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Should Public Elderly Care Be Provided?

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Abstract

The study described in this short paper sets an elderly care model in which the public elderly care and informal elderly care provided by the family are substitutive, with examination of the dynamics of capital accumulation and the labor supply. By virtue of capital accumulation, informal elderly care is reduced by public elderly care. With certain conditions, by virtue of public elderly care, informal elderly care vanishes and a full labor supply is achieved. However, this paper presents derivation of the result that the economy with informal elderly care is socially optimal.

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1. Introduction

In OECD countries, demand for elderly care continues to increase. Informal elderly care is needed because of those nations' respective aging societies. To provide such informal care the number of workers who must stop working for informal elderly care is about 100,000 persons per year in Japan.[1] Why do family members stop work? One reason is the prevailing shortage of public elderly care services. One study of the literature (Colombo, Llena-Nozal, Mercier and Tjadens 2011) demonstrates that expenditures for public elderly care are 1.5% of GDP in OECD countries. That level might be an underestimate when one considers the work stoppage problem: If family members stop working, then they can not obtain labor income. They therefore fall into poverty. For that reason, considering compatibility between market employment and elderly care is important.

This paper sets a model in which public elderly care and informal elderly care provided by the family member are substitutive, with an examination of how capital accumulation and labor supply are determined. This paper presents two steady state equilibria with informal elderly care and without informal elderly care. Moreover, the equilibrium without informal elderly care is not always optimal.

Some studies have specifically examined elderly care. Lundholm and Ohlsson (1998), Tabata (2005), Mizushima (2009), Miyazawa (2010), Cremer and Roeder (2013), and Cremer and Pestieau (2014) assess subsidies for elderly care and ascertain whether the subsidy should actually be provided.[2] Korn and Wrede (2013) and Mou and Winer (2015) set a model with formal and informal elderly care and examine how the labor supply is determined. Nevertheless, these results are not always obtained in a model in which formal elderly care and informal elderly care are substitutive. Substitution between formal and informal elderly care is researched empirically by Houtven and Norton (2004), White-Means and Rubin (2004), and Bonsang (2009). Therefore, it is worthwhile to set a substitutive model that is consistent with the real economy and to examine how informal elderly care is changed by public elderly care.

The results presented herein show that an increase in publicly provided elderly care reduces the informal elderly care and show that the labor supply increases. This result is the same as that reported by Lundholm and Ohlsson (1998). However, this paper presents consideration of the dynamics of the capital stock, which remains unexamined by Lundholm and Ohlsson (1998). By virtue of the dynamics of the capital stock, this paper

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[1] Data: Statistics Japan.

[2] Lundholm and Ohlsson (1998) consider the case of child care. However, the structure of the model can be regarded as an elderly care service model.

can explain that informal elderly care decreases with income growth with capital stock accumulation and can show that the labor supply increases. Although some related reports presented above include consideration of the dynamics of capital accumulation, no report describes examination of a model with substitution involving publicly provided care. The contribution of this paper is an illustration of how economic growth affects informal elderly care.

The paper structure is the following. Section 2 sets the model. Section 3 derives the equilibrium. Section 4 presents the case in which the equilibrium with informal elderly care is optimal. Section 5 examines the consumption tax that is imposed for financing for public elderly care service. The final section concludes this paper.

2. Model

This model economy includes households, firms, and the government.

2.1 Household

Individuals in the household live in two periods: young and old. Utility function u_t is assumed as

$$u_t = \alpha lnc_{1t} + \beta lnc_{2t+1} + \gamma lnE_t + (1-\alpha-\beta-\gamma)lnE_{t+1}, \quad 0<\alpha<1, 0<\beta<1, 0<\gamma<1, \alpha+\beta+\gamma<1. \tag{1}$$

Individuals consume during the young period as c_{1t} and during the old period as c_{2t+1}. The quality of elderly care for their parents is E_t. That for themselves is E_{t+1}. Therein, *t* denotes the period. If younger people live in t period, then they live in $t+1$ period as older people. They have an altruistic motivation for elderly care for their parents.

The quality of elderly care is assumed to be determined by the input of public elderly care g_t and the elderly care time provided by younger people as l_t. For this study, E_t is assumed as

$$E_t = g_t + l_t. \tag{2}$$

Our paper assumes substitutive elderly care between g_t and l_t.[3]

The budget constraint in the young period is given as

$$c_{1t} + s_t = (1-\tau)w_t(1-l_t), \tag{3}$$

where s_t denotes saving for the old period. Additionally, w_t and τ respectively denote

[3] The analyses described in this paper assume the substitution form of elderly care between publicly provided elderly care service and the informal family care. As other forms, related studies reported in the literature assume that function E_t is defined as the form inputting elderly care service purchased by the elderly people and the elderly care (as the time or goods) provided by younger people. Informal family care is assumed for related studies as Mizushima (2009) and others. This paper considers the perfect substitution form based on the related empirical literature.

the wage rate and income tax rate. Younger people work for the unit of $1 - l_t$. In the old period, the budget constraint is given as

$$c_{2t+1} = (1 + r_{t+1})s_t, \tag{4}$$

where r_{t+1} denotes the interest rate. Then, considering (3) and (4), the lifetime budget constraint is

$$c_{2t+1} = (1 + r_{t+1})\big((1 - \tau)w_t(1 - l_t) - c_{1t}\big). \tag{5}$$

At the maximizing problem of the utility function (1) subject to the budget constraint (5), we can obtain elderly care time l_t to maximize the utility as

$$l_t = \frac{\gamma - (\alpha + \beta)g_t}{\alpha + \beta + \gamma}, \text{if } \gamma > (\alpha + \beta)g_t, \tag{6}$$

$$l_t = 0, \text{if } \gamma \leq (\alpha + \beta)g_t, \tag{7}$$

Younger people can provide full time work if sufficient public elderly care is provided. Otherwise, younger people must provide informal or family elderly care. The result is based on substitutive elderly care between public elderly care and informal family care. With a sufficient level of public elderly care, informal elderly care can be reduced.

2.2 Firm

The firm produces final goods by inputting capital stock K_t and labor L_t. The production function Y_t is assumed as

$$Y_t = K_t^{\theta} L_t^{1-\theta}, 0 < \theta < 1. \tag{8}$$

With the perfectly competitive market, the wage rate and the interest rate are derived as

$$w_t = (1 - \theta)K_t^{\theta}(1 - l_t)^{-\theta}, \tag{9}$$

$$1 + r_t = \theta K_t^{\theta-1}(1 - l_t)^{1-\theta}. \tag{10}$$

The capital stock is assumed to be fully depreciated in a single period.

2.3 Government

The government collects income tax revenue from younger people to provide public elderly care. Without population growth, the budget constraint of the government is given as

$$g_t = \tau w_t(1 - l_t). \tag{11}$$

The model in this paper presents consideration of the one sector model. Therefore, the final goods are demanded as consumption goods and publicly provided elderly care.[4]

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[4] This paper sets a one sector model. However, one can consider a two-sector model: one for the final goods sector and the other for elderly care sector. Then, the labor supply is allocated into two sectors. Even if considering two-sector models, the result that an increase in publicly provided elderly care reduces the informal family care does not change. Therefore, the one-sector model is set as a simple form.

The model can be set with elderly care service purchased by elderly people. However, because of the

3. Equilibrium

This section presents derivation of the equilibrium in this model. Considering the capital market equilibrium condition $K_{t+1} = s_t$, the equation below presents the dynamics of capital accumulation:

$$K_{t+1} = (1-\tau)(1-\theta)K_t^{\theta}\left((1-l_t)^{1-\theta} - \frac{\alpha}{\alpha+\beta+\gamma}\frac{1+\tau(1-\theta)K_t^{\theta}(1-l_t)^{1-\theta}}{(1-l_t)^{\theta}}\right). \quad (12)$$

The elderly care time is given to satisfy the following equation:

$$l_t = \frac{\gamma-(\alpha+\beta)\tau(1-\theta)K_t^{\theta}(1-l_t)^{1-\theta}}{\alpha+\beta+\gamma}. \quad (13)$$

For given K_t, one can obtain $K_{t+1}, l_t, w_t, r_t, c_{1t}, c_{2t}$ and E_t from (2), (5), (9), (10), (11), (12), and (13). An increase in tax rate τ and capital stock K_t reduce informal elderly care l_t because of an increase in public elderly care service g_t.

As shown by (12), an increase in K_t raises K_{t+1} directly. However, an increase in K_t has a negative effect on K_{t+1} because of the term of $-\frac{\alpha}{\alpha+\beta+\gamma}\frac{1+\tau(1-\theta)K_t^{\theta}(1-l_t)^{1-\theta}}{(1-l_t)^{\theta}}$. If this negative effect is small, one can obtain the concave form of the dynamics of K_t and the unique stable steady state.[5]

We can have steady states of two types: a steady state with $l_t < 1$ and a steady state with $l_t = 0$. With $l_t = 0$, the dynamics of K_t shown by (12) changes to the following equations as[6]

$$K_{t+1} = \frac{\beta(1-\tau)(1-\theta)}{\alpha+\beta}K_t^{\theta}. \quad (14)$$

An increase in the capital stock raises the publicly provided elderly care and reduces the informal elderly care time. By virtue of income growth with capital accumulation, substitution occurs between publicly provided elderly care and informal family care. An

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individual strategy for elderly care, the equilibrium is complicated. Moreover, for instance, in the case of Japan, a subsidy for the elderly care service exists. By virtue of this subsidy, elderly people pay for only 10% of the aggregate elderly care fee. Fundamentally, this case is regarded as publicly provided elderly care service. Therefore, we assume (2).

[5] The dynamics is checked using numerical examples with various parameters. We can obtain the concave form of the dynamics of K_t and the unique stable steady state.

[6] The local stability condition in the case of $l_t < 1$ can be derived as $-1 < \frac{dK_{t+1}}{dK_t} < 1$, which is $\frac{dK_{t+1}}{dK_t} = \theta - \frac{\tau(1-\tau)\alpha(1-\theta)(1+r)w}{\alpha+\beta+\gamma} - (1-\tau)w\left(1-\theta-\frac{\alpha\left(\tau(1-2\theta)w-\frac{\theta}{1-l}\right)}{\alpha+\beta+\gamma}\right)\frac{dl_t}{dK_t}$ and $\frac{dl_t}{dK_t} = -\frac{\frac{\tau(\alpha+\beta)(1-\theta)(1+r)}{\alpha+\beta+\gamma}}{1-\frac{\tau(\alpha+\beta)(1-\theta)w}{\alpha+\beta+\gamma}} < 0$. The description without t shows the variables in the steady state.

increase in capital stock raises the publicly provided elderly care service g_t. The marginal utility of E_t is $\frac{1}{l_t+g_t}$. This marginal utility is decreased by an increase in g_t. Because of the setting of perfect substitution, we can obtain a result that is consistent with the related empirical literature.

However, we note that the informal family care does not always continue decreasing. Before ceasing informal family care, the economy converges to a steady state. Informal elderly care exists in the long run. The key of the result is the level of g_t. With large τ, one can obtain the steady state without informal family care.

This paper can present consideration of how an aging population affects elderly care. A decrease in the population growth rate and an increase in life expectancy are regarded as representative of an aging population. This paper presents consideration of the preference for elderly care as an effect of an aging population. A decrease in α, β or an increase in γ raises the preference for elderly care. Then, as shown by (6) and (7), the level of g_t to be $l_t = 0$ increases and younger people increase l_t. Simultaneously, a decrease in α or an increase in β, γ raises the capital stock K_{t+1} because of an increase in saving.

4. Should Fully Public Elderly Care be Provided?

In this section, we examine whether public elderly care should be fully provided or not to achieve $l_t = 0$. The resource constraint in *t* period is

$$K_{t+1} = K_t^{\theta}(1 - l_t)^{1-\theta} - c_{1t} - c_{2t} - g_t. \tag{15}$$

The marginal cost to increase g_t is one. However, the marginal cost to increase l_t is $(1-\theta)K_t^{\theta}(1-l_t)^{-\theta}$, which is regarded as the opportunity cost to increase informal elderly care. Therefore, with $1 < (1-\theta)K_t^{\theta}(1-l_t)^{-\theta}$, informal elderly care is socially inefficient. Then, the tax rate τ to provide public elderly care should be set as $1 = (1-\theta)K_t^{\theta}(1-l_t)^{-\theta}$. Considering this equation and (13), the tax rate τ is derived as

$$\tau = \frac{\gamma - (\alpha+\beta+\gamma)\left(1-(1-\theta)^{\frac{1}{\theta}}K_t\right)}{(\alpha+\beta)(1-\theta)^{\frac{1}{\theta}}K_t}. \tag{16}$$

With $1 < (1-\theta)K_t^{\theta}$ at $l_t = 0$, fully public elderly care without informal elderly care should be provided.

5. Consumption Tax

This section presents examination of the consumption tax effect on K_{t+1} as further

taxation. If the consumption tax is used to finance public elderly care, then the government budget constraint changes to

$$\tau_c(c_{1t} + c_{2t}) = g_t. \tag{18}$$

Consequently, the dynamics of K_t is given as

$$K_{t+1} = (1-\theta)K_t^{\theta}\left((1-l_t)^{1-\theta} - \frac{\alpha}{\alpha+\beta+\gamma}\frac{1+\tau(1-\theta)K_t^{\theta}(1-l_t)^{1-\theta}}{(1-l_t)^{\theta}}\right). \tag{19}$$

Therefore, with the same public elderly care g_t in the case of consumption taxation, K_{t+1} is pulled up; capital accumulation is facilitated.[7] This result is obtainable because of the log utility function. In the setting of log utility function, the amount of the expenditure for consumption is given by the proportional rate of income.

6. Conclusions

This paper sets the model with public elderly care as formal elderly care and with family care as informal elderly care. Using the model, one can examine how capital accumulation and the labor supply are determined. In addition, this paper presents an examination of whether public elderly care to increase the labor supply should be provided, or not.

The results of this paper demonstrate that capital accumulation decreases informal elderly care by virtue of publicly provided elderly care. Results show a decrease in informal elderly care with economic growth. This result can be derived by the setting of perfect substitution between elderly care service and informal family care that is consistent with related empirical literatures. Depending on the parameter condition, although informal elderly care should be regarded as decreasing because of the labor supply in an aging society with fewer children, this paper presents the equilibrium in which informal elderly care should exist. In any event, public elderly care should be provided because of an increase in social welfare. Moreover, this paper shows that a consumption tax to finance publicly provided elderly care service is better than an income tax because the former engenders an increase in capital accumulation. This paper can suggest some policy implications for how the government should provide a policy to support elderly care.

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