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Pension Reform and Individual Retirement Accounts in Japan

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Pension Reform and Individual Retirement Accounts in Japan[1]

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Abstract

The paper studies the effects of introducing individual retirement accounts (IRA) as an alternative to the employer-based, pay-as-you-go public pension system in Japan. Without any reform, the projected demographic transition implies a massive increase in government expenditures in the magnitude of 40% of total consumption expenditures at the peak. Gradually shifting the earnings-related part of pension towards self-financed IRA, expenditures can be reduced by 20% of total consumption, providing a major relief for the government budget. The reform generates a significant rise in capital, as individuals save more for retirement, which is invested over many years. As a result, wage, output, and consumption are also higher, leading to a sizeable welfare gain in the intermediate and long run. Current generations, however, can face a large welfare loss depending on how the transition is financed.

Keywords: Pension reform, Individual retirement account, Aging demographics, Japanese economy

JEL classification: H55, H60, J11, J32

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1 Introduction

Japan will face a significant rise in government expenditures as it will go through rapid demographic aging during coming decades. The dependency ratio will reach an unprecedented level of 85% in mid 2050s and stays above 80% until after the end of the century.[1] Research has found that a major increase in taxation is inevitable unless there is reform on age-related transfer system, in particular public pension and health insurance programs.

Kitao (2015) shows that demographic transition financed by consumption taxes will require the tax rate to reach 48% in 2080s without any reform. Hansen and İmrohoroğlu (2013) estimate fiscal adjustments of 30 to 40% of consumption are needed to deal with rising expenditures. Braun and Joines (2014) also show that a consumption tax increase of a similar range is necessary without major reform of pension and health insurance programs. Such high taxes on consumption are most likely unrealistic and politically infeasible, although they represent the magnitude of the fiscal problem Japan has to deal with, one way or another.

Could the government handle rising expenditures through an alternative source of funding other than consumption taxes? Kitao (2015) shows that using labor income tax would be extremely distortionary, shrinking labor supply that would be already scarce. İmrohoroğlu, Kitao, and Yamada (2014) show that the government debt would explode and quickly become uncontrollable if the transition is financed by borrowing.

These results suggest that it is inevitable to implement a policy to reduce expenditures. In this paper we explore a system of individual retirement accounts ("IRA"), in which individuals, or employers on behalf of employees, are required to contribute a given fraction of their earnings to a retirement account. The contribution to the account is set aside from regular assets which individuals are free to use for consumption or saving. The balance in the account is invested in capital and used in production. Once an individual reaches a set retirement age, the balance in his account is paid out and can be used for consumption and saving in the same way as regular assets.

We introduce a simple IRA system described above and set the contribution amount, which eventually will be equivalent to and replace the premium that an employee currently pays for employer-based pension system (*kosei nenkin*). At the same time, we gradually reduce and eventually eliminate part of pension benefits that is based on past earnings. The tax on labor income is reduced by the same amount as the IRA contribution rate so that the net earnings will be the same in the benchmark economy and in the economy with the IRA. The idea is to initiate a transition from the pay-as-you-go pension system to a retirement system that relies on individuals' own savings and investment while keeping constant the rate of contribution imposed on earnings.[2]

[1] The dependency ratio is defined as the ratio of the population aged 65 and above to those at age 20-64. The number is based on the projection of the National Institute of Population and Social Security Research (IPSS).

[2] Of course there are many other ways to introduce the IRA. Papers such as İmrohoroğlu, İmrohoroğlu, and Joines (1998), Kitao (2010), Nishiyama (2011) and Ho (2014) build a dynamic general equilibrium model to study effects of tax-deferred retirement saving account, that approximates 401(k) plans in the context of the U.S. economy. The IRA considered in this paper is different in that the contribution is

We find that the shift can slash the rise in consumption taxes due to the demographic transition by almost 20 percentage points at the peak, generating a significant relief for the government budget. The largest change in the aggregate economy induced by the policy change is in the level of capital. In the benchmark economy, due to a sharp decline in population and demographic aging, capital will start to decline rapidly after 2030s and will fall by more than 50% by the end of the century compared to the level in 2010. With the IRA, capital will not begin to decline until 2050 and will be close to the 2010 level at the very end of the century. The major difference from the pay-as-you-go pension system that drives the result is that contribution collected for the retirement system is invested and used as an input of production for many years. The pay-as-you-go system operates very differently, where premium collected as labor income tax on the young is simultaneously transferred to retirees for their consumption. In the economy with the IRA, larger capital and increased economic activities will raise the relative value of labor input, increasing wage rate and giving more incentives for individuals to work.

In the intermediate and long-run, individuals enjoy a welfare gain from the reform as they experience a rise in output and consumption and less distortion from lower taxes on both labor income and consumption. There can, however, be a large welfare cost on transitional generations in the short-run. We implement the reform gradually and do not reduce benefits of current retirees and also honor contributions that working individuals have already made to the employer-based pension system (*kosei nenkin*) by the time of the reform. As the labor income tax and government revenues decline initially while expenditures do not decline as fast, consumption tax will need to rise by more than in the benchmark economy without the IRA during the first few decades. The wage rates will start to rise immediately but they do not go far above the benchmark level until the middle of the century. Generations that are already economically active at the time of the reform also face a need to build more wealth for retirement and allocate a larger fraction of disposable income from consumption to savings, which also reduces welfare. A careful implementation of the transition scheme is necessary in order to mitigate welfare costs on current generations.

The rest of the paper is organized as follows. Section 2 presents the model and section 3 discusses parametrization of the model. Numerical results are presented in section 4 and section 5 concludes.

2 Model

2.1 Economic environment

Demographics: The economy is populated by overlapping generations of individuals, who enter the economy at age $j = 1$ and live for the maximum of J years. $s_{j,t}$ denotes a probability that individuals of age j at time t survive until the next period $t+1$. Assets left by the deceased are distributed as a lump-sum bequest transfer denoted as b_t to all surviving individuals. The size of a new cohort entering the economy grows at rate n_t.

mandatory, rather than optional and that there is no tax deduction or early withdrawal options.

Endowments: In each period, individuals allocate a unit of disposable time to market work and leisure. Earnings are denoted as $y_t = \eta_j h w_t$, where η_j represents age-specific deterministic productivity and h is endogenously chosen hours of work. The wage rate w_t is determined in a competitive market and set to the marginal product of labor at time t.

Technology: Output Y_t is produced with aggregate capital K_t and labor supply L_t using technology Z_t, according to an aggregate production function

$$Y_t = Z_t K_t^{\alpha} L_t^{1-\alpha}. \tag{1}$$

α represents the share of capital in production and capital depreciates at constant rate δ. The rental rate of capital r_t^k is set to the marginal product of capital net of depreciation.

Individuals' preferences: In each period individuals derive utility $u(c, h)$ from consumption and leisure. They maximize the sum of discounted utility over the lifetime, $\sum_{j=1}^{J} \beta^{j-1} u(c_j, h_j)$, where c_j and h_j denote an individual's consumption and labor supply at age j, respectively, and β is subjective discount factor.

Medical expenditures: There are two types of medical expenditures that individuals face each period, expenditures for health care $m_{j,t}^h$ and long-term care $m_{j,t}^l$. Individuals must pay a fraction $\lambda_{j,t}^h$ and $\lambda_{j,t}^l$ of each type of expenditures as a copay and the rest is covered by public health and long-term care insurances. Total out-of-pocket expenditures of an individual are given as $m_{j,t}^o = \lambda_{j,t}^h m_{j,t}^h + \lambda_{j,t}^l m_{j,t}^l$. Total national medical expenditures M_t consist of out-of-pocket expenses paid by individuals and a part paid by the government M_t^g;

$$M_t^g = \sum_j \left[(1 - \lambda_{j,t}^h) m_{j,t}^h + (1 - \lambda_{j,t}^l) m_{j,t}^l \right] \mu_{j,t},$$

where $\mu_{j,t}$ denotes the number of individuals of age j at time t.

Government: In the benchmark economy, the government runs a pay-as-you-go public pension system and provides retirement benefits $ss_t(e)$ for individuals at and above retirement age j_R. Benefits are determined as a function of an individual's past earnings, summarized by an index e. As discussed in more details in section 3, the formula consists of two parts, basic pension that is independent of past earnings and part that is related to the index e.

The government imposes taxes on earnings at a proportional rate τ_t^l, income from capital rented to firms at τ_t^k, interest rate earned on the government debt at τ_t^d, and consumption at τ_t^c. The government also obtains funds from newly issued government debt D_{t+1}, which pays riskless interest r_t^d. Expenditures consist of government purchases of goods and services G_t, payment of the principal and the interest on debt D_t, public pension benefits, and health and long-term care insurance benefits M_t^g.

As in Kitao (2015) and Braun and Joines (2014), we distinguish between the interest rates that are paid on the government debt and those paid on capital rented to firms and assume that individuals allocate an exogenous fraction ϕ_t of assets to government debt and a fraction $(1 - \phi_t)$ to firms' capital. After-tax gross return on each unit of individuals' savings net of taxes is given as $R_t = 1 + (1 - \tau_t^k) r_t^k (1 - \phi_t) + (1 - \tau_t^d) r_t^d \phi_t$.

The government budget constraint is satisfied every period and given as

$$\begin{aligned} & G_t + (1 + r_t^d) D_t + S_t + M_t^g \qquad (2) \\ & = \sum_x \left\{ \tau_t^l y_t(x) + [\tau_t^k r_t^k (1 - \phi_t) + \tau_t^d r_t^d \phi_t](a_t(x) + q_t(x) + b_t) + \tau_t^c c_t(x) \right\} \mu_t(x) + D_{t+1}, \end{aligned}$$

where S_t represents total pension expenditures $\sum_x ss_t(x) \mu_t(x)$, $\mu_t(x)$ denotes the measure of individuals in state x at time t and $q_t(x)$ is the balance of an individual's IRA, when the new program is introduced as explained in the next section. In computing an equilibrium, at least one variable in equation (2) must adjust to balance the budget. We adjust and determine the consumption tax τ_t^c each period for this purpose during the transition.[3]

2.2 Individuals' problem

Individuals can buy and accumulate one-period riskless asset a_t, which is a composite of an investment in firms' capital and holdings of government bonds and pays after-tax gross interest R_t as defined above. Individuals cannot borrow against future income and transfers and assets must be non-negative. We will first present a benchmark model without the IRA and then introduce the IRA, where we distinguish between regular assets a_t and balance q_t held in the IRA of each individual.

A benchmark model without individual retirement accounts (IRA): A state vector of an individual $x = \{j, a, e\}$ consists of three elements; j age, a assets carried from the previous period, and e index of cumulated labor earnings, which determines each individual's pension benefits. Individuals in each state optimally choose consumption, saving and labor supply to maximize life-time utility. Individuals' problem is solved recursively and the value function $V(x)$ is defined as follows.

$$V(j, a, e) = \max_{c,h,a'} \{ u(c, h) + \beta s_j V(j + 1, a', e') \}$$

[3] We adjust consumption tax rates every period during the transition but we adjust and determine labor income tax rate in the initial steady state, assuming that the consumption tax rate is fixed at 5%, as it was in 2010. During the transition, we keep labor income tax rate at the fixed level determined in the initial steady state and summarize the change in the government budget by a change in consumption taxes.

subject to

$$
\begin{aligned}
&(1+\tau^c)c + a' = R(a+b) + (1-\tau^l)y + ss(e) - m_j^o \\
&y = \eta_j h w \\
&a' \geq 0 \\
&e' = \begin{cases} f(e,y) & \text{for } j < j_R \\ e & \text{for } j \geq j_R \end{cases}
\end{aligned}
$$

The function $e' = f(e, y)$ represents the law of motion for cumulated earnings e of an individual before reaching normal retirement age j_R. Note the pension benefit $ss(e)$ is zero for individuals below j_R.

A model with individual retirement accounts (IRA): We now consider an economy with the IRA, in which individuals are required to keep aside a fraction τ^q of earnings and contribute the amount to each individual's retirement account. q denotes the balance in the account, which is included in the state vector x. As with regular assets a, the balance in the IRA earns after-tax gross return R each period and it is updated as $q' = Rq + \tau^q y$, where y is the earnings of the current period. In the long-run, when the transition to the IRA system is complete, part of public pension benefits related to past earnings is eliminated and replaced by the IRA. Pension benefit will be just the basic pension ss, independent of past earnings e. Therefore, the state e that represents career earnings is no longer needed in the state vector of an individual.[4] The value function $V(x) = V(j, a, q)$ of an individual in state x at age below $j_R - 1$ (one year before the retirement age) is given as follows.

At age below $j_R - 1$:

$$
V(j,a,q) = \max_{c,h,a'} \{u(c,h) + \beta s_j V(j+1, a', q')\}
$$

subject to

$$
\begin{aligned}
&(1+\tau^c)c + a' = R(a+b) + (1-\tau^l-\tau^q)y - m_j^o \\
&q' = Rq + \tau^q y \\
&y = \eta_j h w \\
&a' \geq 0
\end{aligned}
$$

Once an individual reaches the retirement age, the balance in the IRA is paid out to an individual and becomes part of regular assets a, which can be consumed or saved. Therefore at age $j_R - 1$, the IRA balance next period q' is zero and assets next period a' will be the sum of regular assets saved, denoted as $\widetilde{a}'$ below and the payout from the IRA, $Rq + \tau^q y$. For individuals at or above age j_R, $q = 0$ and the state vector essentially consists of two variables j and a.[5]

[4] Note that, however, both q and e are necessary in the state vector during initial years of the transition, when earnings-related part of public pension is gradually reduced until it is completely eliminated while the IRA contribution is introduced.

[5] The value function for individuals aged j_R and above is not displayed here to save the space and

At age $j_R - 1$:

$$V(j,a,q) = \max_{c,h,\widetilde{a}'} \{u(c,h) + \beta s_j V(j+1,a',q')\}$$

subject to

$$\begin{aligned} &(1+\tau^c)c + \widetilde{a}' = R(a+b) + (1-\tau^l-\tau^q)y - m_j^o \\ &q' = 0 \\ &y = \eta_j h w \\ &\widetilde{a}' \geq 0 \\ &a' = \widetilde{a}' + Rq + \tau^q y \end{aligned} \tag{3}$$

2.3 Equilibrium definition

In this section we define a competitive equilibrium in a model with the IRA. For a given sequence of demographic parameters $\{s_{j,t}\}_{j=1}^J$ and $\{n_t\}$, medical expenditures $\{m_{j,t}^h, m_{j,t}^l\}_{j=1}^J$, and government policy variables $\{G_t, D_t, \tau_t^k, \tau_t^d, \tau_t^l, \tau_t^q, ss_t, \lambda_{j,t}^h, \lambda_{j,t}^l\}$, a competitive equilibrium consists of individuals' decision rules $\{c_t(x), h_t(x), a_{t+1}(x)\}$ for each state vector x, factor prices $\{r_t^k, w_t\}$, consumption tax $\{\tau_t^c\}$, accidental bequests transfer $\{b_t\}$, and the measure of individuals over the state space $\{\mu_t(x)\}$ such that:

1. Individuals' decision rules represent the solutions for the optimization problems defined in section 2.2.

2. Factor prices are determined in a competitive market.

$$\begin{aligned} r_t^k &= \alpha Z_t \left(\frac{K_t}{L_t}\right)^{\alpha-1} - \delta \\ w_t &= (1-\alpha) Z_t \left(\frac{K_t}{L_t}\right)^{\alpha} \end{aligned}$$

3. Total lump-sum bequest transfer equals the amount of assets left by the deceased.

$$b_t \sum_x \mu_t(x) = \sum_x \left[a_t(x) + q_t(x)\right](1 - s_{j,t-1})\mu_{t-1}(x)$$

4. The labor and capital markets clear.

$$\begin{aligned} K_t &= \sum_x \left[a_t(x) + q_t(x) + b_t\right]\mu_t(x) - D_t \\ L_t &= \sum_x \eta_j h_t(x) \mu_t(x) \end{aligned}$$

5. Consumption tax τ_t^c satisfies the government budget constraint (2).

it is the same as that of age $j_R - 1$ individuals presented below, except that $q = 0$ and the budget constraint includes a transfer of basic pension benefits ss.

6. The goods market clears.

$$\sum_x c_t(x)\mu_t(x) + K_{t+1} + G_t + M_t = Y_t + (1-\delta)K_t$$

3 Calibration

This section presents parametrization of the model.

Preliminaries: The unit of the model is an individual, who represents a household as head. Frequency of the model is annual. We first compute an equilibrium that approximates the economy in 2010, which we call as initial steady state, as a starting point for the computation of transition dynamics.[6] We also compute final steady state, which differs from initial steady state in demographics, as discussed below. The transition dynamics is computed between the two steady states by solving for an equilibrium in each period.

Demographics: Individuals enter the economy at age 20 and live up to the maximum age of 110. Conditional survival rates $s_{j,t}$ and growth rates of new cohort n_t are based on population estimates of the National Institute of Population and Social Security Research (IPSS). Official projections are available up to 2060 and we assume that survival rates will remain constant at the 2060 level thereafter. The growth rate n_t is negative during the projection period due to low fertility rates and we assume it will gradually rise and converge to 0% by 2150.

The dependency ratio, defined as the ratio of the number of individuals aged 65 and older to 20-64, will increase from less than 40% in 2010, reach the peak of 88% in early 2060s, as shown in figure 1. The ratio will decline as fertility rates recover gradually after 2060 to reach 53% in the final steady state. It remains, however, above 80% until after 2100.

[6] As in Kitao (2015), we use actual age-distribution of 2010 in the initial steady state and the population is not stationary. Aggregate statistics are computed using the actual age distribution.

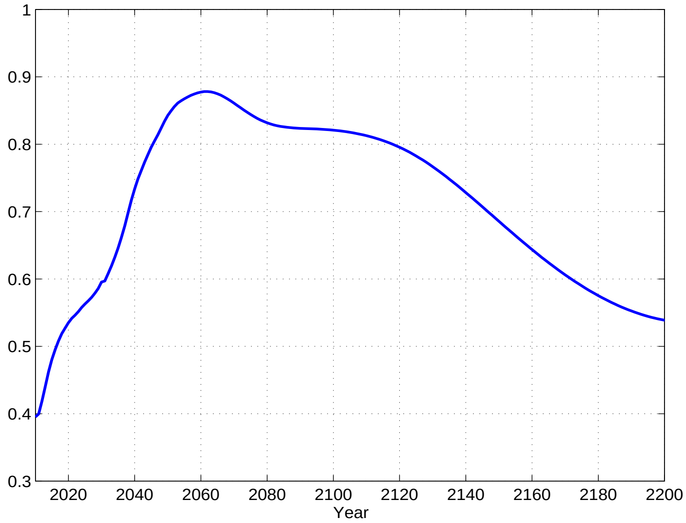


Figure 1: Old-age dependency ratio: ratio of population aged 65 and above to 20-64.

Preferences, endowments, and technology: We assume a non-separable utility function of the form,

$$u(c,h) = \frac{[c^{\gamma}(1-h)^{1-\gamma}]^{1-\sigma}}{1-\sigma}.$$

The parameter γ determines the preference weight on consumption relative to leisure and σ is related to risk aversion. We set γ at 0.352 so that individuals at age 20 to 64 spend 40% of disposable time for market work. σ is set to 3.0, which implies the relative risk aversion of 1.70, and the intertemporal elasticity of substitution at 0.59, in the range of estimates in the literature. Discount factor β is set to 1.021, so that the capital-output ratio in the initial steady state is 2.5, as estimated by Hansen and İmrohoroğlu (2013).

The age-specific labor productivity η_j is calibrated based on wage data from the Basic Survey on Wage Structure (BSWS) in 2010. We assume that $\eta_j = 0$ for individuals above the retirement age and they do not work. We use male data to approximate the market behavior of household heads.

Capital share in the production function is set at 0.362 and depreciation rate at 0.089 based on Hayashi and Prescott (2002). The level of technology Z_t is assumed to grow at 1% each year and the initial level of productivity is set for normalization so that average earnings is unity in the initial steady state.[7]

Medical expenditures: Medical expenditures are taken from data of the Ministry of Health, Labour and Welfare (MHLW).[8] We assume that per-capita expenditures grow at the same rate as the growth rate of the economy. Copay rates of health insurance $\lambda^h_{j,t}$ vary by age; 30% below age 70, 20% at 70-74 and 10% at 75 and above. For long-term care, copay rate $\lambda^l_{j,t}$ is 10% regardless of recipients' age.

[7]The technology growth rate implies per-capita output growth rate of 1.57%.

[8]See Kitao (2015) for more details of the medical expenditure data and calibration.

Total medical expenditures in the initial steady state are 7.4% of GDP in the model, which is in line with the data, 7.8% in 2010. Expenditures will grow to 10.1% of GDP in the final steady state of the benchmark economy without the IRA.

Government - pension system: In the benchmark economy, the government operates pay-as-you-go pension system. Benefits $ss(e)$ are provided for each individual once he reaches the retirement age j_R of 46 (65 years old). Benefits are determined as a function of an index e that represents each individual's average earnings throughout the career. The index e is updated with new earnings y according to a formula

$$e' = f(e, y) = e + \nu \frac{\min(y, \bar{y})}{N_w}, \tag{4}$$

where ν is 1.0 in the benchmark model (later adjusted under a reform) and N_w is the number of working periods, which we set to 45 years, from age 20 to 64. The cap for counted earnings $\bar{y}$ is set at 10.44 million yen, based on the maximum annual earnings used to compute earnings index in the Japanese pension system.

The benefit formula is given as

$$ss(e) = \overline{ss} + \rho \cdot e,$$

with two parameters $\overline{ss}$ and ρ. $\overline{ss}$ represents the first tier of the pension system, basic pension (*kiso nenkin*), which does not depend on a retiree's past earnings. We set the value to the average basic pension benefits received by retirees in 2010, at 655,000 yen per year. We set the parameter ρ at 0.303 to match total pension expenditures at 10% of GDP in 2010. The formula implies the gross replacement rate, defined as the ratio of average pension benefits to average earnings, of 39.6% and the net replacement rate, the ratio to after-tax average earnings, of 59.5%.

Government - expenditures, debt and taxes: According to the National Accounts of Japan (SNA), government expenditures account for 20% of GDP in 2010, including expenditures for health and long-term care insurance, and we set the ratio G_t/Y_t to match the data. Government debt D_t is set at 100% of GDP, based on the net debt data in the 2010 SNA. We set the interest rate on government debt r_t^d at 1%, the average real interest rate on 7-year government bond in 2000s. As in Kitao (2015), the fraction ϕ_t of individuals' assets allocated to government debt is determined in each period so that the ratio D_t/Y_t is 100%.

Capital income tax rate is set at 40%, in the range of estimates of effective tax rates in the literature. Tax rate on interest income from government debt is 20%. Consumption tax rate is set at 5% in the initial steady state, and adjusted during the transition to balance the government budget. In the initial steady state, we use the labor income tax rate to balance the budget and the equilibrium tax rate is 33.5%. The labor income tax rate is fixed during the transition and the government budget is balanced through an adjustment of consumption tax. Labor income tax in our model includes all taxes and premium imposed on earnings, in particular premium for employer-based pension program (*kosei nenkin*) and other insurance programs.

4 Numerical results

4.1 Benchmark model and transition

In this section we briefly discuss features of the benchmark model without the IRA, in initial and final steady states and during the transition. We calibrate parameters of the model in the initial steady state that approximates the economy in 2010 with actual demographic structure of the same year. We then compare the transition dynamics starting in 2010, following demographic projections of the IPSS as discussed in section 3.

In each year of the transition, consumption tax τ_t^c adjusts to satisfy the government budget constraint. Figure 2 shows the path of consumption tax rates from 2010 to 2200.

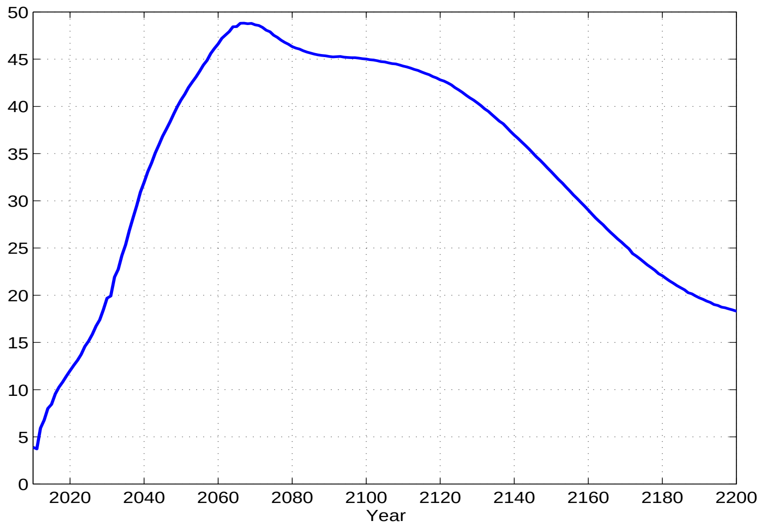


Figure 2: Consumption tax rate 2010-2200: benchmark transition

Consumption tax will start to increase sharply with the rise in dependency ratio and reach the peak of 49% in late 2060s, about 40% above the level in 2015. Tax rate will start to decline thereafter as fertility rates (growth rate of a new cohort) recover and dependency ratio falls. Tax rate, however, stays above 40% for more than 40 years until early 2130s. Consumption tax will settle at 17.6% in the long-run, about 13 percentage points above the level in the initial steady state.

Table 1 summarizes changes in aggregate variables in the final steady state compared to the initial steady state. The rise in government expenditures is mainly driven by an increase in pension benefits and medical expenditures, which rise from 10.0% of GDP to 12.7% and from 7.4% to 10.0%, respectively. Each individual works longer and saves much more in the final steady state, when life expectancy is longer and there are stronger incentives to accumulate wealth for longer retirement. Aggregate variables, however, all decline as the population is significantly lower after the demographic transition, as shown in table 1.[9] Interest rate falls from 5.58% in the initial steady state to 4.49%, as capital-labor ratio increases, driven by larger savings.

[9]The total population in the final steady state is 0.2256 relative to the initial steady state in 2010.

Table 1: Benchmark model : initial and final steady states.

Variables	Initial SS	Final SS
Consumption tax τ^c	5.0%	17.6%
Output Y	1.000	0.224
Capital K	1.000	0.243
Labor L	1.000	0.214
Consumption C	1.000	0.206
Interest rate r	5.58%	4.49%
Wage w	1.000	1.046
Avg work hours	1.000	1.050
SS gross replacement rate	39.6%	37.6%
SS net replacement rate	59.6%	56.5%
SS spending S/Y	10.0%	12.7%
Med spending M^g/Y	7.4%	10.0%

4.2 A model with individual retirement account (IRA)

In the model with the IRA, each individual is required to set aside a fraction τ_t^q of earnings and contribute it to his own retirement account. The balance will be paid out to the individual owner of the account once he reaches the retirement age j_R. In the baseline model without the IRA, individuals received public pensions, which consist of a basic pension that is independent of past earnings and part that is related to an individual's earnings history. In the economy with the IRA, the first tier of basic pension remains the same but the second tier of earnings-related pension is removed and replaced with the IRA.

The reform implies a shift from the current pay-as-you-go public pension system, in which premium collected through payroll taxation is simultaneously transferred to retirees as pension benefits, into self-financed retirement saving system, where a worker's contribution is saved and accumulated in his own account, to cover consumption after retirement. We assume that the removal of earnings-related part of public pension will proceed gradually over 40 years and the new pension system will eventually consist of two parts, basic pension benefits provided by the government and payout from an individual's own retirement account.

In the benchmark model without the IRA, earnings are taxed at $\tau^l = 0.335$, which includes a premium for employer-based pension (*kosei nenkin*). In Japan, both employees and employers contribute half of the premium, approximately 9% of earnings each.

In the policy experiment, we assume that individuals contribute $\tau^q = 9\%$ of earnings, the same rate that they paid as the pension premium, to their own IRA and that labor income tax τ^l is reduced by the same percentage points, so that net labor income will remain the same in both the benchmark and the economy with the IRA.

Table 2 shows changes in aggregate variables in the final steady state with the IRA compared to the final steady state of the benchmark economy without the IRA. Labor income tax is reduced by 9% and instead 9% of earnings is contributed to each individual's retirement account. The balance in the IRA is invested and contributes to production as capital input. As shown in table 2, capital will significantly increase and more than double in the economy with the IRA.

Table 2: Introduction of the IRA: final steady states with and without IRA.

Variables	Baseline	With IRA
Consumption tax τ^c	17.6%	10.3%
Labor income tax τ^l	33.5%	24.5%
IRA contribution τ^q	0.0%	9.0%
Output Y	1.000	1.313
Capital K	1.000	2.013
Labor L	1.000	1.030
Consumption C	1.000	1.122
Interest rate r	4.49%	-0.17%
Wage w	1.000	1.275
Avg work hours	1.000	1.022
SS gross replacement rate	37.6%	8.3%
SS net replacement rate	56.5%	11.1%
SS spending S/Y	12.7%	2.8%
Med spending M^g/Y	10.0%	7.6%
Welfare effect (CEV)	–	3.9%

Figure 3 compares life-cycle profiles of assets in the benchmark and the model with the IRA, both in the final steady state. It shows that individuals have much stronger incentives to accumulate wealth for retirement throughout the life-cycle since they can no longer count on the government to provide generous benefits for the remainder of the life.

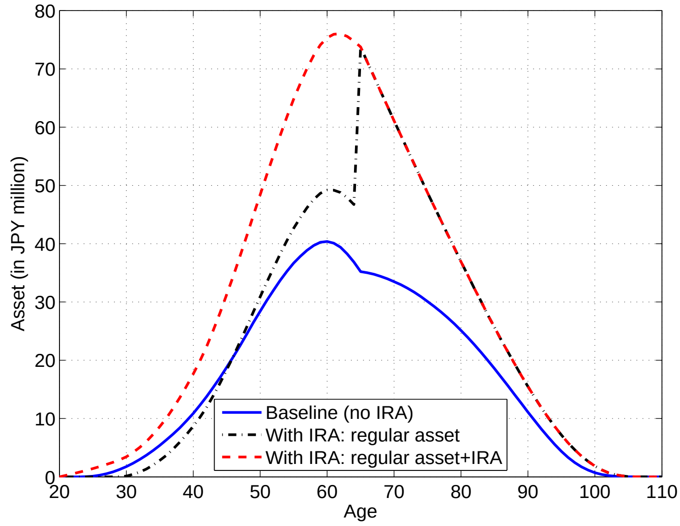


Figure 3: Assets over the life-cycle: final steady state with and without the IRA

As shown in table 2, as the capital increases significantly, capital-labor ratio rises and wage rate increases by 28% and the real interest rate falls to negative 0.2%. Labor supply and average hours also increase in the economy with the IRA by about 3.0% and 2.2%, respectively. The large increase in wage rate and a decline in labor tax give more incentives to work. There are, however, also negative incentive effects because the positive linkage between earnings and future pension benefits is eliminated when part of pension benefits linked to past earnings is replaced by the IRA. These disincentive effects are dominated by the positive effects and work hours increase on the net.[10]

Given the rise in economic activities, especially a significant expansion of earnings and labor income tax base, and lower expenditures for the public pension program, the consumption tax will be 10.3% in the final steady state with the IRA, 7.3 percentage points lower than in the benchmark. Note that this is in addition to the decline in the labor income tax rate τ^l by 9 percentage points and individuals face much less distortions in economic activities.

The bottom row of table 2 shows the long-run welfare effect of introducing the IRA, compared to the benchmark economy. We ask individuals whether they prefer the economy with the IRA or the benchmark economy and evaluate the effect in terms of consumption equivalence. It is a percentage change in consumption across all possible states that would make them indifferent between the two economies. The positive consumption equivalent variation of 3.9% implies that individuals prefer the IRA economy to the baseline economy by a margin of 3.9% evaluated in terms of consumption. Individuals face less distortions by lower labor income tax. They are also encouraged to save more to finance consumption after retirement and more capital is used in production. As a

[10] In this paper we assume that the economy is closed and factor prices are determined by domestic factors. If, however, the model allows cross-border mobility of capital and/or labor, the effects of IRA programs on factor prices could be moderated, though they depend on how the demographic shift and policies evolve in other countries. See, for example, Attanasio et al. (2007) for quantitative analysis of social security reform in the context of open vs closed economies.

result, output and consumption are significantly higher in the economy with the IRA, which raises welfare of individuals.

Transition dynamics: How do we make a transition to such an economy? There are many different transition paths that can be considered before the economy reaches the final steady state described above. We assume that the government honors the pension benefits that existing retirees are entitled to and the contribution that workers have already made towards the employer-based pension system at the time of the reform. More precisely, retirement benefits will continue to be provided according to the same benefit schedule $ss(e)$ based on the cumulated past earnings e.

We consider two scenarios as to how the earnings history e is updated during the transition. In the first case, the index e will cease to be updated and remain the same once the IRA is introduced. In the second case, we let the effect of new earnings data on a new value of e' diminish over time. In the first case, the parameter ν in the law of motion for e in equation (4) will turn zero immediately and in the second case it declines from 1.0 to 0.0 gradually over 20 years.

- Transition case 1: immediately eliminate the adjustment of earnings index e and set ν to 0.
- Transition case 2: gradually diminish the adjustment of earnings index e and reduce ν to 0 over 20 years.

We also adjust labor income tax τ_t^l by slowly decreasing it for a total of 9 percentage points over a 40-year period. At the same time, we raise the IRA contribution rate τ_t^q from 0 to 9%. The consumption tax rate τ_t^c continues to be determined each period so that the government budget constraint is satisfied.

Figure 4 shows paths of consumption taxes under the two transition scenarios of introducing the IRA and they are compared to the path of the benchmark simulations without the IRA. Under both cases of the IRA, consumption tax rates will be higher during initial decades of the transition but eventually taxes are much lower than in the benchmark. Under case 1, in which adjustment of earnings index e is terminated immediately, tax rate will have to jump up from the initial level of 5% to about 10%. As mentioned above, in the benchmark model, work efforts are encouraged not only for the sake of higher disposable income in the current period but also for a higher level of future income through a rise in pension benefits. Since this effect is eliminated right away, there will be an immediate drop in labor supply, as shown in figure 5(b), reducing the total earnings and labor income tax base, requiring consumption tax to jump up to satisfy the government budget constraint. The peak tax rate, however, under case 1 is 36%, reached in late 2040s, the lowest among the three scenarios. This is more than 10 percentage points lower than the peak tax rate in the baseline case. The tax rates will have to rise to a higher peak under case 2, in which earnings-related part of pension is reduced more gradually than in case 1. The IRA makes a large difference in government expenditures in the intermediate and long-run and the tax rate will be permanently lower than in the benchmark economy after mid 2040s in case 1 and 2050s in case 2. By 2100, the tax rates will be about 20 percentage points lower than in the benchmark economy under both cases, giving a significant relief to the government budget.

The large drop in consumption taxes is driven not only by a reduction in expenditures for pension benefits, but also by an increase in revenues from labor income taxation. As shown in figure 5(c), the wage rate grows much faster in both economies with the IRA since the saving and aggregate capital will rise more dramatically as shown in figure 5(a). The level of capital would fall by more than 50% in the benchmark by the end of the century, but capital is close to 100% of the initial level in economies with the IRA. Note that labor supply is initially lower than in the benchmark under case 1, but it will rise above the level of the benchmark by the middle of the century as wage starts to rise and far exceeds the benchmark level eventually, as shown in figure 5(c).

Obviously there are many possible ways to introduce and phase in the IRA during the transition, not just the two scenarios considered above. Besides adjusting the time it takes to phase out the adjustment of pension benefits, other fiscal instruments could be used to mitigate the rising fiscal costs during the initial decades. For example, the government could help finance additional expenditures by issuing more debt, in an attempt to control the rise in consumption taxes. Such policy, however, could crowd out private capital during the transition period and increase the cost of servicing the debt in future.

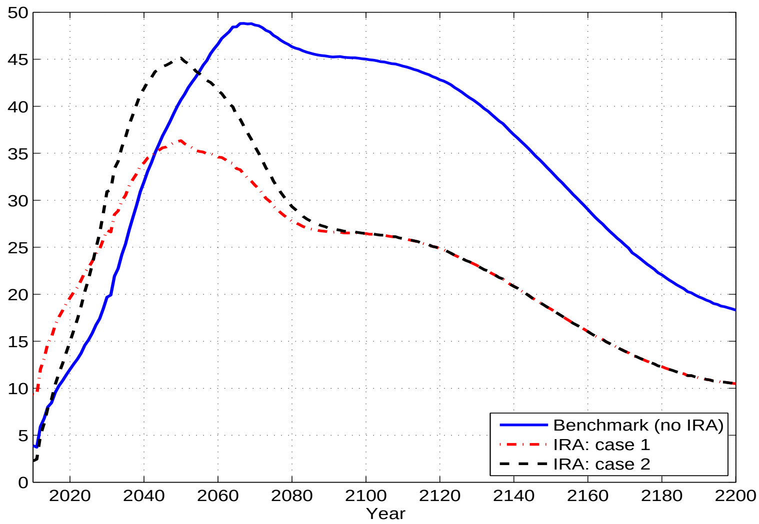
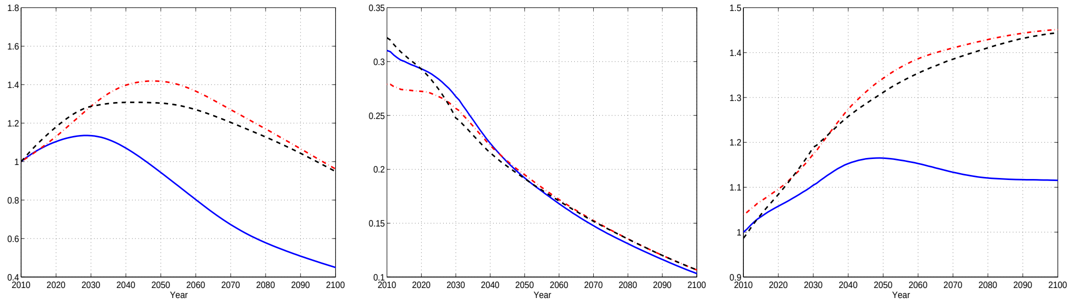


Figure 4: Consumption tax rate 2010-2200: models with and without IRA

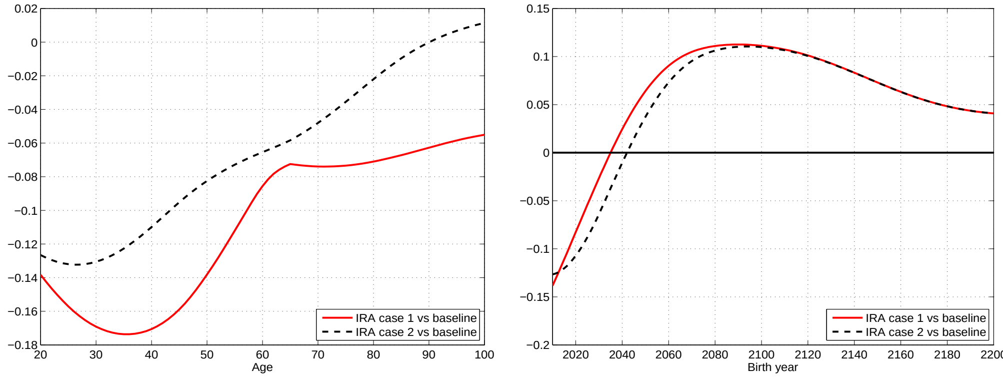


(a) Aggregate capital (b) Aggregate labor (c) Wage

Figure 5: Aggregate capital, labor supply and wage 2010-2100: with and without IRA. Solid lines represent the baseline economy without IRA and the dash-dotted lines represent the economy with IRA case 1 and the dashed lines represent case 2.

Welfare effects: To understand welfare effects of the transition to a new regime, we compute consumption equivalent variation (CEV) in the same way as we did for long-run steady state. For generations that are already economically active in the initial year, we compute a percentage change in consumption for the remainder of their life that would make them indifferent between the benchmark path and an alternative path with the IRA. As shown in figure 6(a), current generations will face a sizeable welfare loss from the shift to the IRA regime, both case 1 and 2. The welfare loss is especially large in case 1, in which consumption tax will immediately rise and stay well above the benchmark level for the next 40 years or so. Young individuals at age 30 to 40 at the time of reform will suffer the most as they will also earn and consume less because the lost linkage between earnings and future pension benefits gives a major disincentive for work. Retirees at the time of reform will continue to receive the same pension benefits as in the benchmark, but they too will suffer from high consumption taxes as well as lower interest rate earned on their savings.

The reform, however, to shift from the pay-as-you-go pension system to the IRA is beneficial for future generations. Figure 6(b) shows welfare effects of future cohorts by the year of the entry to the economy at age 20. Welfare effects turn positive starting with generations entering the economy in mid-2030s in case 1 and in early 2040s in case 2. Welfare gain will monotonically rise for subsequent generations until around 2080 before the gain starts to gradually decline after 2100. These generations will enjoy wage rates that are significantly higher than in the benchmark during their working life and consumption tax rates that are lower by about 15 to 20 percentage points than in the benchmark for entire life. The shift from the pay-as-you-go pension system to the IRA will significantly alleviate fiscal pressures during the period of high taxes in the benchmark economy, from around 2060 to 2120 when the dependency ratio remains at a very high level. As seen in figure 4, consumption tax rates are much lower in the IRA economies after the middle of the century but the difference will gradually decline after 2110. Welfare effects closely follow the dynamics of differences in consumption tax rates over time. As discussed in the analysis of steady states, welfare effects of introducing the IRA will remain positive in the long-run and stay at about 4% in consumption equivalence in the final steady state.



(a) Current generations: by age in 2010

(b) Future generations: by cohort birth year

Figure 6: Welfare effects of introducing the IRA: consumption equivalent variation on current and future generations from the transition

5 Conclusion

Researchers found that aging demographics in Japan will imply a large increase in government expenditures in the magnitude of 30 to 40% of consumption, if there is no change in policies, especially age-related transfer programs such as pension, health and long-term care insurances. As a way to reduce fiscal burdens, this paper builds a general equilibrium model of overlapping generations calibrated to the Japanese economy and demographics to study effects of introducing the individual retirement account (IRA) system and having it replace part of the existing pay-as-you-go public pension system. Such a shift is shown to bring about two major effects. First, individuals face stronger incentives to accumulate wealth for retirement. Unlike the contribution of workers in a pure pay-as-you-go regime, which is simultaneously transferred to retirees for their consumption, the contribution made to the IRA will be invested and used as an input of production for many years, leading to more economic activities and higher wage and consumption. Second, the shift generates a significant relief for the government budget. Consumption tax can be reduced by nearly 20 percentage points at the peak because expenditures for the pension program are reduced and rising economic activities lead to more tax revenues from income.

There exist defined contribution pension programs in Japan but the scope and eligibility are limited and they work as a supplement to the employer-based pay-as-you-go system. Results of the paper suggest that shifting the core of the pension system towards a more self-financed and investment-based program may significantly improve the budget balance for the coming decades and throughout the century, while at the same time giving more resources and incentives for growth in the long-run.

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