



## Sharing Policy in the Field of Medical Care

メタデータ	言語: eng 出版者: 公開日: 2012-11-12 キーワード (Ja): キーワード (En): 作成者: Watanabe, Shigeru, Koh, Genju メールアドレス: 所属:
URL	<a href="https://doi.org/10.24729/00000991">https://doi.org/10.24729/00000991</a>

# Sharing Policy in the Field of Medical Care

Shigeru Watanabe\*

Genju Koh\*\*

**ABSTRACT:** The purpose of this paper is to examine the effects of introducing the sharing arrangement to the field of the medical care.

The following result has been obtained that the introducing of the sharing arrangement to the budget of the public insurance even if the expected income of the doctor kept constant will decrease the deficit of the public insurance when the public insurance system is suffering from the deficit.

It is assumed in this paper that local inhabitants are registered to a local family doctor and the local family doctor gets the income corresponding to the number of the registered inhabitants. It is also assumed that if the insurance program goes into the deficit then the deficit will be shared between the local family doctor and public sector. On the other hand, if the unbalanced amount of the public insurance program is positive, the positive amount will be shared between the family doctor and the public sector. Hence, in this case the local family doctor can obtain the additional income.

It will be shown that generally the introduction of the sharing arrangement will raise the amount of the difference, which may be positive or negative, between the total insurance premiums and the total payments from the insurance. Hence, if the budget of the public health insurance is negatively unbalanced, the introduction of the sharing system will decrease the amount of the deficit. After introducing the sharing system, raising the share rate of the family doctor will also decrease the deficit of the public insurance system when the public insurance system is negatively unbalanced.

In the same way, it will also be shown that the introduction of the sharing arrangement keeping the expected income of the doctor constant will decrease the public expenditures.

**Key Words:** Sharing, Medical Care, Health Insurance, Deficit, Family Doctor

---

\* Professor of Economics at the University of Osaka Prefecture

1-1, Gakuencho, Nakaku, Sakai-City, Osaka, 599-8531, Japan

\*\* Post graduate student of Economics at the University of Osaka Prefecture

## 1. Introduction

The system of profit sharing has been receiving great attention since the work of Weitzman (1983, 1984, and 1985). The purpose of this paper is to examine the effects of introducing the sharing arrangement to the field of the medical care.

It is assumed in this paper that local inhabitants are registered to a local family doctor and the local family doctor gets the income corresponding to the number of the registered inhabitants. It is also assumed that if the insurance program goes into the deficit then the deficit will be shared between the local family doctor and the public sector. On the other hand, if the unbalanced amount of the public insurance program is positive, the positive amount will be shared between the family doctor and the public sector. Hence, in this case the local family doctor can obtain the additional income.

It will be shown that the introduction of the sharing arrangement will increase the amount of the difference, which may be positive or negative, between the total insurance premiums and the total payments from the insurance<sup>1</sup>. Hence, if the budget of the public health insurance is negatively unbalanced, the introduction of the sharing system will decrease the amount of the deficit. After introducing the sharing system, raising the share rate of the family doctor will also decrease the deficit of the public insurance system when the public insurance system is negatively unbalanced.

In the same way, it will also be shown that the introduction of the sharing arrangement keeping the expected income of the doctor constant will decrease the public expenditures.

In the next section a simple model will be shown. The effects of introducing the sharing system will be examined in the third section. Concluding remarks will be given in the last section.

## 2. A Simple Model

We consider the family doctor to whom the local inhabitants are registered under the public insurance program.

Now, suppose that the doctor's income is composed of the following two factors; (i) the doctor gets the income corresponding to the number of the registered inhabitants, (ii) the doctor will also obtain the positive or negative additional income if the budget

of the public insurance program is unbalanced under the sharing system. Hence, if the amount of the difference,  $B$ , between the total insurance premiums and the total payments to the medical costs is positive, the additional doctor's income,  $sB$ , is also positive since the sharing rate,  $s$ , for the doctor is positive and less than 1. On the other hand, if  $B$  is negative, then the additional income is also negative. The medical costs of the registered inhabitants are not exogenously given. It is assumed that the expected value of the medical costs will depend on the efforts,  $e$ , of the family doctor for preventing the occurrence of the heavy illness. The efforts of the doctor will be measured by, for example, the frequency of preventive activities.

Hence, the expected value of the total medical costs will be denoted in the following manner;

$$\sum_{i=1}^n EM_i(e),$$

where  $n$  is the number of the registered inhabitants

On the other hand, the amount of the difference,  $B$ , between the total insurance premiums and the total payments to the medical cost is denoted by (1).

$$B = pn - k \sum_{i=1}^n EM_i(e), \quad (1)$$

where,  $p$ , is the insurance premium per head, and  $k$  ( $0 < k < 1$ ) is the rate of the insurance payment.

Hence, the income,  $y$ , of the doctor will be shown as

$$y = nw + s \left[ pn - k \sum_{i=1}^n EM_i(e) \right], \quad (2)$$

where  $w$  is wage per inhabitant and  $s$  ( $0 < s < 1$ ) is the rate of the sharing for the family doctor.

The utility of the doctor is assumed to depend on the income and leisure time. The leisure time is shown as the time which is not spent by both preventive and curative activities. Then, the leisure time,  $j$ , is denoted as

$$j = T - \hat{j} - \tilde{j},$$

where  $\hat{j}$  is the time spent for the preventive activities and  $\hat{j}$  is assumed to depend on  $e$ , on the other hand  $\tilde{j}$  is the time spent for the curative activities and  $\tilde{j}$  is assumed to depend on the expected value of the total medical costs, and  $T$  is the total time after the deduction of time necessary for sleeping or else.

Hence, the above relation is rewritten as

$$j = T - \hat{j}(e) - \tilde{j} \left( \sum_{i=1}^n EM_i(e) \right),$$

where  $\hat{j}' > 0$ ,  $\tilde{j}' > 0$ ,  $\hat{j}'' > 0$ ,  $\tilde{j}'' > 0$ , are assumed.

Hence, the utility will be shown as

$$u = u \left( nw + s \left[ pn - k \sum_{i=1}^n EM_i(e) \right], T - \hat{j}(e) - \tilde{j} \left( \sum_{i=1}^n EM_i(e) \right) \right). \quad (3)$$

Differentiating (3) with respect to  $e$  yields the following first order condition.

$$-ksu_1 \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) + u_2 \left( -\hat{j}' - \tilde{j}' \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \right) = 0. \quad (4)$$

The second order condition is shown as

$$\begin{aligned} H = & u_{11} \left\{ -sk \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \right\}^2 + u_{12} \left\{ \hat{j}' + \tilde{j}' \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \right\} sk \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \\ & - u_1 sk \sum_{i=1}^n \left( \frac{d^2EM_i}{de^2} \right) + u_{21} sk \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \left\{ \hat{j}' + \tilde{j}' \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \right\} \\ & + u_{22} \left\{ \hat{j}' + \tilde{j}' \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \right\}^2 + u_2 \left[ -\hat{j}'' - \tilde{j}'' \left\{ \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \right\}^2 - \tilde{j}' \sum_{i=1}^n \left( \frac{d^2EM_i}{de^2} \right) \right] < 0, \end{aligned}$$

where  $u_1 = \frac{\partial u}{\partial y} > 0$ ,  $u_2 = \frac{\partial u}{\partial j} > 0$ ,  $u_{12} = \frac{\partial^2 u}{\partial y \partial j} \geq 0$ ,

$$u_{11} = \frac{\partial^2 u}{\partial y^2} < 0, u_{22} = \frac{\partial^2 u}{\partial j^2} < 0, \frac{dEM_i}{de} < 0 \text{ and } \frac{d^2EM_i}{de^2} > 0 \quad (5)$$

are assumed.

From (4)  $\hat{j}' + \tilde{j}' \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) > 0$ ,

is obtained. Hence, the second order condition is satisfied.

### 3. Introduction of Sharing Arrangement

From the first order condition the following relation can straightforwardly be obtained.

$$\begin{aligned} \frac{\partial e}{\partial s} = & \left[ ku_1 \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) + ks u_{11} \left( pn - k \sum_{i=1}^n EM_i \right) \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \right. \\ & \left. + u_{21} \left( pn - k \sum_{i=1}^n EM_i \right) \left\{ \hat{j}' + \tilde{j}' \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \right\} \right] / H. \quad (6) \end{aligned}$$

Hence, if  $B \leq 0$  we get the following result,

$$\frac{\partial e}{\partial s} > 0, \quad (7)$$

since  $\hat{j}' + \tilde{j}' \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) > 0$  from (4).

At  $s = 0$ , we get  $\hat{j}' + \tilde{j}' \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) = 0$  from (4).

Hence, the following relation can be obtained without depending on the sign of  $B$ .

$$\left. \frac{\partial e}{\partial s} \right|_{s=0} > 0. \quad (8)$$

In the same way, the effect of the sharing arrangement on the balance of the insurance program is also obtained straightforwardly.

$$\frac{\partial B}{\partial s} = -k \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \left( \frac{\partial e}{\partial s} \right). \quad (9)$$

Hence, from (7), (8) and (9) we get the following relations (10) and (11).

$$\frac{\partial B}{\partial s} > 0 \quad \text{if } B \leq 0, \quad (10)$$

and

$$\left. \frac{\partial B}{\partial s} \right|_{s=0} > 0. \quad (11)$$

Therefore, from (11) we get a result that the introduction of the sharing arrangement will increase the balance,  $B$ , of the insurance program. Further from (10), raising the sharing rate,  $s$ , of the doctor will increase the budget if the insurance program is suffering from deficit or it is balanced.

Next, we will examine the effect on the public expenditure,  $E$ , defined by

$$E = nw - (1-s)B. \quad (12)$$

Differentiating  $E$  with respect to  $s$  yields the following relation.

$$\frac{\partial E}{\partial s} = B - (1-s) \frac{\partial B}{\partial s}. \quad (13)$$

Hence, from (10), (11) and (13) we get

$$\frac{\partial E}{\partial s} < 0, \quad \text{if } B \leq 0, \quad (14)$$

and

$$\left. \frac{\partial E}{\partial s} \right|_{s=0} < 0, \quad \text{if } B \leq 0. \quad (15)$$

Therefore, from (15) the introduction of the sharing system will decrease the public expenditure if the budget of the insurance program is suffering the deficit or it is balanced. Similarly raising the sharing rate,  $s$ , will also decrease the public expenditure if the budget of the insurance program is suffering the deficit or it is balanced.

However, the sharing arrangement wouldn't be straightforwardly introduced since it reduces the expected income,  $y$ , of the doctor if  $B$  is negative as shown in the following.

$$\frac{\partial y}{\partial s} = pn - k \sum_{i=1}^n EM_i(e) - sk \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \left( \frac{\partial e}{\partial s} \right),$$

and

$$\left. \frac{\partial y}{\partial s} \right|_{s=0} = pn - k \sum_{i=1}^n EM_i(e) < 0, \quad (16)$$

in the case where  $B < 0$ .

Therefore, in the following we will examine the case where  $w$  is raised to compensate the decrease in  $y$  due to the introduction of the sharing system.

Differentiating  $y$  with respect to  $w$  yields the following relations.

$$\frac{\partial y}{\partial w} = n - sk \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \left( \frac{\partial e}{\partial w} \right),$$

and

$$\left. \frac{\partial y}{\partial w} \right|_{s=0} = n. \quad (17)$$

From (16) and (17) we get

$$\left. \frac{\partial w}{\partial s} \right|_{\substack{s=0 \\ dy=0}} = - \left( pn - k \sum_{i=1}^n EM_i(e) \right) / n. \quad (18)$$

Hence, the effect of introducing the sharing arrangement on  $e$  when the expected income of the doctor is compensated by the increase in  $w$  will be shown in the following manner.

$$\left. \frac{de}{ds} \right|_{\substack{s=0 \\ dy=0}} = \frac{\partial e}{\partial s} + \frac{\partial e}{\partial w} \frac{(-B)}{n}. \quad (19)$$

Differentiating (4) with respect to  $w$  yields the following (20).

$$\frac{\partial e}{\partial w} = \left[ u_{11} nsk \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) + u_{21} n \left\{ \hat{j}' + \tilde{j}' \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \right\} \right] / H < 0, \quad (20)$$

since  $\hat{j}' + \tilde{j}' \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) > 0$  from (4) and  $H < 0$  from (5).

At  $s = 0$ , we obtain the following (21).

$$\left. \frac{\partial e}{\partial w} \right|_{s=0} = 0, \quad (21)$$

since, at  $s = 0$ ,  $\hat{j}' + \tilde{j}' \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) = 0$  from (4).

Therefore, from (8), (19) and (21) we can get the following relation (22).

$$\left. \frac{de}{ds} \right|_{\substack{s=0 \\ dy=0}} > 0. \quad (22)$$

In the same way, the following relation (23) can also be obtained straightforwardly.

$$\left. \frac{dB}{ds} \right|_{\substack{s=0 \\ dy=0}} > 0. \quad (23)$$

Hence, the introduction of the sharing arrangement, even when the expected income of the doctor is compensated, will increase the amount of the difference, which may be positive or negative, between the total insurance premiums and the total payments from the insurance.

Next, we will examine the effect on the public expenditures,  $E$ , given by (12). Differentiating  $E$  with respect to  $s$ , keeping the expected income of the doctor constant, yields the following equation.

$$\left. \frac{dE}{ds} \right|_{\substack{s=0 \\ dy=0}} = \left( n - \frac{\partial B}{\partial w} \right) \left( \frac{dw}{ds} \right) + B - \frac{\partial B}{\partial s}. \quad (24)$$

From (18) the equation (24) is rewritten as follows.

$$\left. \frac{dE}{ds} \right|_{\substack{s=0 \\ dy=0}} = \left( n - \frac{\partial B}{\partial w} \right) \left( \frac{-B}{n} \right) + B - \frac{\partial B}{\partial s} < 0. \quad (25)$$

The sign of (25) is negative from (11) and (21) since

$$\left. \frac{\partial B}{\partial w} \right|_{s=0} = -k \sum_{i=1}^n \left( \frac{dEM_i}{de} \right) \left. \frac{\partial e}{\partial w} \right|_{s=0} = 0.$$

Hence, the introduction of the sharing arrangement, keeping the expected income of the doctor constant, will decrease the public expenditure given by (12).

#### 4. Concluding Remarks

It is assumed in this paper that local inhabitants are registered to a local family doctor and the local family doctor gets the income corresponding to the number of the



registered inhabitants. It is also assumed that if the insurance program goes into the deficit then the deficit will be shared between the local family doctor and the public sector. On the other hand, if the unbalanced amount of the public insurance program is positive, the positive amount will be shared between the family doctor and the public sector. Hence, in this case the local family doctor can obtain the additional income.

It has been shown that generally the introduction of the sharing arrangement will raise the amount of the difference, which may be positive or negative, between the total insurance premiums and the total payments from the insurance. Hence, if the budget of the public health insurance is negatively unbalanced, the introduction of the sharing system will decrease the amount of the deficit. After introducing the sharing system, raising the share rate of the family doctor will also decrease the deficit of the public insurance system when the public insurance system is negatively unbalanced.

In the same way, it has also been shown that the introduction of the sharing arrangement keeping the expected income of the doctor constant will not only increase the amount of the difference, which may be positive or negative, between the total insurance premiums and the total payments from the insurance but also decrease the public expenditures for both doctor' income which corresponds to the number of the registered inhabitants and the public share of the insurance budget which may be positive or negative.

## Notes

- 1 See Nishimura (1987), Watanabe (1982) and Watanabe (2009) for another approach to Insurance.

## References

- M. Weitzman, "Some Macroeconomic Implications of Alternative Compensation Systems" *Economic Journal*, Vol. 93, 1983.
- , "*The Share Economy*" Harvard University Press, 1984.
- , "The Simple Macroeconomics of Profit-Sharing", *American Economic Review*, Vol. 75., 1985.
- S. Nishimura, *Economic Analysis of Medical Care*, Touyou Keizai, 1987.
- S. Watanabe, *Public Policy on Medical Care*, University of Osaka Prefecture, 1982.
- , "Policy in the Presence of Tax Evasion – Tax Evasion Crime and Insurance –" *Journal of Economic Studies* (University of Osaka Prefecture), Vo. 54 No. 2. 2009.