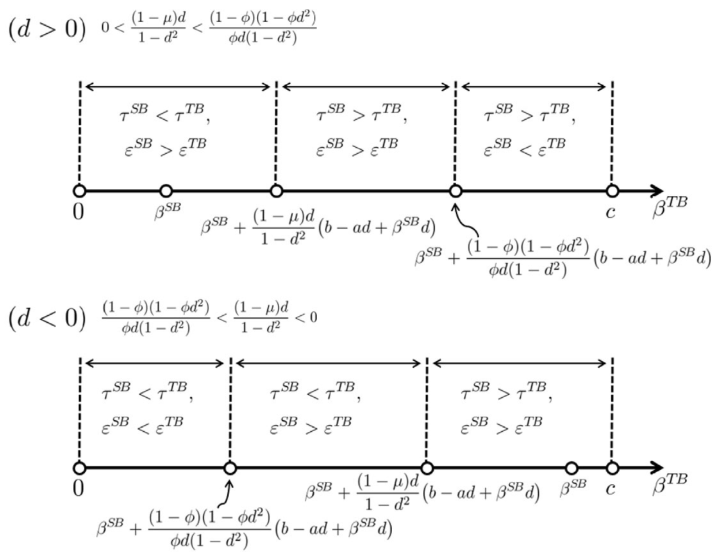

Figure 2: The second-best and third-best solutions. ($\beta^{SB}\neq\beta^{TB}$)

In fact, τ^{SB}, ε^{SB}, and ε^{TB} generate three patterns on the discrepancy between β^{SB} and β^{TB}. Figure 2 shows how the patterns must be in the cases of substitutes and complements. In the case of substitutes, suppose that in the third-best regime, the insurer prefers to decrease the quantity as close as possible to the second-best level. Then, he/she may raise the copayment to the level of $\frac{(1-\mu)d}{1-d^2}(b-ad+\beta^{SB}d)$. However, the effort is still under the optimal level at this point. Beyond the level of the copayment, the effort rises to the optimal level, but the quantity must be sacrificed. At the level of $\frac{(1-\phi)(1-\phi d^2)}{\phi d(1-d^2)}(b-ad+\beta^{SB}d)$, the effort reaches the satisfying level, but the quantity goes far beyond the optimal level.

The conflict may be eased if these two optimal levels are close to each other. In fact, when d, the substitution degree, becomes large, the middle regions in Figure 2 become narrow. Similarly, when the weight on the consumer's welfare, ϕ, approaches unity, the conflict is eased. In summary,

$$\frac{\partial}{\partial d}\left(\frac{1-\phi}{\phi}\,\frac{1-\mu d^2}{d(1-d^2)}\right)<0,\qquad \frac{\partial}{\partial \phi}\left(\frac{1-\phi}{\phi}\,\frac{1-\mu d^2}{d(1-d^2)}\right)<0,$$

where $\frac{1-\phi}{\phi}\,\frac{1-\mu d^2}{d(1-d^2)}=\frac{(1-\phi)(1-\phi d^2)}{\phi d(1-d^2)}-\frac{(1-\mu)d}{(1-d^2)}$.

4 Penalty systems

This section considers another instrument for the insurer to resolve the moral hazard problem: the penalty system. In the penalty system, the consumer's benefit created by the care is revealed ex post with a given probability, and every party can observe that the level is less than what was expected. For example, suppose that the insurer can establish guidelines for providing care and announce a target level of the benefit that is expected to be achieved before the care manager contracts with the provider. If the realized benefit is shorter than the target level, the care manager or the provider must be blamed for it. In any case, the person who is considered responsible for the shortage is penalized through monetary compensation or damage to one's reputation. In Section 4.1, we will examine the case where the provider is penalized, and in Section 4.2, we will explore the case where the care manager is penalized.

4.1 Penalty to the provider

Let $\bar{F}$ denote the target level of the consumer's benefit that is announced by the insurer in advance. Consider a simple rule for penalty; the shortage of the benefit, $\bar{F}-F(\tau,\varepsilon)$, is deducted from the provider's profit in the case that the realized benefit is revealed with probability q.

Therefore, the problem of the care manager is

$$\max_{\tau}\ \Gamma(\tau,\varepsilon,\alpha,\beta)=(1-\phi^0)(\rho^0-c^0)+\phi^0 W(\tau,\varepsilon,\alpha,\beta), \tag{12}$$

$$\text{s.t. } \varepsilon\in\operatorname*{argmax}_{\varepsilon'}\ (1-\phi)\{[\rho+\delta\tau-G(\varepsilon')]-q[\bar{F}-F(\tau,\varepsilon')]\}+\phi W(\tau,\varepsilon',\alpha,\beta). \tag{13}$$

The effort optimized by the provider, given the quantity, is

$$\varepsilon=\psi(b-d\tau)\quad\text{where }\psi\equiv\frac{\phi+(1-\phi)q}{1+(1-\phi)q}. \tag{14}$$

Let β^{P1} denote the copayment in this penalty system. Then, we derive the solutions for this regime as follows:

$$\tau^{P1}=\frac{1}{1-\nu d^2}(a-\nu bd-\beta^{P1}), \tag{15}$$

$$\varepsilon^{P1}=\frac{\psi}{1-\nu d^2}(b-ad-\beta^{P1}d), \tag{16}$$

where $\nu=(2-\psi)\psi$.

The following propositions show whether the penalty system can resolve the moral hazard without copayment.

Proposition 3: Suppose $\beta^{TB}=\beta^{P1}$. Then, if the quantity and effort are substitutes $(d>0)$, the optimal quantity in the third-best regime is larger than that in the penalty regime $(\tau^{TB}>\tau^{P1})$, and if they are complements, the optimal quantity in the third-best regime is smaller than that in the penalty regime $(\tau^{TB}>\tau^{P1})$. The optimal effort in the third-best regime is smaller than that in the penalty regime $(\varepsilon^{TB}<\varepsilon^{P1})$, regardless of substitution between quantity and effort.

Proposition 4: Suppose $\beta^{SB}=\beta^{P1}$. Then, in the case of substitutes $(d>0)$, the solution for quantity in the penalty regime is larger than that in the second-best regime $(\tau^{SB}>\tau^{P1})$. Otherwise, the solution in the second-best regime is larger than that in the penalty regime $(\tau^{SB}<\tau^{P1})$. In any case, the second-best effort is larger than the penalty effort $(\varepsilon^{SB}>\varepsilon^{P1})$.

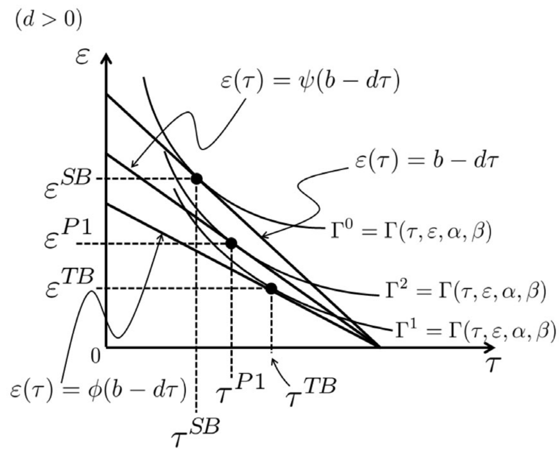

Figure 3: The penalty system. ($\beta^{SB} = \beta^{TB} = \beta^{P1}$)

The differences between the quantities and efforts are as follows:

$$\tau^{TB} - \tau^{P1} = \frac{(\nu - \mu)d}{(1-\mu d^2)(1-\nu d^2)}(b - ad + \beta d),$$

$$\varepsilon^{TB} - \varepsilon^{P1} = \frac{(\phi - \psi)(1-\phi\psi d^2)}{(1-\mu d^2)(1-\nu d^2)}(b - ad + \beta d),$$

$$\tau^{SB} - \tau^{P1} = \frac{(\nu - 1)d}{(1-\mu d^2)(1-\nu d^2)}(b - ad + \beta d),$$

$$\varepsilon^{SB} - \varepsilon^{P1} = \frac{(1-\psi)(1-\psi d^2)}{(1-\mu d^2)(1-\nu d^2)}(b - ad + \beta d),$$

where $\mu < \nu < 1$ and $\phi < \psi < 1$.

The implications of these propositions are simple. Considering the penalty imposed on his/her profit, the provider wishes to raise his/her effort from the third-best level, given the quantity required by the care manager. The reaction function in this case is $\varepsilon(\tau) = \psi(b - d\tau)$. Because $\phi < \psi < 1$, the slope of the reaction curve is steeper than that of the third-best level but less steep than that of the second-best level, as shown in Figure 3. Hence, the penalty system can resolve the moral hazard partially.

However, the next proposition shows that the penalty system is not a "perfect" solution.

Proposition 5: There does not exist copayment β^{P1} such that $\tau^{SB} = \tau^{P1}$ and $\varepsilon^{SB} = \varepsilon^{P1}$ for either substitutes or complements.

This is proved in the same manner as that in Proposition 2.

4.2 Penalty to the care manager

Next, consider the case where the care manager is penalized. Because the shortage of the benefit, $\bar{F} - F(\tau, \varepsilon)$, is deducted from the care manager's profit with probability q, the problem faced by the care manager is

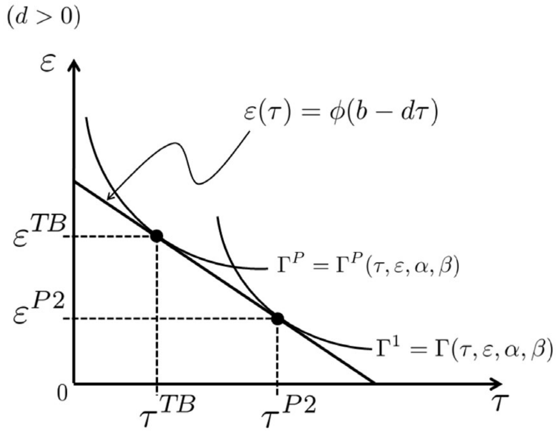

Figure 4: Penalty to the care manager. (d>0)

$$\max_{\tau} \ \Gamma^P(\tau, \varepsilon, \alpha, \beta) \equiv (1-\phi^0)\{(\rho^0 - c^0) - q[\bar{F} - F(\tau, \varepsilon')]\} + \phi^0 W(\tau, \varepsilon, \alpha, \beta), \quad (17)$$

$$\text{s.t.} \ \ \varepsilon \in \underset{\varepsilon'}{\operatorname{argmax}} \ (1-\phi)[\rho + \delta\tau - G(\varepsilon')] + \phi W(\tau, \varepsilon', \alpha, \beta). \quad (18)$$

Solving this problem, we obtain the following solutions:

$$\tau^{P2} = \frac{1}{1-\mu d^2}(a - \mu bd - \gamma\beta^{P2}), \quad (19)$$

$$\varepsilon^{P2} = \frac{\phi}{1-\mu d^2}(b - ad + \gamma\beta^{P2} d), \quad (20)$$

where $\gamma = \phi^0/(\phi^0 + (1-\phi^0)q)$, and β^{P2} is the copayment in this system.

Comparing Equations. (10) and (11) with Equations. (19) and (20), we can evaluate this system when the copayment is not used. Because $\gamma < 1$ for any $\phi^0 \in (0, 1)$ and $q \in (0, 1)$, we obtain the following proposition:

Proposition 6: Suppose $\beta^{SB} = \beta^{TB} = \beta^{P2}$. Then, penalty to the care manager aggravates the moral hazard problem. Thus, $\tau^{SB} < \tau^{TB} < \tau^{P2}$ and $\varepsilon^{SB} > \varepsilon^{TB} > \varepsilon^{P2}$, when $\beta^{SB} = \beta^{TB} = \beta^{P2}$.

Consequently, penalty to the care manager is a "bad policy" unless the copayment is used.

The implication of Proposition 6 may be clear. If the care manager is supposed to be blamed for the shortage of the benefit, he/she will be more eager to raise the benefit. However, because the reaction of the provider cannot be changed, he/she must raise the quantity, which in turn leads to lower effort. Figure 4 illustrates the implication of the proposition. For any α and β, the indifference curve in terms of Γ^P must have a steeper slope than that of the curve in terms of Γ at any point (τ, ε). As shown in Figure 4, these curves are located such that they are tangent to the same reaction curve, $\varepsilon(\tau) = \phi(b - d\tau)$, which implies that $\tau^{TB} < \tau^{P2}$ and $\varepsilon^{TB} > \varepsilon^{P2}$.

5 Optimal copayments

Finally, let us consider the equilibrium copayment and premium. Because it is difficult to derive the "full" solutions for β and α analytically, we only show some pictures in the case of $d \to +0$. When d approaches 0, the solutions for quantity and effort, as functions of β, approach the following values: $\tau^{SB}(\beta)=a-\beta$, $\tau^{TB}(\beta)=a-\beta$, $\tau^{P1}(\beta)=a-\beta$, $\varepsilon^{SB}(\beta)=b$, $\varepsilon^{TB}(\beta)=\phi b$, and $\varepsilon^{P1}(\beta)=\psi b$. The insurer's problem in each regime is

$$\max_{\alpha,\beta} EU^r(\beta,\alpha) \equiv pU[w-\alpha-\beta\tau^r(\beta)-s+F(\tau^r(\beta),\ \varepsilon^r(\beta))]+(1-p)U(w-\alpha), \tag{21}$$

$$\text{s.t. } \alpha=[c^0+G(\varepsilon^r(\beta))+(c-\beta)\tau^r(\beta)]. \qquad r=SB,\ TB,\ P1, \tag{22}$$

where the constraint equation is derived from Equations. (4), (5), and (6). Figure 5 illus-

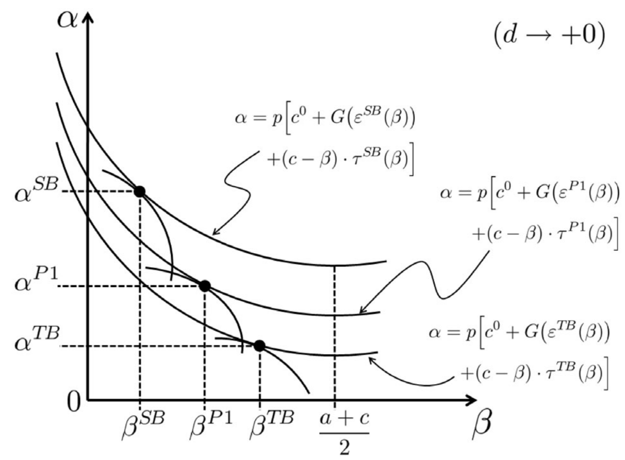

Figure 5: A solution (β,α) when $d \to +0$. (Case 1)

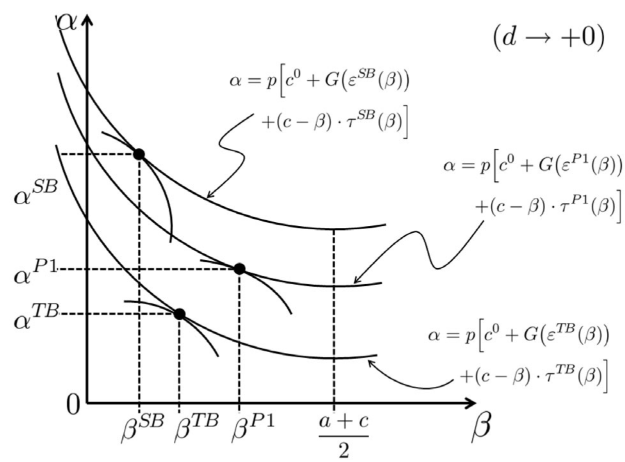

Figure 6: A solution (β,α) when $d \to +0$. (Case 2)

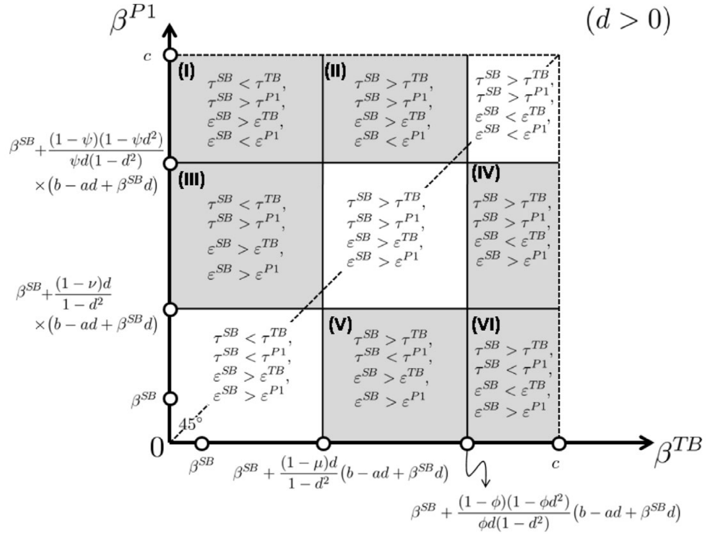

Figure 7: Solution patterns on (β^{TB}, β^{P1})

trates a set of solutions for the problem in three regimes. Letting $SLOPE^r$ denote the slope of the indifference curve in regime r, we can verify that $|SLOPE^{SB}| > |SLOPE^{TB}| > |SLOPE^{P1}|$ at any point (β, α). Accordingly, if the constraint curves are close to each other ($\phi \rightarrow 1$), it is possible that $\beta^{SB} < \beta^{TB} < \beta^{P1}$, as shown in Figure 5. In this case, it is possible that $\tau^{TB} < \tau^{SB} < \tau^{P1}$ and $\varepsilon^{TB} < \varepsilon^{SB} < \varepsilon^{P1}$, which implies that the penalty system does not work and that it may even worsen the moral hazard. On the contrary, Figure 6 suggests another possibility: $\beta^{SB} < \beta^{P1} < \beta^{TB}$. In this case, the penalty system might alleviate the moral hazard; that is, $\tau^{P1} < \tau^{SB} < \tau^{TB}$ and $\varepsilon^{TB} < \varepsilon^{SB} < \varepsilon^{P1}$. In general, the sets of optimal βs could exhibit various patterns. In Figure 7, we can find all the possible patterns taken by β^{TB} and β^{P1} toward β^{SB}. Actually, there are nine regions on space (β^{TB}, β^{P1}). In regions (I) and (VI), the difference between β^{TB} and β^{P1} is extremely large, and the patterns of quantity and effort are opposite; $\tau^{SB} < \tau^{TB}$ in region (I), but $\tau^{SB} > \tau^{TB}$ in region (VI), and so on. In regions (I), (II), and (III), the penalty system would work because $\tau^{SB} < \tau^{TB}$ and $\varepsilon^{SB} > \varepsilon^{TB}$, but $\tau^{SB} > \tau^{P1}$ or $\varepsilon^{SB} < \varepsilon^{P1}$. However, in regions (IV), (V), and (VI), the penalty system might not work. We find that, even in the case of $\beta^{P1} < \beta^{TB}$, the penalty system possibly works because regions (II) and (III) protrude over the area under the 45-degree line. The emerging pattern depends on ϕ, d, p, q, and the shape of utility function U.

6 Discussion and implications

The model used in this analysis is simple, but the results provide some useful suggestions. First, in the long-term care system, the supply-side cost sharing rule for the provider, including prospective payment, capitation, or withhold, is not effective in raising the effort chosen in the third-best regime. This result is in striking contrast to Proposition 2 in Ma and McGuire (1997), where the effort is chosen before the quantity. In the system discussed here, because the care manager must choose the quantity before the provider chooses the effort, the reimbursement cannot affect the provider's decision. Further, we cannot use the supply-side cost sharing rule for the care manager such that the prospective payment is not related to the quantity of care, because the care manager must be compensated for making care plans, and not for providing care. Thus, what he/she specifies on the plan does not affect the compensation.

Second, on the contrary, it turns out that the copayment plays an important role in the long-term care system where the provider partially considers the benefit of the consumer. In fact, the copayment in the third-best regime must be increased for alleviating the moral hazard. This might explain why a copayment of 10% is required in Japan, where the care manager is supposed to decide on care quantity, but no copayment is required in Germany, where the care manager is not integrated into the system. However, the copayment cannot induce the third-best solution to the second-best level. Thus, the problem must not be completely solved by manipulating the copayment only. This result is derived from the conflict between the incentive for decreasing the quantity and that for increasing the effort. Hence, the insurer must sacrifice one of these incentives for the other, which must leave some moral hazard.

Third, we can introduce the penalty system to the provider to resolve the moral hazard partially. Without copayments, the penalty must induce a solution for the quantity and effort that is close to the second-best level from the third-best level. In the case of using copayments, it is not clear whether the penalty might work, but when the optimal copayments for the third-best and penalty regimes are close, the penalty would possibly be useful.

Fourth, we cannot use penalty to the care manager for reducing the moral hazard; in fact, it may even worsen the moral hazard. The insurer may expect the care manager to monitor the procedure of care and the provider's performance, while he/she cannot hold the care manager responsible for poor performance. This is an important point on the design of the long-term care system. The system must induce the care manager to concentrate on the maximization of the consumer's benefit.

Finally, while the optimal solutions depend on the shape of the utility function and the complete solution is not obtained, we infer some aspects of the optimal policy of the insurer from the results. The consumer faces a trade-off between the premium and the copayment in the insurance system; he/she must agree to pay a higher premium to avoid a higher copayment, and vice versa. If the consumer prefers a higher premium, the optimal insurance system chooses a lower copayment, which implies that the copayment is not very helpful in resolving the moral hazard. In this case, the penalty system is a useful alternative. This paper ignores the monitoring cost, but if the probability of penalization can be increased through monitoring, we can conclude that the cost will pay off from the consumer's perspective.

7 Conclusion

This paper develops a simple model of the long-term care insurance system for examining the moral hazard problem. We find that the separation of care management and care provision might create serious problems in the system. In this case, why does the long-term care system in Japan require the independence of care managers from the care providers? This system might be problematic in terms of the moral hazard. Further research should be conducted in this field because the design of the long-term care system may emerge as an important issue in other countries as well.

Appendix A

Derivation of the third-best solution. The problem that the care manager has to solve is as follows:

$$\max_{\tau} \ (1-\phi^0)(\rho^0-c^0)+\phi^0 W(\tau,\varepsilon,\alpha,\beta), \tag{A1}$$
$$\text{s.t.} \ \ \varepsilon \in \arg\max_{\varepsilon'} \ (1-\phi)[\rho+\delta\tau-G(\varepsilon')+\phi W(\tau,\varepsilon',\alpha,\beta). \tag{A2}$$

The first-order condition in terms of Equation. (A2) is

$$-(1-\phi)G'(\varepsilon)+\phi F_{\varepsilon}(\tau,\varepsilon)=0, \tag{A3}$$

which derives the reaction function $\varepsilon(\tau)=\phi(b-d\tau)$. The first-order condition in terms of Equation. (A1) is

$$-\beta+F_{\tau}(\tau,\varepsilon)+F_{\varepsilon}(\tau,\varepsilon)\varepsilon'(\tau)=0, \tag{A4}$$

where $\varepsilon'(\tau)=-\phi d$. By solving Equations. (A3) and (A4), we obtain the third-best solutions for quantity and effort (Equations. (10) and (11)).

Appendix B

Proof of Proposition 2. The quantities in the second-best and third-best regimes are derived as Equations. (8) and (10). The copayment that equates τ^{SB} to τ^{TB} is

$$\beta^{TB}=\beta^{SB}+\frac{(1-\mu)d}{1-d}(b-ad+\beta^{SB}d). \tag{B1}$$

However, the copayment that equates ε^{SB} (Equation. (9)) to ε^{TB} (Equation. (11)) is

$$\beta^{TB}=\beta^{SB}+\frac{(1-\phi)(1-\phi d^2)}{\phi d(1-d^2)}(b-ad+\beta^{SB}d). \tag{B2}$$

Equation. (B1) contradicts Equation. (B2) because $(1-\mu)d/(1-d^2)\neq(1-\phi)(1-\phi d^2)/\phi d(1-d^2)$ for any $\phi\in(0,1)$ and $d\in(-1,1)$.

Proof of Proposition 5. The copayment that equates τ^{SB} to τ^{P1} is

$$\beta^{P1} = \beta^{SB} + \frac{(1-\nu)d}{1-d}(b - ad + \beta^{SB}d), \tag{B3}$$

and the copayment that equates ε^{SB} to ε^{P1} is

$$\beta^{P1} = \beta^{SB} + \frac{(1-\psi)(1-\psi d^2)}{\psi d(1-d^2)}(b - ad + \beta^{SB}d). \tag{B4}$$

Equation. (B3) contradicts Equation. (B4) because $(1-\nu)d/(1-d^2) \neq (1-\psi)(1-\psi d^2)/\psi d(1-d^2)$ for any $\psi \in (0, 1)$ and $d \in (-1, 1)$.

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