Should Public Elderly Care Be Provided?

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Abstract

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. 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 simultaneously 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 their respective aging societies. Therefore, the number of workers that 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) shows that expenditures for public elderly care are 1.5% of GDP in OECD countries. Considering the work stoppage problem, that level might be an underestimate. What is the work stoppage problem? If the family members stop working, then they can not obtain labor income. They fall into poverty. Therefore, it is important to consider compatibility between market employment and elderly care.

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

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

2. Model

This model economy has 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

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

[1] Data: Statistics Japan.

Individuals care for consumption during the old period c_{t+1}, the quality of elderly care for their parents E_t, and that for themselves E_{t+1}. Therein, t denotes the period. If younger people live in t period, then they live in t+1 period as the old period. 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. E_t is assumed as the following form:

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

Our paper assumes substitutive elderly care between g_t and l_t.

The budget constraint in the young period is given as

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

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

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

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

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

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

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

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

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 the final goods by inputting the 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

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

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

It is assumed that the capital stock is 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 shown below:

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

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 shows the dynamics of capital accumulation:

$$K_{t+1} = (1 - \tau)(1 - \theta) K_t^{\theta} (1 - l_t)^{1-\theta}. \tag{12}$$

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

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

For given K_t, we can obtain $K_{t+1}, l_t, w_t, r_t, c_t$ and E_t from (2), (5), (9), (10), (11), (12), and (13). Defining the left-hand side and the right-hand side of (13) respectively as L and R, the informal elderly care is given by the unique solution for given K_t, as shown by the following figure.

[Insert Fig. 1 around here.]

As shown in Fig. 1, 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.[2]

Then, the dynamics of K_t has three patterns of dynamics because an increase in K_t raises K_{t+1} directly. However, an increase in K_t reduces K_{t+1} because of a decrease in $1 - l_t$. The dynamics of capital stock can be depicted as shown below.

[Insert Fig. 2 around here.]

Fig. 2 includes two cases: one for the steady state with $l_t < 1$ and the other for the steady state with $l_t = 1$. With $l_t = 1$, the dynamics of K_t shown by (12) changes to the following equations as[3]

$$K_{t+1} = (1 - \tau)(1 - \theta) K_t^{\theta}. \tag{14}$$

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[2] Total differentiation of (13) with respect to K_t and l_t derives $\frac{dl_t}{dK_t} = -\frac{\alpha^2\theta(1-\theta)\tau K_t^{\theta-1}(1-l_t)}{l_t^2\left(\beta - \frac{\alpha\tau(1-\theta)K_t^{\theta}}{(1-l_t)^{\theta}}\right)^2 (1-l_t)^{1+\theta} + \alpha^2\theta(1-\theta)\tau K_t^{\theta}} < 0$.

[3] The local stability condition in the case of $l_t < 1$ can be derived by $0 < \frac{dK_{t+1}}{dK_t} < 1$, which is $\frac{dK_{t+1}}{dK_t} = \theta + \frac{\alpha^2\theta(1-\theta)^2\tau K_t^{\theta}}{l_t^2\left(\beta - \frac{\alpha\tau(1-\theta)K_t^{\theta}}{(1-l_t)^{\theta}}\right)^2 (1-l_t)^{1+\theta} + \alpha^2\theta(1-\theta)\tau K_t^{\theta}}$. However, in the case of $l_t = 1$, the local stability condition always holds because of $\frac{dK_{t+1}}{dK_t} = \theta$.

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

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

The marginal cost to increase g_t is one. On the other hand, 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 the informal elderly care. Therefore, with $1 < (1-\theta)K_t^{\theta}(1-l_t)^{-\theta}$, that is, if the following inequality holds, informal elderly care is socially inefficient. Fully public elderly care should be provided because informal elderly care is more costly than public elderly care.

$$l_t > 1 - (1-\theta)^{\frac{1}{\theta}}K_t. \tag{16}$$

From (6), the condition in which a household selects informal elderly care is

$$l_t > 1 - \left(\frac{\alpha\tau(1-\theta)}{\beta}\right)^{\frac{1}{\theta}}K_t. \tag{17}$$

Therefore, if $\tau = \frac{\beta}{\alpha}$, then the condition in which socially informal elderly care should be selected is the same as the condition that the household selects.

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

$$\tau_c c_t = g_t. \tag{18}$$

Then, the dynamics of K_t is given as

$$K_{t+1} = (1-\theta)K_t^{\theta}(1-l_t)^{1-\theta}. \tag{19}$$

Therefore, with the same public elderly care g_t in the case of both income taxation and consumption taxation, K_{t+1} is pulled up and capital accumulation is facilitated.

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 the public elderly care to increase the labor supply should be provided or not. 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. Moreover, this paper presents results of an examination of a consumption tax for financing public elderly care. Results demonstrate that reform of elderly care should be considered.

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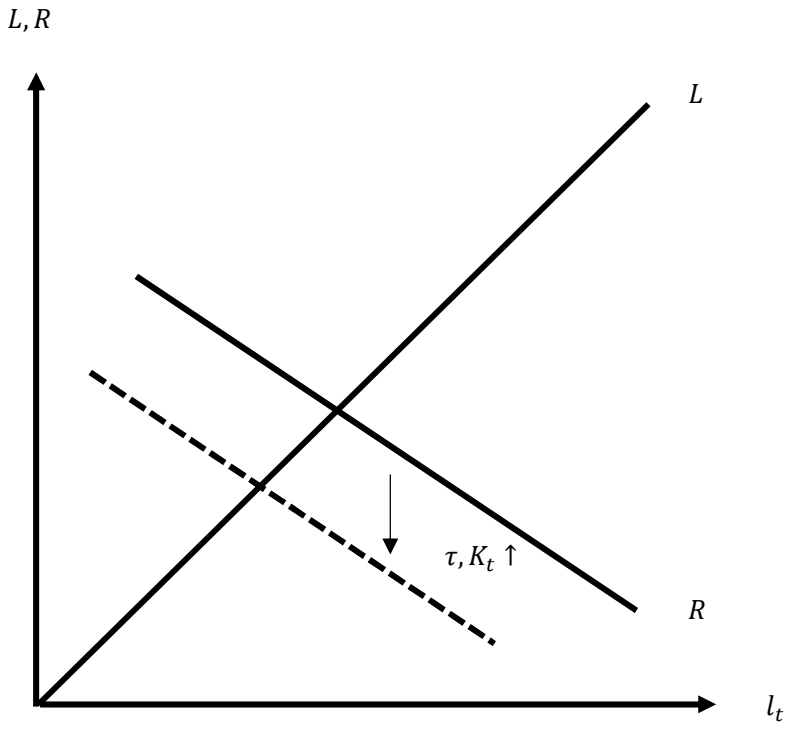

Fig. 1: Unique Solution of l_t

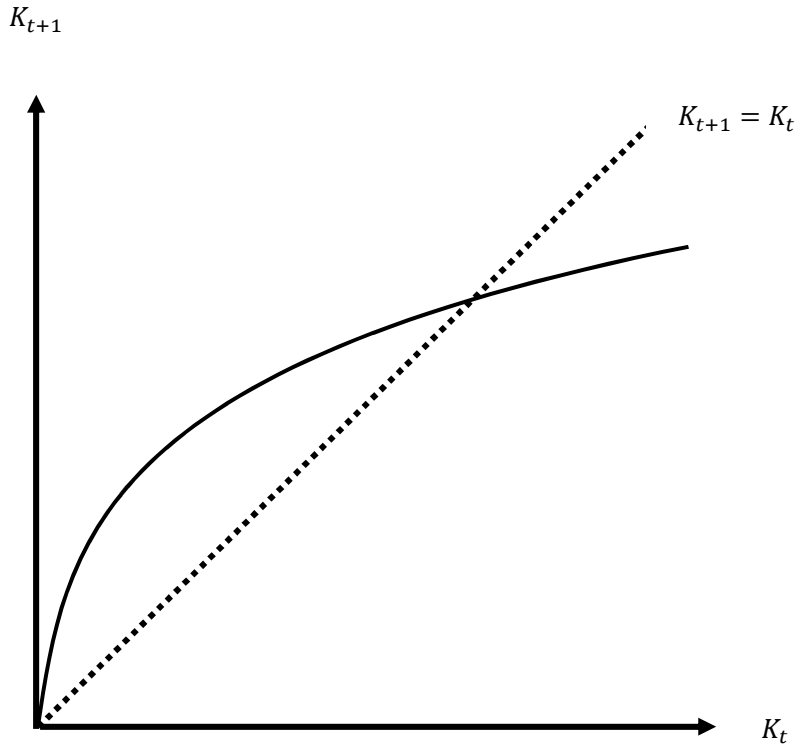

Fig. 2: Steady State Equilibrium