Aging and Elderly Care in an Open Economy[1]

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(DRAFT)

(Abstract)

Caring of the elderly present a difficult challenge to the developing countries where the population is rapidly ageing. Costs of medical care of the aged will grow more than proportionally as the ageing proceeds, and for nursing the aged human services are essential and not easily substitutable by machines or tools.

To clarify the basic nature of the nursing problem of the aged, we present a proto-type model of overlapping generations in which a person works during young age and consumes elderly and nursing cares during old-age. It is shown that the individuals with utility functions that limit substitution between the present consumption of goods and the future consumption of nursing services will be forced to save more during their working years. The decline of labor growth rate implies a decrease in the transformation possibility from the present consumption to the nursing care in the next period. When the nursing services cannot be substituted by capital expenditures, a natural policy for a country is to import foreign labor services, and to encourage outflow of capital.

[1] We are indebted to two thoughtful referees for their comments. We have not only incorporated their comments liberally, we have also highlighted their suggestions in the paper.

<Prologue>

"I wish to be left sooner in the mountain to relieve the burden from my descendants. I destroyed my teeth for myself by rocks to look older" (Shichiro Fukasawa, *Narayamabushi-ko* (Elegy for the Old: The Tune of Narayama, 1968)

"Several decades from now, Satoshi, as a working member of a society, would have to support two strangers besides his parents." (Sawako Ariyoshi, *Kokotsu no Hito,* 1972, (Translation:*The Twighlight Years,* By Mildred Tahara, 1984)

"You have begot me, bred me, loved me. I return those duties as are right fit. (Corderia)、" *King Lear*, Act 1, Scene 1, 95.

Literature describes the depth of emotion attached to caring for an aging generation, a hard and sublime duty of the mankind. In medieval villages in the highland of Japan, a legend told of the old people who sacrificed themselves by straying into mountains to save care from and food for the young. Fukasawa writes about a woman who even prepared herself for this sacrifice by destroying her own still youthful teeth so that she could look old.

In the best-selling novel about modern Japan, Sawako Ariyoshi describes a process of how a middle-class family life was disrupted by an elderly man who was losing memory as well as control. A housewife had to give up her full-time job to become a part-timer so that she could take care of her elderly father in-law. In the Shakespeare's classical drama, one sees a prototype of generational conflicts and even implicit strategic negotiations.

1. Introduction

This paper is driven by three motivations. First, as is illustrated in the prologue, caring for the elderly poses serious problems in societies. According to *the Illustrated White Paper for the Elderly* (National Social Welfare Association, 1999), in 2000 about 17.2 % of population in Japan consists of people over 65 years old, and a 7.0% consists of people over 75 years old. About four persons in the active age group of 15 to 64 years are taking care of an elderly person of age 65 year or older. In 2025, it is expected that more than 27.4% of Japan's population will consist of elderly people of age 65 or older, and about 11.9% of population will be at least 75 years old. About two and a half persons in the active population will have to take care of an elderly person of age 65 or older and 5 persons in the active population will have to take care of an elderly person of age 75 or older. This trend goes to an extreme by the year 2050: slightly less than a third (32.3%) of the population will be over 65 years old, and almost one fifth (18.8%) of the population will be over 75 years old. That means, about 1.7 persons in the active population will have to support an elderly person of age 65 or older, and about 3 persons in the active population have to support an elderly person of age 75 or older.

Less conspicuous but similar patterns can be found in many developed countries. For instance, in the year 2025, the proportions of population over 65 years of age are going to be 18.8% in the United States, 21.2% in the Great Britain, 23.4% in Germany, 21.7% in France and 24.3% in Sweden (National Social Welfare Association, 1999). This means that the aging pattern of Japan is not an isolated case. The aging trend is seen all over the world.

The second motivation for this paper is the rising cost of elderly care. The cost of nursing as a proportion of national income increases more rapidly than the proportionate increase in the elderly population. In addition, more serious problems are the hidden costs of taking care of elderly within the family, and the increasing costs of public care for the elderly, classified as social assistance. Nursing requires human care that can hardly be substituted by medical instruments and robots. Thus the aging of population will necessitate a larger proportion of labor force to be engaged in the elderly care sector.

Of course, not everyone older than 65 needs active cares from others. As aging progresses, however, more and more persons will require intensive care. For instance, while only 2.5% of people between age 65 to 69 need care at home, at nursing facilities or

at hospitals, the ratio of people who need such care climbs up rapidly for older age groups, for instance to 4.3% for the age group 70-74, to 8.0% for the age group 75-79, to 16.8% for the age group 80-84, and to as high as 35.3% for the age group 85 or over. According to the Ministry of Welfare (1995), out of 850 thousand households who needed elderly cares, about 5.6% are single households, about 16.9% are households consisting of couples, and about 56% are households consisting of three generations, i.e., the adults, their parents and their children.

In 1995, the Ministry of Welfare of Japan surveyed households with recently deceased family members to shed light on the caring arrangements of the dying family members. The findings of the survey are striking: About 66.8% of such cares were provided by direct family members, about 5.5% of cares were provided by other relatives, and about 16.4% by professionals in the hospitals and clinics. The average age of caring family members and relatives was 60.4 years. About 30% of those who took care of the old often resigned from jobs or took leaves of absence. The majority of them were under heavy stress, and a substantial fraction of them could not afford to have sufficient sleep or to leave the house.

Thus, although the average length of period during which old persons must go through nursing might not be too long, the anxiety of people in Japan over nursing expenses during old-age has been tremendous and has significant macroeconomic consequences. Because of such strong anxieties over the health and nursing care expenses, older people often refrain from consuming enough, which aggravated recession and deflation in Japan. There are some studies on these issues in the US. Alan Garber (Chapter 7 in Yukio Noguchi and David Wise eds, 1994) investigated carefully the rapid increase in costs and the uncertainty about the medical cares of aged persons. They emphasized the need for alleviating the anxiety of the elderly and their family members and for better saving behavior to meet the resource needs.

A few studies examined the link between the rising elderly health care expenditures and aging pattern in the US. Fuchs [1990] noted that the health sector's share in GDP in the United States rose from under 4% to more than 11% in the 1980s. He attributed this to price factors --- prices of medical services grew by 1.6% per annum, much faster than other prices --- and to quantity factors --- the growth in the quantity of health care consumption was 0.9% faster per annum than the other factors. He found that the aging speed, wage growth, technological change in the medical sector and human factor such

as moral hazards were significant determinants of such rapid rise in the health care costs in the US. On the other hand, taking into account the effects of income, productivity, distribution of income on medical expenses, Karatzas [2000] found that the aging has little to do with the medical costs. This is contrary to the commonsense view.

The problem of rising medical expenditures is also present in Japan. Japan spent 21.5 billion yen for healthcare services in 1955. In 1995 this figure rose to 28.5 trillion yen. In the United States, however, the national expenditure on health care grew from 27 billion dollars in 1960 to 698 billion dollars in 1990. Sato [2001] puts Japanese medical expenditures in international perspective. She points out that the medical care as a proportion of GDP is as high as 14% in the United States, but it is low at the rate 7.2% in Japan. She classifies the causes of rising medical costs as follows: (1) the demand side factors such as better access to care, more use of care and aging population; (2) the supply side factors such as technological advances and moral hazards; and (3) the higher price of medical care.

Incidentally, statistics seems to indicate that the savings rate of Japanese households now faces a refraction point, at least, a plateau. Japan's households kept saving with an exceptionally high rate during the 1990s. The Department of Statistics (1994 and 1999) indicates that the savings rate of all households as a group in Japan kept increasing until 1994, but during 1994 to 1999 remained almost constant. While the savings rate of salaried households was still increasing, the savings rate of other households decreased *Household Survey* because of their loss of income and employment in independent enterprises. Using enquete surveys, the Bank of Japan (2001) suggested that while anxieties over future employment, pensions, and old-age care had positive effect on savings rate, the capital loss due to fall in residential prices had negative effect on savings rate. In 2000, the household savings rate was only 10.3%. It ranked only 8th among the OECD countries and Japan was no longer a country with an extremely high savings rate. Ishikawa et. al. (2002) forecast dramatic decline of the savings rate after 2010.

While it is difficult to determine whether the observed decline in Japan's saving rate was due to recent changes in the treatment of national account or due to structural changes in the economy, this paper attempts to shed light on the predicted trend of the savings rate arising from structural changes. The main message of this paper is as follows: Whether an aging population increases or decreases the saving rate depends on the

elasticity of substitution between consumption of goods and nursing services.

Summing up, we note that for intensive care of old people, human labor is essential and cannot be easily substituted by capital equipments. While technological progress in gerontology is highly needed to find cheaper ways to provide for the elderly care, at present its outcome is uncertain. In the meantime, the cost of caring for the elderly is rising sharply and it is hard to substitute nurses with robots and machines.

Our third motivation of this paper is to find alternative means of financing the elderly care expenses once the economy is open to exporting capital to and importing labor services from foreign countries. We examine theoretically the often-made claim that the Japanese people save too much and accumulate too much balance of payments surplus because they have to spend a large amount when the population becomes suddenly old. Noguchi (1990), Horioka (1991), (1992), and EPA (1991) extensively debated on the effect of aging on the balance of payment of Japan. See Yashiro and Sato-Oishi (1997) for an excellent summary of this debate and Lincoln (1993) for an informal lucid explanation of the effect. A formal theoretical analysis incorporating aging and care will shed further light on this open-economy issue. It is shown that, depending on the elasticity of substitution between the present consumption of goods and the future consumption of nursing services, an aging of population may exhibit an increase in its saving rate.

An important open-economy policy issue is whether an ageing country should import more immigrants. This policy question is examined in Section 3 with reference to the present state of Japan's immigration policy. Goto (1998) claimed that since trade and capital movements tend to equate factor prices, migration is redundant for the adjustment. We show that this holds if the adjustment cost for capital movements and for international labor movements are neglected, and if the production functions of the foreign country and the home country are identical.

In this paper, we construct a simple proto-type model of overlapping generations in which a person works during young age and consumes elderly and nursing cares during old-age. This simplified model clarifies the basic nature of the nursing problems of the elderly population. We show that the individuals with utility functions that limit substitution between the present consumption of goods and the future consumption of nursing services will be forced to save more during their working years. The decline of labor growth rate implies a decrease in the transformation possibility from the present

consumption to the nursing care in the next period. We also argue that when the nursing services cannot be substituted by capital expenditures, it is desirable to import foreign labor services as well as to encourage outflow of capital. We also show that in spite of our emphasis on the old-age nursing care, the neoclassical property of the overlapping generation model remains intact.

The rest of the paper is organized as follows. In section 2, we set out our theoretical apparatus, and examine the theoretical issues. In section 3 we use the theoretical apparatus of section 2 to address the policy issues.

2. Theoretical Apparatus

The welfare of the elderly depends on the level of the care. The elderly care includes medical care and nursing services. The welfare of an individual in a society depends also on the material wellbeing during the lifetime. In this paper we consider only the nursing services during old age, and we identify all material well-being with consumption of an aggregate good during the first period. More specifically, we assume an overlapping generations economy in which each agent lives for two periods – young and old. Each adult is endowed with 1 unit of labor that he supplies to the labor market inelastically and earns wage rate w_t out of which he consumes c_t and saves s_t. In the second period, he retires, and consumes nursing services n_{t+1}. Let the agent of the t^{th} generation have the lifetime utility $u(c_t)+v(n_{t+1})$, where $u(c_t)$ is the present utility of the t^{th} generation defined on the present consumption of goods c_t and $v(n_{t+1})$ is the utility derived from the nursing service n_{t+1} which we assume as hours of nursing time and it is provided by the future generation. The consumption good is the numeraire and the total available time of an young is normalized to 1.

Household's Choice Problem

The choice problem of an adult of t^{th} generation is:

Maximize: $u(c_t)+v(n_{t+1})$

Subject to

(1) $c_t + + \frac{w_{t+1} n_{t+1}}{1+r_{t+1}} \le w_t$

Note that $s_t = w_t - c_t$. Denote by $\rho_{t+1} = w_{t+1}/(1+r_{t+1})$ the wage-rental ratio in period t+1. The optimal solution for s_t and n_{t+1} depend on the wage rate w_t and the wage-rental rate ρ_{t+1} in period *t+1*. We denote the optimal solution by

(2) $\quad s_t = s(w_t, \rho_{t+1})$, and $\quad n_{t+1} = n(w_t, \rho_{t+1})$

Suppose there is a drop in fertility rate in period t. To examine the effect of this fertility decline on savings, consumption of nursing services and the welfare of various generations, notice that the effect for any generation t in our set-up is percolated through the income w_t and the price of the nursing services ρ_{t+1}. The agents take these as given. In a closed economy, the effect of fertility decline in period t will affect the wage rate w_{t+1} and the rental rate $1+r_{t+1}$ and hence the wage-rental ratio ρ_{t+1} but the wage rate w_t will be unaffected. Let us assume that a fertility decline in period t increases the wage rate w_{t+1} and decreases the interest rate r_{t+1}, and thus increases the wage-rental rate ρ_{t+1} (we shall show that this will be the case in most situations). As shown in figure 1a, this will shift inward the budget line of a representative adult of period t (the dotted budget line with a slope of $-1/\rho'_{t+1}$. We are using x' to denote the variable x after demographic shock and without ' to denote the variable before the demographic shock in figure 1). The effect on savings and consumption of nursing services will depend on the income and substitution effects, but there will be a fall in the welfare level of generation t.

Could an outflow of capital or immigration of labor improve the welfare of generation t? Either of the two will lower the wage-rental ratio ρ_{t+1} and hence will improve welfare of generation t and even can attain a higher level of autarky welfare level than the level that the representative adult of generation t could achieve without the fertility decline.

The welfare effect on the future generations are more complicated to determine since there is a wealth-effect from the fertility decline because generation t+1 will have higher wage rate w_{t+1}, which shifts his budget constraint along the consumption axis as shown by the dotted lines in figure 1b. In this case we cannot even determine the welfare effect. To determine these effects we shall consider the constant elasticity of substitution (CES)

utility function which assumes constant inter-temporal rate of substitution, beginning with the case of Cobb-Douglas utility function, i.e., with the unit elasticity of substitution case. To that end, we begin with the description of the autarky equilibrium.

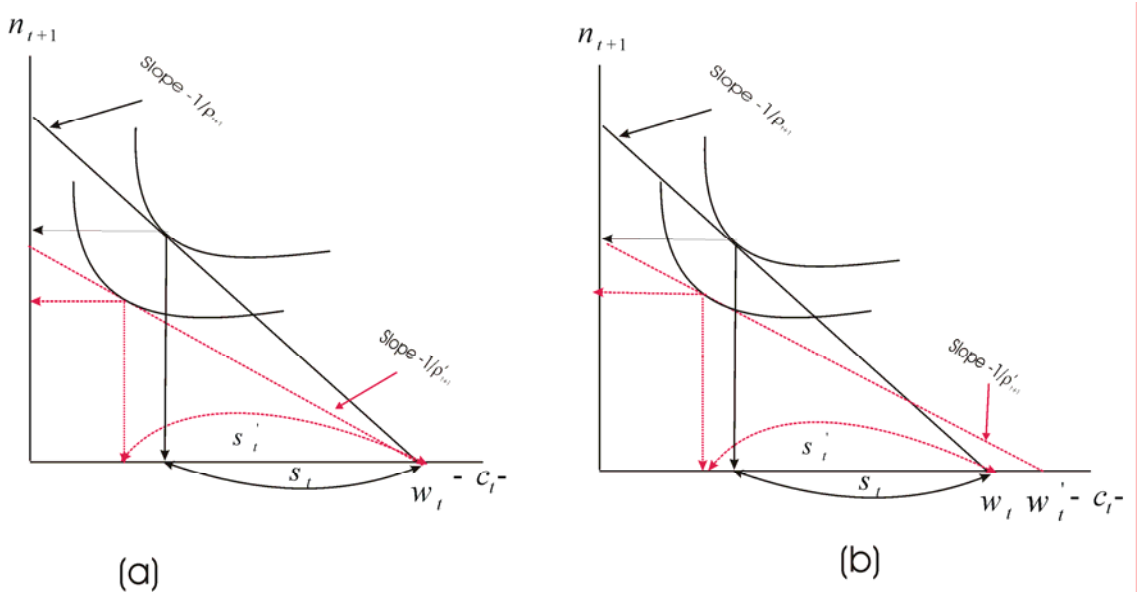

Figure 1

Autarky Equilibrium

Let L_t be the number of young agents in period t. We assume that population is growing exogenously at the rate of g, i.e., $L_{t+1} = (1+g)L_t$. Denote by $\hat{L}_{t+1}$ the labor in the productive sector. Then in equilibrium we must have,

(3) $$\hat{L}_{t+1} = L_{t+1} - n_{t+1}L_t = \left[1 - \frac{n_{t+1}}{1+g}\right]L_{t+1}.$$

Denote by e_t the fraction of labor in the productive sector in period t. It then follows from the above that

(4) $$e_{t+1} = \frac{\hat{L}_{t+1}}{L_{t+1}} = 1 - \frac{n_{t+1}}{1+g}$$

Assume that capital fully depreciates in one period and it takes one period to gestate. This also means that rental rate and interest rate are identical. The aggregate capital

K_{t+1} in period t+1 is given by

(5) $$K_{t+1} = L_t s_t$$

We assume that the nursing sector does not require any capital. The productive sector uses capital and labor to produce output using a constant return to scale production function $Y_t = F(K_t, \hat{L}_t)$. Denote the capital labor ratio in the productive sector in period *t+1* by $\hat{k}_{t+1} = \frac{K_{t+1}}{\hat{L}_{t+1}}$. Utilizing (2) and (4) we have,

(6) $$\hat{k}_{t+1} = \frac{s_t}{(1+g) - n_{t+1}}$$

In autarky, the competitive wage rate and interest rate between period t and t+1 are determined in the productive sector as follows

(7) $$1 + r_t = f'(\hat{k}_t)$$

(8) $$w_t = f(\hat{k}_t) - \hat{k}_t \cdot f'(\hat{k}_t) \equiv \omega(\hat{k}_t)$$

where, $f(k) \equiv F(k,1)$. We assume that production function is concave. Notice that the wage rental-rate $\rho_t(\hat{k}_t) = \frac{f(\hat{k}_t) - \hat{k}_t f'(\hat{k}_t)}{f'(\hat{k}_t)}$, which as a function of $\hat{k}_t$ is an increasing function.[2] Substituting (7), (8) and (2) in (6), we have the following non-linear difference equation in the capital labor ratio $\hat{k}_t$ of the productive sector.

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[2] To see this, note that $\rho_t'(\hat{k}_t) = -\frac{f''(\hat{k}_t) f(\hat{k}_t)}{\left[f'(\hat{k}_t)\right]^2}$, which is positive for concave production function.

(9) $$\hat{k}_{t+1} = \frac{s(w_t, \rho_{t+1})}{(1+g) - n(w_t, \rho_{t+1})} \equiv \varphi\left(\hat{k}_t, \hat{k}_{t+1}\right)$$

for an appropriately defined function φ. Equation (9) provides the fundamental difference equation of our growth model. Once we obtain $\left\{\hat{k}_t\right\}_0^\infty$ we can derive all other equilibrium quantities. Thus the dynamic properties of our economy could be studied from the properties of the difference equation (9).

The implicitly defined second order difference equation in (9) is, however, hard to study. We shall consider two examples to study the dynamic properties of our economy when there is exogenous shock in the fertility rate: One with Cobb-Dougals utility and production functions, and the other with constant elasticity of substitution (CES) utility function and Cobb-Douglas production function.

Cobb-Douglas Economy

Assume Cobb-Douglas utility function as $u(c_t) = \alpha \ln c_t$ and $v(n_{t+1}) = (1-\alpha)\ln n_{t+1}$, $\alpha > 0$. Assume Cobb-Douglas production function as $f(k) = k^\theta, 0 < \theta < 1$. We then have the following optimal solutions:

(10)
$$c_t = \alpha w_t$$
$$n_{t+1} = (1-\alpha)(1+r_{t+1})\frac{w_t}{w_{t+1}}$$

Thus we have

(11) $$s_t = (1-\alpha) w_t$$

Notice that a rise in wage rate in the next period only due to a fall in the fertility rate in this period will have no effect on consumption and savings in this period but the demand for nursing services will fall to the level such that the share of current income spent on

nursing will remain constant. However, if both w_t and w_{t+1} change due to a constant fertility decline over time which started in the past, there will be an increase in savings. The effect on demand for nursing services will depend on how the ratio of the wage rates w_t / w_{t+1} and the interest rate r_{t+1} are affected by such fertility decline. To that end, we study the difference equation (9) which for this specific economy becomes,

$$\hat{k}_{t+1} = \frac{(1-\alpha)}{(1+g)} \hat{k}_t^{\theta}, \ \hat{k}_0 \text{ given}, \ t \geq 0. \tag{12}$$

The above is a stable dynamical system with the steady-state capital labor ratio of in the productive sector is given by

$$\hat{k}^* = \left[\frac{(1-\alpha)}{(1+g)} \right]^{\frac{1}{1-\theta}} \tag{13}$$

and the phase diagram is as shown in figure 2.

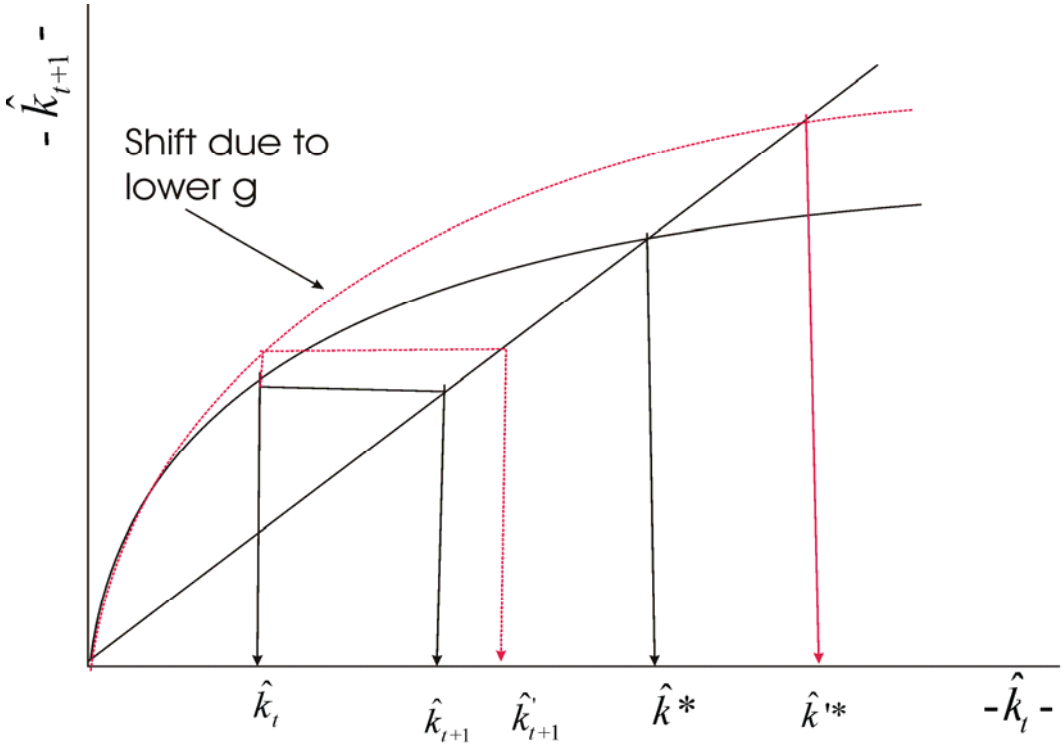

Figure 2

It is clear from the above phase diagram that if there is a constant fertility decline beginning in time period t, the capital labor ratio in all subsequent periods will be higher than the levels without the fertility decline, and hence the economy will have higher wage rates $w_{t+1}, w_{t+2}...$ and higher wage rental rates $\rho_{t+1}, \rho_{t+2}...$ compared to the rates when there was no fertility decline. We now examine the general equilibrium effect of fertility decline on other variables.

From equation (4) it follows that

$$
\begin{aligned}
e_t &= 1 - \frac{(1-\alpha)(1+r_t)w_{t-1}/w_t}{1+g} \\
&= 1 - \frac{(1-\alpha)}{1+g} \cdot \frac{\theta}{1-\theta} \frac{\omega\left(\hat{k}_{t-1}\right)}{\hat{k}_t} \\
&= 1-\theta
\end{aligned}
\tag{14}
$$

The last equality follows after substituting Eq.(12) in the denominator in the previous step and then simplifying. Thus in this economy the fraction of labor in the nursing sector is independent of population growth rate in all periods.

From the second line of Eq. (10) we have

$$
\begin{aligned}
n_{t+1} &= (1-\alpha)w_t / \rho_{t+1} \\
&= (1-\alpha)\theta \hat{k}_t^{\theta} / \hat{k}_{t+1} \\
&= \theta(1+g)
\end{aligned}
\tag{15}
$$

In the above, we derived the last equality after substituting $\hat{k}_{t+1}$ from Eq. (12) and then simplifying. It is clear from (15) that all generations will have the same level of consumption of nursing services, the level of which is lower, lower is the population growth rate.

Since wage rates in all future periods are higher, it follows that there will be higher savings due to a fall in fertility rate. The savings rate, defined as s_t / w_t will, however,

remain unaffected by a drop in the fertility rate.

Constant Elasticity of Substitution Economy

We consider now a more general CES utility function to shed light on the effect of fertility decline on savings rate and other variables. We assume the following forms for the CES utility function:

(16) $$u(c_t) = \frac{c_t^{1-\sigma}}{1-\sigma}, \text{ and } v(n_{t+1}) = \frac{n_{t+1}^{1-\sigma}}{1-\sigma}, \ \sigma > 0, \sigma \neq 1.$$

After algebraic manipulations, we have the optimal solution for n_{t+1} and s_t as follows:

(17) $$n_{t+1} = \frac{w_t}{\rho_{t+1} + \rho_{t+1}^{1/\sigma}}$$

and

(18) $$\begin{aligned} s_t &= \rho_{t+1} n_{t+1} \\ &= \frac{w_t}{1 + \rho_{t+1}^{1/\sigma - 1}} \end{aligned}$$

Notice that in this case the effect on savings rate of generation t from a constant fertility decline over time beginning in time period t depends on whether $\sigma > 1$ or $\sigma < 1$. We know that an increase in interest rate has a negative income effect and a positive substitution effect on savings and the net effect depends on which effect is dominant. It is well-known that when $\sigma > 1$, the income effect dominates the substitution effect and the net effect of an increase in interest rate on savings is negative. The opposite is the case when $\sigma < 1$. The empirical estimates of σ in macroeconomics and public finance literature vary anywhere from 1 to 4 for the US during post-war period. Assuming similar estimates hold for Japan, we can see that a decline in fertility rate will increase the savings rate s_t / w_t. The economic interpretation of this result is that the households save more so that they can afford more costly nursing services when they become old.

Substituting the first part of equation (18) in equation (6) we have,

(19) $$\hat{k}_{t+1} = \frac{\rho_{t+1}}{(1+g)/n_{t+1} - 1}$$

For the Cobb-Douglas production function we have, $\rho_{t+1} = \frac{(1-\theta)}{\theta} \cdot \hat{k}_{t+1}$. Substituting this in equation (19) we have

(20) $$n_{t+1} = \theta(1+g).$$

Thus, the equilibrium consumption of nursing services does not depend on elasticity of substitution, σ, and its level is constant over time. The equilibrium consumption of nursing services is, however, lower if there is a decline in the fertility rate g. From Eq. (4) it also follows that

(21) $$e_t = 1-\theta$$

Substituting equation (17) in equation (20) and after simplification we have the following non-linear difference equation for $\hat{k}_t$,

(22) $$\left[\frac{1-\theta}{\theta}\right]^{(1-\sigma)/\sigma} \hat{k}_{t+1}^{1/\sigma} + \hat{k}_{t+1} = \frac{1}{(1+g)} \hat{k}_t^{\theta}$$

The above defines implicitly $\hat{k}_{t+1}$ as a function of $\hat{k}_t$. This is an increasing function of $\hat{k}_t$ and its derivative at $\hat{k}_t = 0$ is ∞. It will have phase diagram similar to the one shown in figure 2. Thus the dynamic properties of this model will be similar to those of a standard neoclassical growth model.

3. Foreign Capital Investment and International Labor Migration

If this country is opened to the world market, then certainly immigration from abroad will help the welfare of the country as long as the foreign technology and population growth rate are initially identical to those in the home country. This proposition is

understood by looking at wage-rental frontiers, which depict the relationship between the present wage and the rate of return to saving to the future. Initially, the foreign wage-rental frontier is given. The home country's wage-rental frontier shrinks downward because the same amount of saving will be less effective in obtaining care in the future. Therefore, the inflow of foreign workers will recover the labor growth rate and improve the consumption possibility of the home country. In the simplest case where the foreign country is a large country so that its wage-rental frontier does not change because of emigration, the home country can enjoy the same welfare as the foreign country.

In fact, in some countries, legal and illegal migration plays an important role in mitigating the problems arising from aging. About 40% of the immigration in the Northern part of Italy is composed of women from all over the world, whose job is to take personal care of elderly, in a ratio of almost one to one. For instance, in the region Emilia-Romagnia (with approximately 4 million inhabitants) the recent regularization of illegal immigrant accounted for 60,000 irregulars of which 25,000 were women working as caretakers.[3]

In Japan, we find a completely different picture concerning migration related to care-taking. In 2001, Japan was reported to have 1.78 million foreign residents, which is half a million more than the number of foreign residents recorded in 1992 (Department of Justice, 2002). None of them were recorded, however, as engaged in care and welfare. Only 95 foreign residents were recorded in the medical occupation. About 80% of those who are Japanese descendants are recorded as workers in the manufacturing and construction sectors. According to the present immigration law, foreigners are not permitted to stay in Japan as caretakers or social workers. In this sense, our approach is far from the reality of Japan, but it points out the potentially serious need for the immigrants for the rapidly aging country.

So far, the argument for enlarging the capacity of immigration in Japan was supported by the idea of supplementing labor for hard or difficult jobs and for highly specialized skills. The immigration policy does not extend to simple labor. Care-taking is considered a part of simple labor. This paper provides a completely different view point, nanmely the necessity of immigration to cope with aging problems.

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[3] We owe this data to a referee of this paper.

The foreign workers (not residents) in 2000 were about 0.71 million. In order to replenish decreasing labor force, the Ministry of Welfare and Labor (2002) indicates that approximately 0.61 million workers are to be admitted annually. This sounds a bit awful to the Japanese who are so used to a homogenous society.

In Kageyu spa of (mid-mainland) Nagano prefecture in Japan, there were 21 nurses (or caretakers) from Brazil in 2000.[4] According to the Asahi Newspaper (January 14, 2000), the Japanese Government started considering the question of whether foreigners should be admitted to provide nursing services. In the year 2025, the elderly persons who require intensive care will increase to 5.2 million from the present level of 2.8 million. Presently there are only 170 thousand in-home caregivers, but Japan will need more than a million nurses and male nurses including their administrative support in future. There are opposing opinions about letting immigrants provide this service. For instance, the Nursing Service Organizations are hardly welcoming to such a policy. Some economists admit that this trend is inevitable. The aged and patients often say that they are happier to be taken care of by kind foreigners than by busy natives.

In any case, unlike in Italy, it seems to be a remote possibility that elderly care is supported by migration. Of course, according to our model, one could achieve the same goal by exporting capital. Instead of accumulating capital in the home country where the rate of return will be reduced because of fall in the labor force due to fall in fertility level and decreasing utility from nursing, the home country can invest capital abroad, earning a higher rate of return, and pay for the nursing care in the next period utilizing the higher returns from foreign investment. This provides a theoretical explanation of the commonly made observation that the Japanese save a large percentage of their income in order to consume when the population becomes aged. This analysis is also consistent with the claim by Goto (1998) that Japan can avoid the social problems that are involved with immigrant workers by trading with foreign countries first and then investing capital in foreign countries. Both capital movement and migration carry

[4] Before World War II, many Japanese migrated to Brazil and their descendants still speak Japanese. Probably because of that, Brazilian citizens are under less strict regulations for immigration into Japan. Patients as well as the aged in Japan welcome these kind of nursing persons from abroad.

adjustment cost in terms of economic, social and human terms. In the frictionless world, it does not matter whether capital or labor moves. In practice, the adjustment cost will decide which factors are tempted to move.

We live, however, in a world where technological levels differ from one part of the world to the other. There are two conceivable cases. One case is where the labor force in the Northern countries possesses a higher level of human-capital such that a worker in the North is as effective as say two workers in the rest of the world. Then if the production function in terms of the effective labor unit is identical, the neoclassical theory of capital movements and migration will hold. A worker in the South will have wage rate only half of the wage rate in the North after migration.

In reality, however, the technological level of the North seems to be higher than that in the South. If the two regions have the same shape for production iso-quants in terms of capital and labor, and if the levels of total factor productivity between the two regions are different, what will be the pattern of international factor movements? The exodus of capital from the North to the South is not the solution in this situation. The flow of both capital and labor from the South to the North will enhance the world welfare.[5] Our main conclusion is that since Japan is aging rapidly, it is desirable not to rely only on foreign investment but also to admit foreign workers.

Concluding Remarks

In order to focus on the problem associated with the care for the aged, we have built an overlapping generations model that takes full account of the nursing cost of an economy facing rapid aging. The rapid aging presents a challenge to the society because the present generation will face a less favorable trade-off in transforming the saving into nursing services when they become old. If the elasticity of substitution between the present consumption and the future nursing consumption is less than unity, the savings of the current generation will increase.

[5] Formally, the concentration of production in the North by deserting the South would be the optimal solution, but probably congestion in the north will stop such a process. See also Raut (2003) for some other considerations along this line.

In such a case the increased savings may find an outlet to foreign market. We found that that immigration and capital outflow are alternative remedies to a country that faces rapid aging of population.

It is needless to say that aging and nursing problems have much wider dimensions such as ethical, sociological, and medical. Labor for nursing and labor for production of goods are definitely important dimensions and thus may warrant more immediate concerns. Investment in human capital including nursing may need more careful attention. Capital and labor cannot be necessarily substituted, and their contribution to total factor productivity may differ. Transportation costs for migration and foreign investments also vary depending on the situations. The Gast-arbeiter (guest workers) issues in Europe pose social problems of adjustment for many generations. The "hollowing out" of capital exporting country presents also a serious problem to the home country.

Our policy conclusions should be judged in the light of the above qualifications before implementing. We, however, believe that the main messages of this chapter will still hold: the aging of a population create a problem of caring and supporting the elderly generation. This problem generates serious macroeconomic consequences that should be dealt with a proper combination of policies concerning migration and foreign investment.

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