

Can Guest Workers Solve Japan's Fiscal Problems?

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Basic Issue: Indebted and Disappearing Japan

- Three significant challenges faced by Japan
 1. High debt to output ratio (close to 150%)
 2. Projected increase in government expenditures due to aging population
 - Spending to output projected to rise by 7% due to increases in public pension and health spending
 3. Projected decline in "bodies"
 - Total: 127 million in 2010 to 50 million in 2100
 - Working age: 60 million in 2010 to 20 million in 2100
- We explore the impact of various *guest worker programs* on (i) the fiscal sustainability and (ii) the welfare effects on the native born workers

High Debt to GNP Ratio

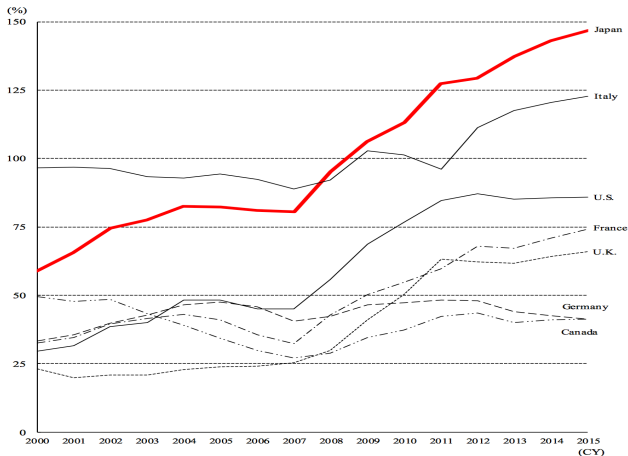


Figure: Net Debt to GNP Ratio (Ministry of Finance)

Disappearing Japan

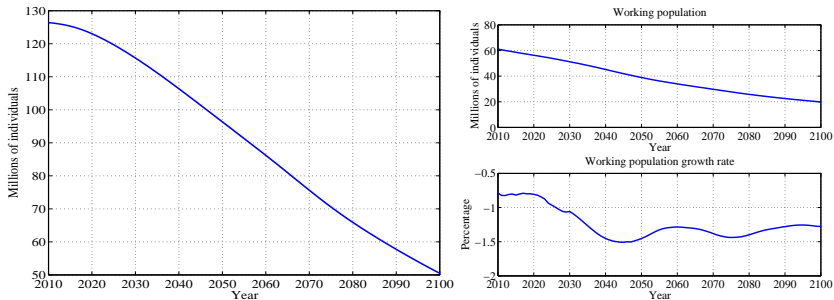


Figure: Total and Working Age Population in Japan (Figure 8 in Imrohoroglu, Kitao, and Yamada (2014))

What We Do

- Construct a general equilibrium model with overlapping generations of individuals
- Calibrate the model to Japanese micro data
- Incorporate the projected Japanese demographics and government accounts
- Compute a benchmark transition toward a final balanced growth path
- Compute alternative transitions indexed by a particular guest worker policy
- Measure impacts on the fiscal sustainability
- Compute welfare effects on current and future cohorts

What We Find

1. 200,000 workers for 10 years \Leftarrow Current govt's proposal
 - reduction of 0.5 to 1.1% points in terms of *consumption tax rate* in a few years
 - 2 to 4% points in a few decades
 - 3 to 5% points in the long run
2. U.S.-style (16.4% of employment)
 - 3 to 5% points in a 5 years
 - 6 to 10% points in a few decades
 - 3 to 6% points in the long run
- Very large welfare gains
 - 1 to 2% points of CEV for current cohorts
 - 2 to 4% points of CEV for future cohorts

Related Literature

- Evaluate the size of the fiscal problem in Japan
 - Doi, Hoshi, and Okimoto (2011)
 - İmrohoroğlu and Sudo (2011a,2011b)
 - Hoshi and Ito (2014)
 - Hansen and İmrohoroğlu (2015)
 - İmrohoroğlu, Kitao, and Yamada (2014)
 - Braun and Joines (2014), Kitao (2015a,2015b)
- Immigration issues
 - Storesletten (2000,2003), Auerbach and Oreopoulos (1999), Lee and Miller (2000)
 - Fehr, Jokisch and Kotlikoff (2004)
 - Shimasawa and Oguro (2010)

Model Overview

- A large scale overlapping generations model
- Benchmark model: *no* foreign workers
 - Introduce them in policy experiments
- Individuals enter the economy at age $j = 1$, retire after j^R , can live up to J years
- Demographics:
 - $s_{j,t}$: survival probability
 - $n_{j,t}$: cohort size
 - The cohort size $n_{j,t}$ evolve as

$$n_{j+1,t+1} = s_{j,t}n_{j,t}$$

Individuals' Problem

Individuals' maximize utility over the life cycle:

$$U = \sum_{j=1}^J \beta^{j-1} S_{j,t+j-1} \frac{c_{j,t+j-1}^{1-\theta}}{1-\theta}.$$

- β : discount factor
- $S_{j,t+j-1} = \prod_{k=1}^{j-1} s_{k,t+k-1}$: unconditional survival probability
- $c_{j,t}$: consumption of age j at time t
- θ : inverse of the intertemporal elasticity of substitution

Individuals' Problem (cont.)

After-tax earnings:

$$\tilde{y}_{j,t} = (1 - \tau_{l,t} - \tau_{p,t})y_{j,t}\Lambda_{j,t}$$

- $y_{j,t} = w_t\eta_j$: before-tax earnings
 - w_t : wage, η_j : age-specific productivity
- $\Lambda_{j,t} \in [0, 1]$: employment rate of age j at t
- $\tau_{l,t}$: labor income tax ← **exogenous**
- $\tau_{p,t}$: payroll tax for public pension ← **exogenous**

Individuals' Problem (cont.)

Budget constraint:

$$c_{j,t}(1 + \tau_{c,t}) + s_{j,t}a_{j+1,t+1} = \tilde{y}_{j,t} + p_{j,t} + tr_t + R_t a_{j,t}$$

- $\tau_{c,t}$: consumption tax rate ← **endogenous**
- $s_{j,t}$: actuarially fair price of annuity
 - assume perfect annuity markets
- $a_{j,t}$: a composite of firms' capital and government bonds
- R_t : after-tax gross return
- $p_{j,t}$: pension benefit (> 0 if $j \geq j^R$)
- tr_t : non-pension lump-sum transfer

Individuals' Problem (cont.)

Savings on capital and government bond:

- Two types of assets: capital and government bond
 - different interest rates: $r_{k,t}$ and $r_{b,t}$
- Share parameter ϕ_t : exogenous
- After-tax gross return on individuals' savings
 - ϕ_t : bond holdings, $1 - \phi_t$: capital holdings

$$R_t = 1 + (1 - \tau_{k,t})r_{k,t}(1 - \phi_t) + (1 - \tau_{b,t})r_{b,t}\phi_t$$

Technology

- Production technology:

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

- Factor prices:

$$r_{k,t} = \alpha Z_t \left(\frac{K_t}{L_t} \right)^{\alpha-1} - \delta, \quad w_t = (1 - \alpha) Z_t \left(\frac{K_t}{L_t} \right)^\alpha$$

- $K_t = (1 - \phi_t) \sum_j a_{j,t} n_{j,t}$: aggregate capital
- $L_t = \sum_j \eta_j \Lambda_{j,t} n_{j,t}$: aggregate labor

Government and Fiscal Policies

Government budget:

$$(1 + r_{b,t})B_t + G_t + P_t + TR_t = T_t + B_{t+1}$$

- B_{t+1} : issuance of new debt
- G_t : (exogenous) government expenditure
- P_t : pension benefits to retirees
- TR_t : transfers to individuals
- T_t : total tax revenues

Government and Fiscal Policies (cont.)

Government budget:

$$T_t = \tau_{c,t} \sum_j c_{j,t} n_{j,t} + \sum_j (\tau_{l,t} + \tau_{p,t}) y_{j,t} \Lambda_{j,t} n_{j,t} \\ + [\tau_{k,t} r_{k,t} (1 - \phi_t) + \tau_{b,t} r_{b,t} \phi_t] \sum_j a_{j,t} n_{j,t}$$

$$G_t = \sum_{j,t} g_{j,t} n_{j,t}$$

$$P_t = \sum_j p_{j,t} n_{j,t}$$

$$TR_t = tr_t \sum_j n_{j,t}$$

Calibration

- **Target:** Japanese economy in 2014 (initial SS)
 - final SS: a balanced growth path with stationary population
- Demography:
 - $\{s_{j,t}\}$: estimates by the National Institute of Population and Social Security Research from 2014 to 2060
 - Converges to a stationary population in 2200
- Preferences:
 - $\beta = 1.0162 \Rightarrow K/Y = 2.5$
 - $\theta = 2 \Rightarrow \text{IES} = 0.5$
- Technology:
 - $Z_{t+1}/Z_t = 1.5\%$: per-capita output growth of about 1%
 - $\delta = 0.0821, \alpha = 0.3794$

Tax Rates

- **Initial SS:**

- $\tau_l = 18\%$: Gunji and Miyazaki (2011)
 - 33% in 2007 net of pension premium 15%
- $\tau_p = 18\%$: approximation of the premium for the employment based pension (*kosei nenkin*)
- $\tau_k = 35\%$: corporate tax rate
- $\tau_b = 20\%$: tax on the interest paid on government debt
- $\tau_{c,2014} = 8\%$: actual consumption tax rate

- **Transition:**

- $\{\tau_{c,t}\}$ is **endogenously** determined after 2015 to achieve the government budget balance

Government Expenditures

- Per-capita government expenditure: $G/Y = 0.18$
- Replacement rate κ_t : $P_t/Y_t = 0.106$
 - Adjusted by the “macroeconomic slide”
- $B_t/Y_t = 130\%$: the debt to GDP ratio **fixed**
- $r_{b,t} = 1\%$: return from the government bond **exogenous**

Underlying Assumptions

- **Guest workers**

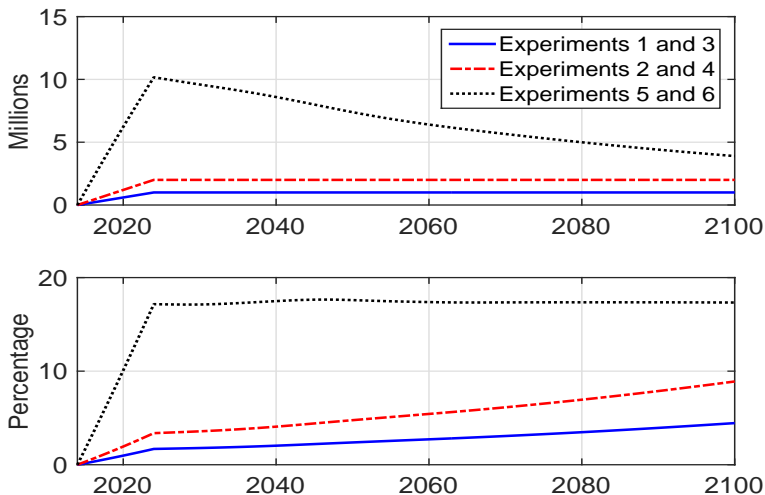
- come to Japan at age 35 and stays for **10 years**
- pay τ_l and τ_c , but they do not pay τ_p (premium)
- consume 50% of earnings (net of consumption tax)
- do not save domestically
 - send their earnings to their own economies
- the government incurs medical expenditure $g_{j,t}^*$ for each guest worker
 - $g_{j,t}^* = 0.5m_{j,t}$

Guest Worker Programs

	Annual Flow of Foreign-Born Workers	Their Relative Skill Level
Experiment 1	100,000	50%
Experiment 2	200,000	50%
Experiment 3	100,000	100%
Experiment 4	200,000	100%
Experiment 5	s.t. 16.4% are foreign	50%
Experiment 6	s.t. 16.4% are foreign	100%

- Exp 1 and Exp 2: unskilled workers
- Exp 3 and Exp 4: average native-born workers

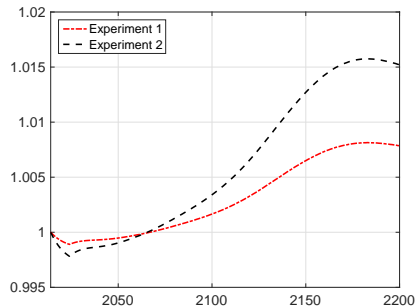
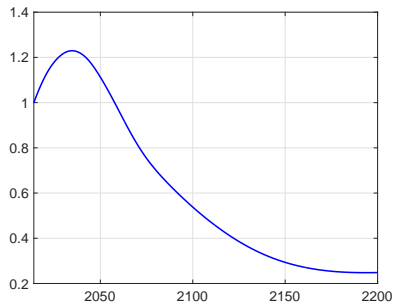
Guest Workers: Number and Share



Experiment 1 and 2

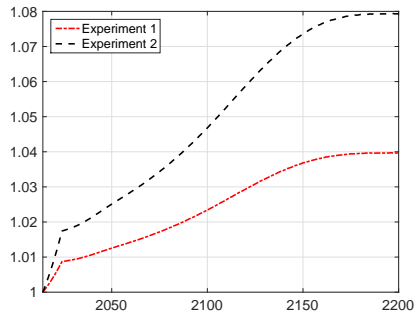
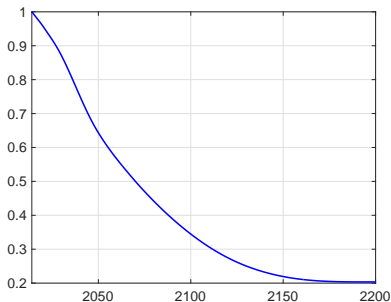
	Annual Flow of Foreign-Born Workers	Their Relative Skill Level
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Experiment 2	200,000	50%
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Experiment 6	s.t. 16.4% are foreign	100%

Capital : Baseline and Changes



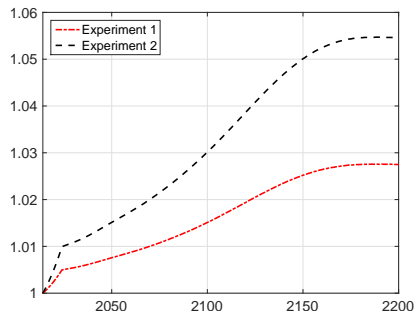
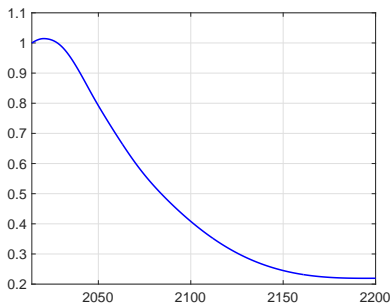
- Left: the time path of detrended capital
- Right: the ratio to the baseline model

Labor : Baseline and Changes



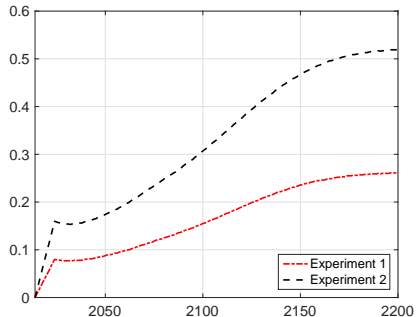
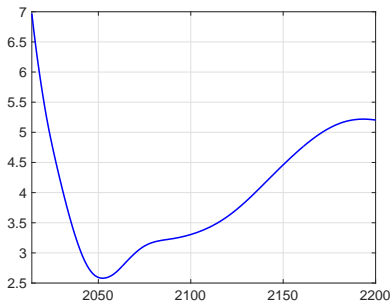
- Left: the time path of detrended labor
- Right: the ratio to the baseline model

Output : Baseline and Changes



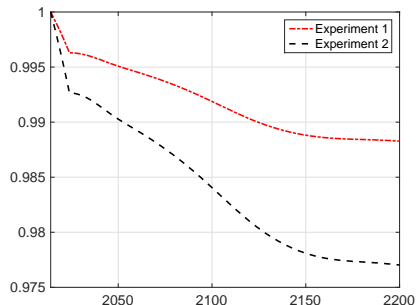
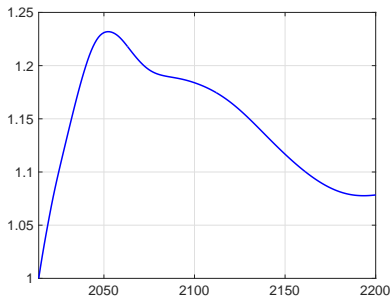
- Left: the time path of detrended output
- Right: the ratio to the baseline model

Interest Rate : Baseline and Changes



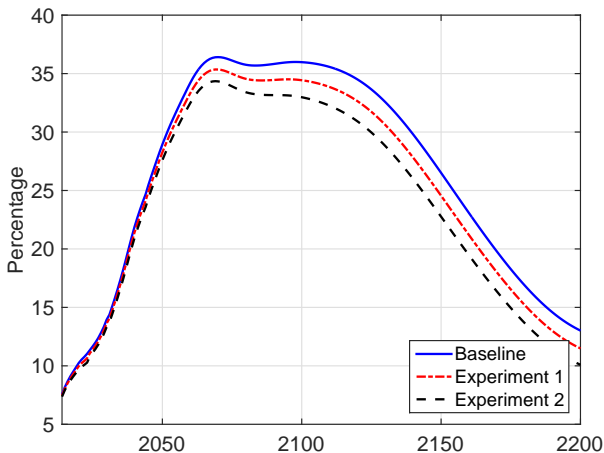
- Left: the time path of interest rate (%)
- Right: %-difference

Wage : Baseline and Changes



- Left: the time path of detrended wage
- Right: the ratio to the baseline model

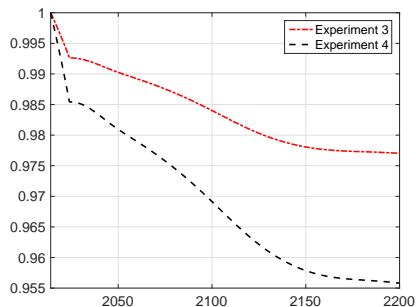
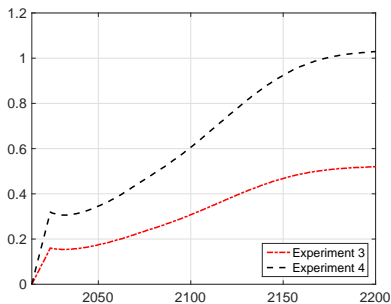
Consumption Tax Rate



Experiment 3 and 4

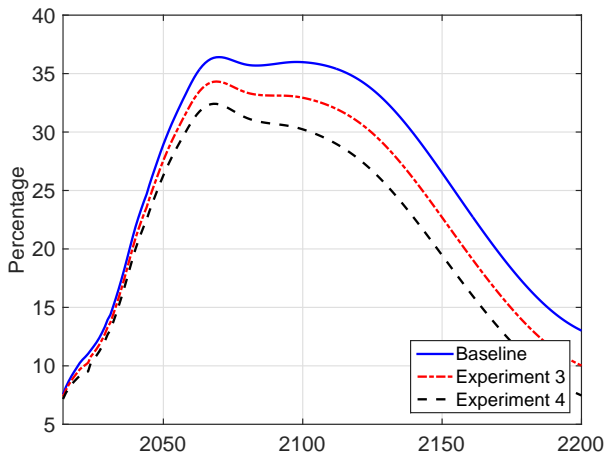
	Annual Flow of Foreign-Born Workers	Their Relative Skill Level
Experiment 1	100,000	50%
Experiment 2	200,000	50%
Experiment 3	100,000	100%
Experiment 4	200,000	100%
Experiment 5	s.t. 16.4% are foreign	50%
Experiment 6	s.t. 16.4% are foreign	100%

Interest Rate and Wage



- Left: interest rate (%-difference), Right: wage

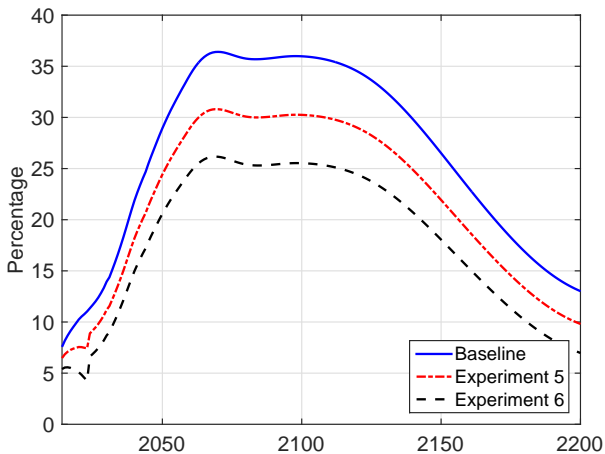
Consumption Tax Rate



Experiment 5 and 6

	Annual Flow of Foreign-Born Workers	Their Relative Skill Level
Experiment 1	100,000	50%
Experiment 2	200,000	50%
Experiment 3	100,000	100%
Experiment 4	200,000	100%
Experiment 5	s.t. 16.4% are foreign	50%
Experiment 6	s.t. 16.4% are foreign	100%

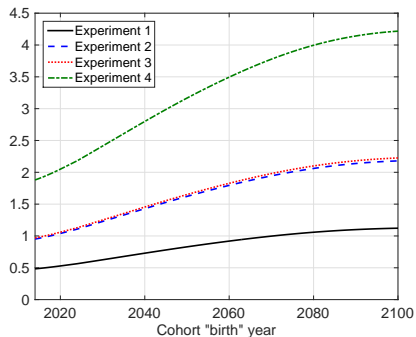
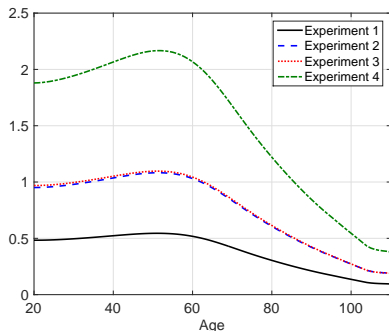
Consumption Tax Rate



Welfare analysis: CEV

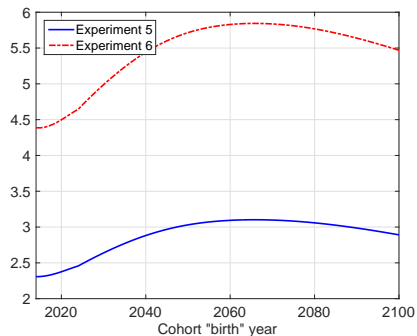
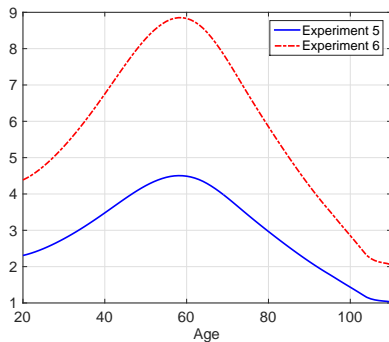
- We compute the consumption equivalent variation (CEV) for individuals at each age
- What percent of consumption over the remaining life time each individual needs in the benchmark transition in order to achieve the same remaining life time utility under an alternative transition?
- For individuals born in 2015 and later, we compute a similar CEV that equalizes life time utilities across the benchmark and an alternative transition
- A CEV of 1%, for example, implies that an individual is better off if a guest worker program is introduced; his remaining life-time utility would be the same in the baseline economy if his consumption in each period were raised by 1%

Welfare Effects of Experiments 1-4



- Left: the welfare effects in CEV from guest worker programs on the generations alive in 2014
- Right: the CEV for future generations

Welfare Effects of Experiments 5-6



- Left: the welfare effects in CEV from guest worker programs on the generations alive in 2014
- Right: the CEV for future generations

Partial Equilibrium Analysis

	Baseline		PE Experiments			
	GE	PE	Exp 1	Exp 2	Exp 3	Exp 4
2015	8.17	11.35	11.10	10.86	10.86	10.38
2020	10.24	12.96	12.56	12.17	12.16	11.38
2030	13.95	14.93	14.63	14.34	14.32	13.74
2040	21.88	19.76	19.41	19.06	19.04	18.34
2050	28.94	22.71	22.29	21.89	21.87	21.06
2060	34.20	24.83	24.36	23.90	23.88	22.96
2070	36.41	25.55	25.01	24.48	24.45	23.41
2080	35.75	24.65	24.04	23.45	23.42	22.27
2100	35.98	24.69	23.91	23.16	23.13	21.67
∞	11.73	9.15	8.16	7.23	7.17	5.41

“Immigration” Policy

	Baseline	Exp 1	Exp 2	Exp 3	Exp 4
2015	8.17	8.07	7.96	7.96	7.75
2020	10.24	10.01	9.77	9.77	9.29
2030	13.95	13.31	12.68	12.66	11.45
2040	21.88	20.61	19.41	19.35	17.10
2050	28.94	27.12	25.45	25.29	22.20
2060	34.20	31.82	29.68	29.50	25.62
2070	36.41	33.52	30.97	30.75	26.22
2080	35.75	32.46	29.59	29.35	24.36
2100	35.98	31.77	28.23	27.93	22.00
∞	11.73	7.91	4.84	4.43	-0.53

Conclusion

- Japan is facing a severe aging-induced fiscal problem.
- If current spending policy is maintained with debt stabilized around 200%, a huge consumption tax rate (50%) is needed to achieve fiscal sustainability (Hansen and Imrohoroglu, Braun and Joines)
- Even a relatively small policy has measurable fiscal effects and large welfare gains
- A U.S.-style program essentially solves Japan's fiscal problems
 - Needed consumption tax much lower
 - Welfare gains under this program are even larger
- Political feasibility?