# Demographic Change, Intergenerational Altruism, and Fiscal Policy:
## A Political Economy Approach*

Kazumasa Oguro
(Hitotsubashi University)

Manabu Shimasawa
(Akita University)

Reiko Aoki
(Hitotsubashi University)

Takashi Oshio
(Hitotsubashi University)

**Abstract**: Our study employs an overlapping generations model in which the political powers of different generations (the working generation and retired generations with and without children) determine the distribution of fiscal burden among the generations. We investigate the relationship among the extent of intergenerational altruism, political regimes, and intergenerational distribution of fiscal burden. Our numerical simulations show that the more the working generation cares about the utility of the retired generation, the more likely it is for an intergenerational coalition to be established. This coalition can make the working generation better off by lowering their tax rates. We also show that Demeny voting, which allows parents to vote on behalf of their children, requires a higher degree of altruism to decide on intergenerational coalition. However, Demeny voting can make both the working generation and the retired generation with children better off once it establishes the intergenerational coalition.

Key words: Public debt, public deficit, OLG model, intergenerational altruism, Demeny voting

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## 1. Introduction

This study employs an overlapping generations (OLG) model in which the allocation of fiscal burden among generations, including the future generation, is determined by intergenerational political relations. We demonstrate how a change in intergenerational altruism and political power can affect the relations among generations, including the allocation of tax burden and utility.

Japan's outstanding public debt as a proportion of GDP is now the largest among the industrialized countries, primarily owing to their rapidly ageing population. The country's fiscal strain is expected to worsen, as social security payments are expected to increase by about one trillion yen per year. Japan's policy for public finance needs to undergo a drastic change in order to enhance fiscal sustainability.

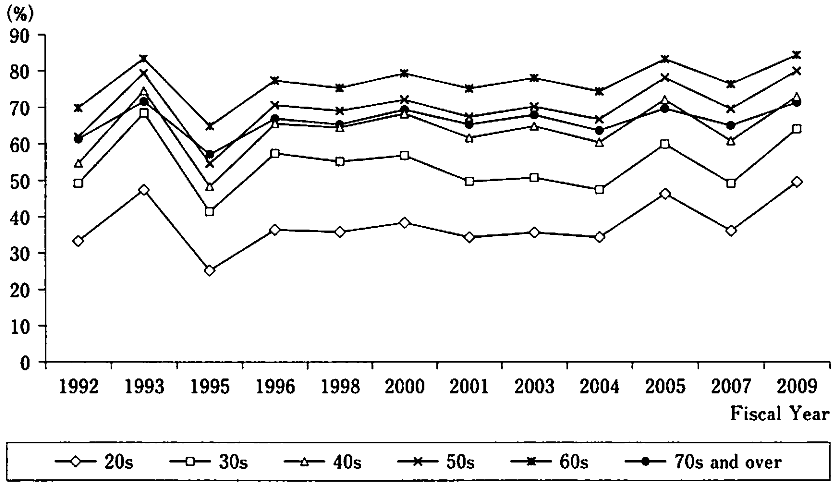
According to Masujima et al. (2009), under the current system, the projected ratio of the future generation's lifetime net public burden (lifetime tax minus transfers) to lifetime wages is 51.4 percent; the ratio remains at -7 percent for the current generation aged 90 or older. This means that the future generation's lifetime public burden will be 60 percentage points more than that of the current generation aged 90 or older.

It has proven extremely difficult, however, to reduce this intergenerational inequality. The older generation's politically advantageous position is one reason for this difficulty. In fact, the proportion of the older generation is increasing in Japan owing to lower fertility rates, and this has enhanced their political position in society. Their higher voting turnout rates make their political power even more pronounced (see Figure 1).

Thus, the older generation can leverage the political process to shift the country's fiscal burden to the working generation. They are inclined to let the government issue public debt and leave the liability to the future generation because of their shorter time horizons. Coupled with their greater political power, this dynamic can explain the divergence between desirable policy and reality: public debt levels continue to grow, but the political will to change the situation is lacking.

This situation may change if the retirees with children behave differently from those without children. The retirees' children are the current working generation; their children are the retirees' grandchildren. Hence, we focus on the possibility of forming an intergenerational coalition, determined by both the economic gains accrued from the coalition and the degree of forward altruism. Intergenerational altruism may cause the retired generation to behave in a manner that favors the interests of the working and future generations, even if such a choice may reduce their own lifetime consumption. Furthermore, the working generation's behavior is determined by the gains they expect from the coalition and backward altruism. The final coalition choice is substantially affected by the power relations among the generations.

Since the 1990s, both empirical and theoretical political economic approaches have been adopted vis-à-vis the politics of public finance (e.g., Alesina et al. 1998, Persson and Tabellini 2000, Shi and Svensson 2006). Several sources of political factors have been identified: (1) the political cycle of fiscal policy generated by the reelection motive of politicians and a change in the majority party




Source: "The Association for Promoting Fair Elections" http://www.akaruisenkyo.or.jp/

**Figure 1: Election turnout rate by age group**

(Rogoff 1990, Kneebone and McKenzie 2001, Foucault et al. 2008), (2) a change of government and strategic motives (Persson and Svensson 1989, Tabellini and Alesina 1990, Crain and Tollison 1993), and (3) the common pool problem (Alesina and Drazen 1991, Ihori and Itaya 2001). The common pool problem has been identified as an important political source of fiscal profligacy (resulting in a negative fiscal budget). Income inequality and racial bias (Woo 2003) and the relationship between federal and state (central and local) governments (Rodden 2002, Doi and Ihori 2002, Schaltegger and Feld 2009a, 2009b) are also suggested as significant factors.

To the best of our knowledge, however, the relationship between political regimes and fiscal policy has not been studied. In this paper, we use the OLG framework with two generations (working and retired) and three groups (working, retired with children, and retired without children). The three groups are composed of independent political voting blocks. This framework allows us to analyze the relationship between the political regime, characterized by the power relations among the voting groups, and the political outcome, which determines fiscal policy. The fiscal policy defines taxes and transfers.

Our analysis shows that a higher degree of backward altruism can replace the coalition of the retired generation—between those with children and those without children—with the coalition between the working generation and the retired generation with children. This intergenerational coalition makes the working generation better off by lowering their tax rates. We also show that Demeny voting, which allows parents to vote on behalf of their children, can make both the working generation and the retired generation with children better off than the retired generation without children.

In Section 2, we present an OLG model with two generations and three voting blocks that characterize the possible political regimes and outcomes. In Section 3, we conduct numerical simulations to apply the theoretical analysis to the case of Japan. We summarize the results and discuss questions for future research in Section 4.

## 2. Model

### 2.1 Household

Two generations are involved in each period $t$ ($t=0, 1, 2...$): the working generation (generation $t$) and the retired generation (generation $t-1$), which was the working generation in period $t-1$. We assume that wages are exogenous and that the interest rate is zero. Each generation earns lifetime wages fixed at 1 (with no wage growth). The working generation pays tax $\theta_t(t)(<1)$ only in period $t$[1] and expects lifetime consumption $C_t(t) \equiv c_t^1(t) + c_t^2(t+1)$, which is the sum of their consumption while working, $c_t^1(t)$, and after retirement, $c_t^2(t+1)$:

$$C_t(t) = 1 - \theta_t(t) \tag{1}$$

Equation (1) represents the intertemporal budget constraint that the working generation expects in period $t$ (i.e., before retirement).

The retired generation in period $t$ can recover part of the tax paid in period $t-1$ by issuing bonds or placing a larger tax burden on the working generation. That is, the retired generation can reduce their lifetime tax to $\theta_{t-1}(t)$ in period $t$. We can define the retired generation's "profit" in period $t$ as $\varphi_t \equiv \theta_{t-1}(t-1) - \theta_{t-1}(\mathrm{t})$. If this generation has a heavier tax burden in period $t$, it will face a negative profit $\varphi_t < 0$. Accordingly, the retired generation revises its lifetime consumption in period $t$ to[2]

$$C_{t-1}(t) = c_{t-1}^1(t-1) + c_{t-1}^2(t) = 1 - \theta_{t-1} + \varphi_t = 1 - \theta_{t-1}(t). \tag{2}$$

### 2.2 Government budget constraint

For simplicity, we assume no government expenditure (other than transfers to households), so that all the debt incurred in period $t$ is assumed to be repaid in period $t+1$. Denoting the (planned) tax on generation $t+1$ in period $t$ as $\theta_{t+1}(t)(<1)$, public debt at the beginning of period $t$ as $D_t$, and population size of generation $t$ as $N_t$, we express the government's budget constraint[3] as

$$D_t = N_{t-1}(\theta_{t-1}(t) - \theta_{t-1}(t-1)) + N_t\theta_t(t) + N_{t+1}\theta_{t+1}(t) \tag{3}$$

The total tax burden on the future generation (generation $t+1$), $N_{t+1}\theta_{t+1}(t)$, corresponds to the public debt at the end of period $t$, $D_{t+1}$, because all the debt incurred in period $t$ is assumed to be repaid in period $t+1$. Therefore, the budget constraint, equation(3), can be expressed as a function of public debt:

$$D_{t+1} = D_t - [N_{t-1}(\theta_{t-1}(t) - \theta_{t-1}(t-1)) + N_t\theta_t(t)] \tag{4}$$

1) $t$ as a suffix indicates generation $t$, while $t$ within parentheses indicates period $t$.

2) In equation (2), only the consumption after retirement $c_{t-1}{}^2(t)$ and income transfer $\varphi_t$ can change. Also, only $\theta_{t-1}(t)$ can change in the definition of $\varphi_t$.

3) This budget constraint represents the No-Ponzi-Game condition.

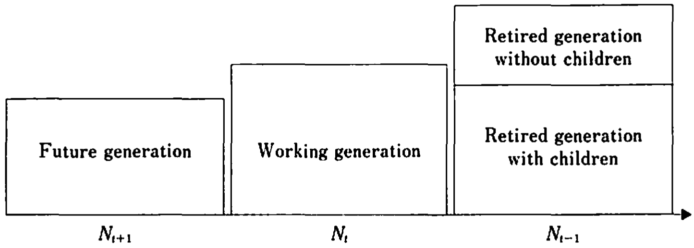



**Figure 2: Generation structure in the model**

In addition, using each generation's lifetime tax rates in periods $t(\theta_{t-1}(t),\ \theta_t(t)$, and $\theta_{t+1}(t))$, we can rewrite equation (3) as

$$n_t d_t + \theta_{t-1}(t-1) = \theta_{t-1}(t) + n_t\theta_t(t) + n_{t+1}n_t\theta_{t+1}(t) \tag{5}$$

where $d_t \equiv D_t/N_t$ is the public debt per capita in the working generation and $n_t \equiv N_t/N_{t-1}$ is 1 plus the rate of population growth from the retired generation to the working generation[4].

### 2.3 Household utility

We assume that the working generation includes people who have not finished having children and therefore, that we cannot divide the working generation into groups of those who have or would have children and those who do not or would not have children. In contrast, the retired generation can be divided into two groups: those with children and those without children (see Figure 2). In this sense, the retired generation is heterogeneous, whereas the working generation is homogeneous.

We evaluate the utility obtained by generation t from lifetime consumption evaluated at period s as log $C_t(s)$ and assume that parents and children are mutually altruistic[5]. Then, the utility function of the retired generation with children can be given by

$$U^{child}_{t-1} = \log[1-\theta_{t-1}(t)] + \delta\log[1-\theta_t(t)] + \pi_t\delta^2\log[1-\theta_{t+1}(t)], \tag{6}$$

where $\delta$ measures the concern of parents for their children (forward altruism). The first term represents the utility derived from their own consumption; the second, from that of their children (the working generation) and the third, from that of their grandchildren (the future generation). The future generation consists of children of the working generation, $\pi_t \times 100$ percent of whom have children.

In the same manner, the utilities of the retired generation without children and the working generation are given by

$$U^{nc}_{t-1} = \log[1-\theta_{t-1}(t)], \tag{7}$$

4 ) Because we assume that the lifetime wage the working generation earns is 1, $d_t$ also represents the ratio of public debt to total wage income in period $t$.

5 ) For simplicity, we assume a logarithm function for the utility from lifetime consumption. To analyze another type of utility function is a subject for future study.

and

$$U_t = \sigma \log[1-\theta_{t-1}(t)] + \log[1-\theta_t(t)] + \pi_t \delta \log[1-\theta_{t+1}(t)], \tag{8}$$

respectively, where $\sigma$ represents the concern of children for the utility of their parents (backward altruism). The first term represents the utility derived from their parents' consumption; the second, the utility from their own consumption; and the third, the utility from their children's consumption.

### 2.4 Objective function of the political process

Let us consider the extent of each generation's political power. We denote the extent of generation $t$'s political activism in period $s$ as $s_t(s)$[6]. We now define the total political power for the three groups: $V_1 \equiv \pi_{t-1} s_{t-1}(t) N_{t-1}$ for the retired generation with children, $V_2 \equiv (1-\pi_{t-1}) s_{t-1}(t) N_{t-1}$ for the retired generation without children, and $V_3 \equiv s_t(t) N_t$ for the working generation. We denote the relative political power of the working generation to that of the retired generation as $\rho_t \equiv s_t(t)/s_{t-1}(t)$.

We consider the following five regimes and denote the objective function in regime $i$ ($i$=1, 2, 3, 4, 5) in period $t$ as $W_t$(regime $i$). In the first two regimes (Regimes 1 and 2), one group has an independent majority, and the group's political objective is to maximize its utility. In what follows, we summarize the conditions for choosing each regime (second line) and the objective function (third line).

**Regime 1:** Retired Generation with Children Independent Majority Regime

$$\pi_{t-1} s_{t-1}(t) N_{t-1} > (1-\pi_{t-1}) s_{t-1}(t) N_{t-1} + s_t(t) N_t \Leftrightarrow \rho_t < (2\pi_{t-1} - 1)/n_t \tag{9}$$

$$W_t(\text{regime } 1) = U_{t-1}^{child} \tag{10}$$

**Regime 2:** Working Generation Independent Majority Regime

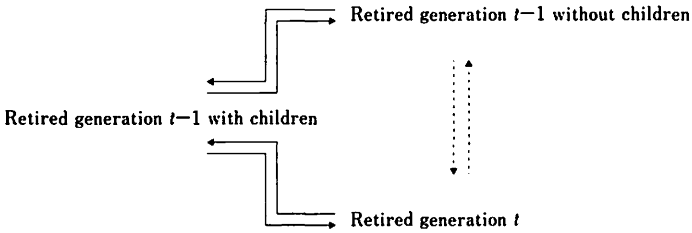
$$s_t(t) N_t > s_{t-1}(t) N_{t-1} \Leftrightarrow \rho_t > 1/n_t \tag{11}$$

$$W_t(\text{regime } 2) = U_t \tag{12}$$

We can rule out the possibility of an independent majority by the retired generation without children, because we assume that $\pi_{t-1} > 0.5$, meaning $V_1 > V_2$.

Next, we consider a situation in which none of the three groups can have an independent ma-

6) In this paper, we assume that the range of own political power that each generation can control, $s_k(t)$, is very limited. The reason is as follows: political power consists of both the voting turnout at election and the structure of the election system. Although each generation can control its own turnout, it cannot change the existing political structure. In the Japanese election system, there is an inequality in voting values between urban areas (where the majority of younger generation voters live) and local areas (where the majority of older generation voters live). The inequality of voting values of the Japanese upper household's election is estimated to be 5 times; therefore, the working generation's voting turnout at election does not have much impact on the distribution of power. Hence, political power is assumed as an exogenous variable in this paper.




Note: The dash line indicates the Working Generation and Retired Generation without Children Coalition Regime, which is unlikely to be chosen, as explained in the Appendix.

**Figure 3: Coalitions among generations**

jority. From (9) and (11), this situation occurs when

$$(2\pi_{t-1}-1)/n_t<\rho_t<1/n_t. \tag{13}$$

Assuming that condition (13) holds, there are potentially three coalition regimes (see Figure 3). In each coalition regime, the objective function is represented by the weighted average of the coalition members' utilities, where the weights reflect their respective political power[7].

**Regime 3:** Retired Generation Coalition Regime

$$\begin{aligned} &s_{t-1}(t)N_{t-1}>s_t(t)N_t \text{ and } (13) \\ &W_t(\text{regime } 3)=s_{t-1}(t)N_{t-1}[\pi_{t-1}U_{t-1}^{child}+(1-\pi_{t-1})U_{t-1}^{nc}] \end{aligned} \tag{14}$$

**Regime 4:** Working Generation and Retired Generation with Children Coalition Regime (Intergenerational Coalition)

$$\begin{aligned} &s_t(t)N_t+\pi_{t-1}s_{t-1}(t)N_{t-1}>(1-\pi_{t-1})s_{t-1}(t)N_{t-1} \text{ and } (13) \\ &W_t(\text{regime } 4)=s_{t-1}(t)N_{t-1}[\pi_{t-1}U_{t-1}^{child}+\rho_t n_t U_t] \end{aligned} \tag{15}$$

**Regime 5:** Working Generation and Retired Generation without Children Coalition Regime

$$\begin{aligned} &s_t(t)N_t+(1-\pi_{t-1})s_{t-1}(t)N_{t-1}>\pi_{t-1}>\pi_{t-1}s_{t-1}(t)N_{t-1} \text{ and } (13) \\ &W_t(\text{regime } 5)=s_{t-1}(t)N_{t-1}[(1-\pi_{t-1})U_{t-1}^{nc}+\rho_t n_t U_t] \end{aligned} \tag{16}$$

7) When a coalition achieves a majority, its objective function will be the weighted average of its coalition groups, with weights reflecting their political powers. Denoting the utility of group $k$ by $U_k$, the objective function will be given as $W_t=V_iU_i+V_jU_j$. In this situation, we can easily show that a group cannot be better off in a coalition with another group/other groups than when it has an independent majority. Assume that a set of tax rates maximizes group $k$'s utility by $\theta^*(k)$. Group $k$ can achieve $\theta^*(k)$ if it has an independent majority. Now, let us suppose that group $k$ makes a coalition with another group/other groups, and that the coalition adjusts a set of tax rates to maximize social welfare, defined as the political power-weighted average of each group's utilities in the coalition. Then, the optimal set of tax rates in the coalition must differ from $\theta^*(k)$. Hence, by the definition of $\theta^*(k)$, a group cannot achieve a higher utility in a coalition than when it has independent majority. This explanation holds despite the assumption of altruistic attitudes toward another group/other groups.

We can numerically show that Regime 5 never occurs, given the utility functions defined by equations (6)—(8) and the Japanese parameters assumed in the numerical simulations in Section 3. Regime 5 is chosen only if the retired generation without children obtains a higher utility from Regime 5 than from Regime 3 and the working generation obtains a higher utility from Regime 5 than from Regime 4. We confirm that there can be no combination of $(\rho_t, \delta, \sigma)$ that satisfies both these conditions simultaneously, given the Japanese parameters assumed in Section 3. We can also rule out the case that no coalition is chosen—that is, the voting paradox never occurs—through numerical simulations[8]. Therefore, either Regime 3 or 4 must be chosen. We refer to Regime 4 as the "Intergenerational Coalition."

For Regime 4 to be chosen, two conditions must be satisfied: (i) inequality (13), which is required for any coalition between generations, and (ii) the utility of the retired generation with children must be higher in Regime 4 than in Regime 3. The second condition can be written as

$$U_{t-1}^{child}(\text{regime } 4) > U_{t-1}^{child}(\text{regime } 3) \tag{17}$$

## 3. Numerical simulations

### 3.1 Choice of coalition regimes: the case of Japan

In this section, we apply the framework presented in Section 2 to Japan, focusing on two potential regimes: the Retired Generation Coalition Regime (Regime 3) and the Intergenerational Coalition Regime (Regime 4). We divide the population aged 20 to 89 into two groups, the working generation (generation t; 20 to 54 years[9]) and the retired generation (generation $t-1$; 55 to 89 years). Based on the population statistics published by the Ministry of Internal Affairs and Communication in 2008, we assume that $N_t = 58{,}000{,}000$, $N_{t-1} = 45{,}000{,}000$, and $n_t = 1.29$. As for population growth, we assume that $n_{t+1} = (1-0.007)^{35} = 0.78$, based on government population projections[10]. We also assume that the proportion of the retired generation with children, $\pi_{t-1}$, is equal to 0.7 and that the proportion of the working generation with children, $\pi_t$, is equal to 0.53[11].

Given these parameter values, we first derive the conditions for the independent majority regimes to be chosen from inequalities (9) and (11): if $\rho_t < (2\pi_{t-1} - 1)/n_t = 0.310$, the Retired Generation with Children Independent Majority Regime (Regime 1) will be chosen; if $\rho_t > 1/n_t = 0.776$, the Working Generation Independent Majority Regime (Regime 2) will be chosen; and for other values of $\rho_t (0.310 < \rho_t < 0.776)$, the Retired Generation Coalition Regime (Regime 3) or the Intergenerational Coalition Regime (Regime 4) will be chosen.

8) Proof that Regime 5 never occurs and that the case of no coalition is ruled out are available upon request (Email: ZVU07057@nifty.com).

9) The minimum voting age in Japan is 20 years.

10) The National Institute of Population and Social Security Research projects an annual population growth rate of $-0.7$ percent until 2100 (medium-level projection in 2006). In this simulation, we set $n_t = 1.29$ and $n_{t+1} = 0.78$. However, even if we assume $n_t = n_{t+1} = 1.29$ or $n_t = n_{t+1} = 0.78$, our numerical simulations can confirm that the results remain the same.

11) The 2005 White Paper on the National Lifestyle (Cabinet Office) states that the proportion of the 20-49-year-old households with children was 69.4 percent in 1980 and 53.2 percent in 2000

We further examine which regime will be chosen by comparing the maximized utility levels of the retired generation with children under both the regimes. If the Retired Generation Coalition Regime (Regime 3) is chosen, the political process maximizes objective function (14) subject to budget constraint (5). The first-order conditions are given by

$$\begin{aligned} 1-\theta_{t-1}(t) &= \frac{h_t}{1+A_t n_t + A_t b_t n_t n_{t+1}}, \\ 1-\theta_t(t) &= A_t(1-\theta_{t-1}(t)), \\ 1-\theta_{t+1}(t) &= A_t b_t(1-\theta_{t-1}(t)) \end{aligned} \tag{18}$$

where

$$h_t \equiv 1 + n_t + n_t n_{t+1} - n_t d_t - \theta_{t-1}(t-1),\ A_t = \frac{\pi_{t-1}\delta}{n_t},\ \text{and}\ b_t = \frac{\delta\pi_t}{n_{t+1}}.$$

In the same manner, if the Working Generation and Retired Generation with Children Coalition Regime (Regime 4) is chosen, the first-order conditions for maximizing the objective function are given from equations (15) and (5) by

$$\begin{aligned} 1-\theta_{t-1}(t) &= \frac{h_t}{1+a_t n_t + a_t b_t n_t n_{t+1}}, \\ 1-\theta_t(t) &= a_t(1-\theta_{t-1}(t)), \\ 1-\theta_{t+1}(t) &= a_t b_t(1-\theta_{t-1}(t)) \end{aligned} \tag{19}$$

where

$$a_t = \frac{\rho_t n_t + \pi_{t-1}\delta}{(\rho_t\sigma_t + \pi_{t-1})n_t}$$

The utility levels of the retired generation with children are determined by introducing equations (18) and (19) into equation (6) for two regimes, respectively. Then, we compare the obtained utility levels to determine which regime is chosen. The results depend on the values of $\delta$, $\sigma$, and $\rho_t$; we use numerical simulations because it is difficult to analyze them algebraically. For simulations, we calculate the utility of the retired generation with children corresponding to the different values of $\delta$, $\sigma$, and $\rho_t$, which are each adjusted with a ridge of 0.05 over the ranges of $0<\delta<1$, $0<\sigma<1$, and $0.31<\rho_t<0.77$, respectively.

In numerical simulations, we further assume that the ratio of public debt to total wage income, dt, is equal to 0.054, obtained by dividing 190 percent, which was the public debt ratio to GDP in 2009, by 35 years (one generation)[12]. Finally, we tentatively assume that $\theta_{t-1}(t-1)=0.25$.

The simulation results are summarized in Table 1. The figure in each cell denotes the upper bound of $\rho_t$ for the Intergenerational Coalition Regime to be chosen in response to each combination of the assumed values of $\delta$ and $\sigma$. The blank cells indicate that the Retired Generation Coalition Regime will be chosen. For instance, suppose the figure 0.5 appears in the cell $(\delta, \sigma)=(0.7, 0.7)$. This means that for $(\delta, \sigma)=(0.7, 0.7)$, the Intergenerational Coalition Regime will be chosen when $\rho_t<0.5$ and, otherwise, the Retired Generation Coalition Regime will be chosen. The blank

12) In our model, $d_t$ represents the ratio of public debt to total wage income in period t. We assume that the GDP per one period (35 years) is equal to the total wage income per one period. Therefore, if the ratio of the annual public debt to GDP is 190 percent, the ratio of the public debt to total wage per one period is 5.4 percent (=190/35).

**Table 1: Retired Generation Coalition Regime vs. Intergenerational Coalition Regime**

| | | σ | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.05 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.35 | 0.4 | 0.45 | 0.5 | 0.55 | 0.6 | 0.65 | 0.7 | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | 1 |
| | 0.05 | | | | | | | | | | | | | | | | | | | | |
| | 0.1 | | | | | | | | | | | | | | | | | | | | |
| | 0.15 | | | | | | | | | | | | | | | | | | | | |
| | 0.2 | | | | | | | | | | | | | | | | | | | | |
| | 0.25 | | | | | | | | | | | | | | | | | | | | |
| | 0.3 | | | | | | | | | | | | | | | | | | | | |
| | 0.35 | | | | | | | | | | | | | | | | | | | | |
| | 0.4 | | | | | | | | | | | | | | | | | | | | |
| | 0.45 | | | | | | | | | | | | | | | | | | | | |
| δ | 0.5 | | | | | | | | | | | | | | | | | | | | 0.35 |
| | 0.55 | | | | | | | | | | | | | | | | | 0.35 | 0.4 | 0.45 | 0.55 |
| | 0.6 | | | | | | | | | | | | | | | 0.35 | 0.4 | 0.45 | 0.55 | 0.7 | 0.75 |
| | 0.65 | | | | | | | | | | | | | 0.35 | 0.4 | 0.45 | 0.55 | 0.7 | 0.75 | 0.75 | 0.75 |
| | 0.7 | | | | | | | | | | | 0.35 | 0.4 | 0.45 | 0.5 | 0.6 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| | 0.75 | | | | | | | | | | 0.35 | 0.4 | 0.45 | 0.55 | 0.7 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| | 0.8 | | | | | | | | | 0.35 | 0.4 | 0.5 | 0.6 | 0.7 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| | 0.85 | | | | | | | 0.35 | 0.35 | 0.4 | 0.5 | 0.6 | 0.7 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| | 0.9 | | | | | | | 0.35 | 0.4 | 0.5 | 0.6 | 0.7 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| | 0.95 | | | | | | 0.35 | 0.4 | 0.5 | 0.55 | 0.7 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| | 1 | | | | | 0.35 | 0.4 | 0.45 | 0.55 | 0.65 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |

Note: A blank cell means that the Retired Generation Coalition Regime will be chosen. The above figures represent the upper bounds of $\rho_t$, under which Intergenerational Coalition Regime will be chosen. For example, the figure 0.5 of $(\delta, \sigma) = (0.7, 0.7)$ means that Intergenerational Coalition Regime will be chosen if $\rho_t < 0.5$ and Retired Generation Coalition Regime will be chosen if $\rho_t > 0.5$.

cell $(\delta, \sigma) = (0.5, 0.5)$ indicates that the Retired Generation Coalition Regime will be chosen regardless of the value of $\rho_t$.

Two main points should be noted from Table 1. First, a combination of the higher values of $\delta$ and $\sigma$ raises the possibility of choosing the Intergenerational Coalition Regime. This is a reasonable result, considering that both the parameters indicate intergenerational altruism, which is likely to encourage coalition between generations. Second, a higher value of the relative political power of the working generation ($\rho_t$) reduces the possibility of choosing the Intergenerational Coalition Regime. This is indicated by the existence of the upper bound of $\rho_t$ for this regime to be chosen. This can be explained as follows: As the relative political power of the working generation increases, the formation of an intergenerational coalition requires the retired generation to pay more taxes in order to induce the working generation to join. In other words, if the working generation has greater political power, the retired generation is more reluctant to cooperate with the working generation.

**Table 2: Shift of coalition regimes and lifetime tax rate and utility for each generation for different values of $\sigma$, assuming $(\rho_t, \delta) = (0.45, 0.8)$**

| | $\sigma$ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.4 | 0.55 | 0.6 | 0.65 | 0.7 | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | 1 |
| Lifetime tax rate of Retired generation$(\theta_{t-1}(t))$ | −0.656 | −0.148 | −0.168 | −0.187 | −0.206 | −0.225 | −0.243 | −0.261 | −0.278 | −0.296 | −0.312 |
| Lifetime tax rate of Working generation$(\theta_t(t)$ | 0.280 | 0.004 | 0.014 | 0.025 | 0.035 | 0.045 | 0.055 | 0.065 | 0.075 | 0.084 | 0.093 |
| Lifetime tax rate of Future generation$(\theta_{t+1}(t))$ | 0.610 | 0.460 | 0.466 | 0.471 | 0.477 | 0.482 | 0.488 | 0.493 | 0.498 | 0.503 | 0.508 |
| Utility of Retired generation with children$(U_{t-1}^{child})$ | −0.078 | −0.074 | −0.069 | −0.065 | −0.061 | −0.058 | −0.055 | −0.052 | −0.050 | −0.049 | −0.047 |
| Utility of Retired generation without children$(U_{t-1}^{nc})$ | 0.504 | 0.138 | 0.155 | 0.171 | 0.187 | 0.203 | 0.218 | 0.232 | 0.245 | 0.259 | 0.272 |
| Utility of Working generation $(U_t)$ | −0.526 | −0.189 | −0.187 | −0.184 | −0.179 | −0.174 | −0.167 | −0.158 | −0.149 | −0.138 | −0.127 |

Retired Generation Coalition Regime (σ = 0.4) | Intergenerational Coalition Regime (σ = 0.55–1)

Next, we focus on how the degree of backward altruism $(\sigma)$ affects the results. Backward altruism is present only in the utility function of the working generation, (8), and not in those of the retired generations, (6) and (7). Let us assume $(\rho_t, \delta, \sigma) = (0.45, 0.8, 0.4)$ in Japan[13]. Then, based on Table 1, the Retired Generation Coalition Regime is chosen. If $\sigma$ rises to 0.55 or above, the Intergenerational Coalition Regime will be chosen. Table 2 summarizes how the lifetime tax rate and utility for each generation changes in response to different values of $\sigma$, assuming $(\rho_t, \delta) = (0.45, 0.8)$. As seen in Table 2, when $\sigma$ rises to 0.55 from 0.4, the working generation's tax rate for $\theta$t drops substantially, and its utility, Ut, jumps. This is because the regime shift caused by a higher $\sigma$ reduces the tax burden on the working generation. As $\sigma$ rises from 0.55, the tax burden will gradually shift from the retired generation to the working generation under their coalition regime. However, a heavier weight on the utility of the retired generation (their parents) more than offsets the negative impact of higher taxes on the utility of the working generation, making the working generation better off.

### 3.2 Effect of Demeny voting

In this section, we examine the implications of Demeny voting. Demeny proposed a political voice for children by allowing their parents to vote on their behalf (Demeny 1986, Aoki and Vaithianathan 2009). Let $\xi$ denote the extent of the extension of voting rights to children in terms of a reduction of the minimum voting age. Then, the working generation has voting rights $(N_t)$ and the extension of voting rights to children $(\xi N_t n_{t+1})$. As a result, the total political power of the

13) These values are assumed tentatively. We need to use empirical analysis to examine how plausible they are in Japan.

working generation will change from $V_3 \equiv s_t(t)N_t$to $\overline{V_3} \equiv s_t(t)N_t(1+\xi n_{t+1})$. Then, by making some rearrangements in (15), we have a new regime:

**Regime 6**: Demeny voting + Working Generation and Retired Generation with Children Coalition Regime

$$s_t(t)N_t(1+\xi n_{t+1})+\pi_{t-1}S_{t-1}(t)N_{t-1}>(1-\pi_{t-1})s_{t-1}(t)N_{t-1} \text{ and (13) modified}$$

$$W_t(\text{regime 6})=\pi_{t-1}s_{t-1}(t)N_{t-1}U_{t-1}^{child}+s_t(t)N_t(1+\xi n_{t+1})U_t \tag{20}$$

$$=s_{t-1}(t)N_{t-1}[\pi_{t-1}U_{t-1}^{child}+\rho_t n_t(1+\xi n_{t+1})U_t]$$

In this regime, politicians similarly maximize their objective function (20) with respect to $\theta_{t-1}(t)$, $\theta_t(t)$, and $\theta_{t+1}(t)$, subject to (4). Assuming that the Retired Generation Coalition Regime is currently prevailing in Japan, let us consider a shift to the Demeny voting + Intergenerational Coalition Regime[14]. For this shift to take place, the utility of the retired generation with children must be higher in Regime 6 than in Regime 3[15]:

$$U_{t-1}^{child}(\text{regime 6})>U_{t-1}^{child}(\text{regime 3}) \tag{21}$$

As in the previous section, we determine the values of intergenerational altruism and relative political power that change the regime. The simulation results are summarized in Table 3. The parameters $(\rho_t, \delta, \sigma)$ are adjusted with a ridge of 0.02. We assume that the voting age is lowered to 10, meaning that there would be 10 new age groups. Because the working and retired generations each include 35 age groups (20 to 54 and 55 to 89), it is reasonable to set parameter $\xi$ to 10/35. From Table 3, we find that, assuming $(\rho_t, \delta)=(0.45, 0.8)$, the Demeny voting + Intergenerational Coalition Regime will be chosen when $\sigma$ is 0.96 or higher. We also observe from Table 4 that when the regime switches consequent to a rise of $\sigma$ from 0.4 to 0.96, the working generation's lifetime tax rate, $\theta_t(t)$, drops sharply and its utility jumps[16].

Two main points should be noted from Tables 2 and 4. First, Demeny voting requires higher values of intergenerational altruism, $\delta$, $\sigma$, to establish intergenerational coalition. This is because Demeny voting raises the relative political power of the working generation, making it more costly (higher taxes) for the retired generation with children to form a coalition with the working generation. Higher degrees of altruism are needed to overcome this concern. Second, with Demeny voting, the tax burden shifts from the working and future generations to the retired generation. For example, by comparing the results for $\sigma=1$ in Tables 2 and 4, we find that Demeny voting reduces $\theta_t(t)$and $\theta_{t+1}(t)$ from 0.093 and 0.508 to $-0.007$ and 0.454, respectively, while it raises $\theta_{t-1}(t)$ from $-0.312$ to $-0.297$. This is because the utility of the working generation is weighted more heavily in the objective function, which means that at the margin more resources

14) Under Demeny voting, condition (13) has to be modified to $(2\pi_{t-1}-1)/n_t<\rho_t(1+\xi n_{t+1})<1/n_t$.

15) In this section, we analyze the possibility that the introduction of Demeny voting causes a transition from Regime 3 without Demeny voting to Regime 6 with it.

16) Although $\sigma=0.96$ reflects a very high level of backward altruism, Demeny voting will reduce the tax burden of the working and future generations under an intergenerational cooperation scheme if the high level holds.

**Table 3: Retired Generation Coalition Regime vs. Demeny voting + Intergenerational Coalition Regime**

| | | $\sigma$ | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.02 − 0.76 | 0.78 | 0.8 | 0.82 | 0.84 | 0.86 | 0.88 | 0.9 | 0.92 | 0.94 | 0.96 | 0.98 | 1 |
| $\delta$ | 0.02 − 0.74 | | | | | | | | | | | | | |
| | 0.76 | | | | | | | | | | | | | 0.4 |
| | 0.78 | | | | | | | | | | | | 0.44 | 0.76 |
| | 0.8 | | | | | | | | | | | 0.5 | 0.76 | 0.76 |
| | 0.82 | | | | | | | | | | 0.76 | 0.76 | 0.76 | 0.76 |
| | 0.84 | | | | | | | | | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 |
| | 0.86 | | | | | | | | 0.54 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 |
| | 0.88 | | | | | | | 0.48 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 |
| | 0.9 | | | | | | 0.44 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 |
| | 0.92 | | | | | 0.4 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 |
| | 0.94 | | | | 0.36 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 |
| | 0.96 | | | 0.34 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 |
| | 0.98 | | | 0.52 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 |
| | 1 | | 0.42 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 |

Note: A blank cell means that Retired generation Coalition Regime will be chosen. The above figures represent the upper bounds of $\rho_t$, under which Demeny voting + Intergenerational Coalition Regime will be chosen. For example, the figure 0.48 of $(\delta, \sigma) = (0.88, 0.88)$ means that Demeny voting + Intergenerational Coalition Regime will be chosen if $\rho_t < 0.48$ and Retired Generation Coalition Regime will be chosen if $\rho_t > 0.48$.

**Table 4: Shift of coalition regimes and lifetime tax rate and utility for each generation for different values of $\sigma$, assuming $(\rho_t, \delta) = (0.45, 0.8)$**

| | $\sigma$ | | | |
|---|---|---|---|---|
| | 0.4 | 0.96 | 0.98 | 1 |
| Lifetime tax rate of Retired generation $(\theta_{t-1}(t))$ | −0.656 | −0.281 | −0.289 | −0.297 |
| Lifetime tax rate of Working generation $(\theta_t(t))$ | 0.280 | 0.006 | 0.000 | −0.007 |
| Lifetime tax rate of Future generation $(\theta_{t+1}(t))$ | 0.610 | 0.461 | 0.458 | 0.454 |
| Utility of Retired generation with children $(U_{t-1}^{child})$ | −0.078 | 0.033 | 0.047 | 0.060 |
| Utility of Retired generation without children $(U_{t-1}^{nc})$ | 0.504 | 0.248 | 0.254 | 0.260 |
| Utility of Working generation $(U_t)$ | −0.526 | −0.030 | −0.010 | 0.010 |

**Retired Generation Coalition Regime** ($\sigma$ = 0.4)

**Intergenerational Coalition Regime** ($\sigma$ = 0.96, 0.98, 1)

should be shifted to the working generation (and the future generation) owing to forward altruism. However, the extra tax burden of the retired generation with children is more than offset by the utility gain of their children, and the utility levels of both the working generation and the retired generation with children are higher than in the case without Demeny voting. For example, by comparing the results for $\sigma=1$ in Tables 2 and 4, we find that Demeny voting raises $U_t$ and $U_{t-1}^{child}$ from $-0.127$ and $-0.047$ to 0.010 and 0.060, respectively.

## 4. Summary and Future Research

We employed an OLG model with two generations (working and retired) divided into three groups (working, retired with children, and retired without children), where the allocation of government funding is determined by political powers allocated among the groups. We examined how the majority coalition depends on political power and the extent of intergenerational altruism.

We observed that a higher degree of backward altruism can replace the coalition of the retired generation—between those with children and those without children—with the coalition between the working generation and the retired generation with children. This intergenerational coalition makes the working generation better off by lowering their tax rates.

We also examined the impact of Demeny voting, which allows parents to vote on behalf of their children. Demeny voting requires higher values of intergenerational altruism to establish a coalition between the working generation and the retired generation with children. Once the intergenerational coalition is established, however, both the generations can enjoy higher utility than in the case without Demeny voting.

There are several assumptions that we hope to relax in future research. We assumed that the retired generation without children does not care about other generations at all whereas the retired generation with children cares not only about their children but also about their grandchildren. We also assumed that the population growth rate, wages, and interest rates are exogenous.

Finally, the analysis in this paper depends on numerical simulations. We confirmed that it is impossible to have a coalition between the working generation and the retired generation without children in the current parameter settings. However, this result must be checked against different parameters from those used in our paper and the policy instruments that increase backward altruism among the working generation. It is also worthwhile to analyze the impact of modified Demeny voting, which reflects the utility of the future generation. These issues remain for future research.

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# Meta-analytic Approach to the Impacts of Tourism and Fiscal Expenditure on the Remote Islands of Japan

Noriko Ishikawa
(Faculty of Economics, Konan University)
Mototsugu Fukushige*
(Graduate School of Economics, Osaka University)

**Abstract**: In this paper, we formulate an econometric model that estimates both fiscal and tourism multipliers simultaneously for each remote island region in Japan, and analyze the results through a meta-analytic approach that allows us to evaluate the impact of this policy on regions with different characteristics. The results show that the null hypothesis that fiscal and tourism multipliers are zero in all remote island regions can be rejected. However, the null hypothesis that tourism multipliers are equal to zero in all remote island regions cannot be rejected for remote island regions with positive and statistically significant fiscal multipliers.

Keywords: Tourism Multiplier, Fiscal Multiplier, Remote Islands, Meta-analytic Approach, Japan

*JEL* classification: O23, R58, Q56, L83.

## 1. Introduction

As Japan is a nation of islands, the Japanese government has implemented a wide variety of measures at the national level to promote the development of its remote islands. Following the introduction of the first measure for assisting remote islands, namely the Improvement of Sea Routes to Remote Islands Act, which was enacted on 4 July 1952, the Law for the Development of Remote Islands of 22 July 1953 subsequently strengthened assistance to these islands. Although the 1953 law involved temporary legislation with a limit of 10 years, it has been amended four times and extended five times, thus remaining in force for over 50 years. Through this law, the government has attempted to improve the fundamental conditions on the remote islands, including the living environment and the industrial infrastructure[1]. Moreover, Special Measures Acts were enacted in each region, corresponding to regional differences: the Special Measures Act

* Corresponding Author: 1-7, Machikaneyama-cho, Toyonaka, Osaka, 560-0043, Japan e-mail: mfuku@econ.osaka-u.ac.jp

1) The number of islands covered under the 1953 law is 315 and it is estimated that roughly 737,000 people (0.6% of the total Japanese population) lived on the islands in April 2001. Annual expenditure for promoting the remote islands amounted to 160 billion yen in the 2001 fiscal year, which equaled 1.7% of Japan's total general public works expenses.