Financing Health Care in Japan:

A Fast Aging Population and the Dilemma of Reforms

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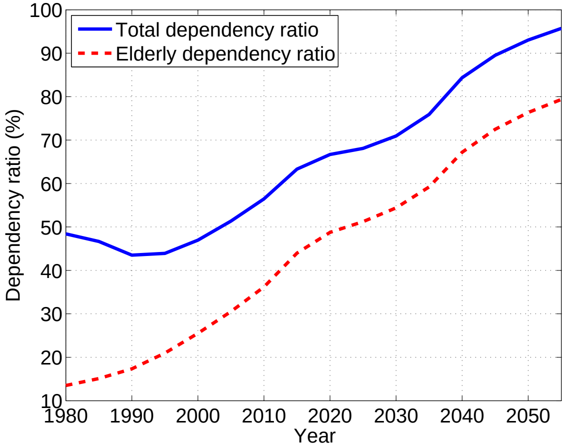
Background

- Population aging:
  - A global trend of aging
    - Observed: European countries, Japan, Asia tigers, *etc.*
    - Expected: Many developing countries, e.g., China, Malaysia, Thailand, *etc.*
  - A fast aging population in Japan – old-age dependency ratio will reach near 80% in 2050 from current 35%.
- Impacts:
  1. Fewer workers/tax payers
  2. Higher medical care demand

Dependency Ratio



Background (cont.)

- Universal health insurance (UHI):
  - UHI is provided in most developed countries
  - Many others are pursuing it, e.g., the US, Mexico, Turkey...
- Japan has a public UHI system
- The health care provided by the UHI in Japan is financed by (in 2002)
  1. Premium (a payroll tax): 51.7%
  2. Government general tax revenue: 33.0%
  3. Co-payment: 15.3%

Questions

- How does the fast population aging affect the cost of Japan's health care system?
- How large is the corresponding impact on tax burden?
  - the old need much more medical care the young
  - shrinking working population
  - tax distortion
- Any policy that can reduce the negative impact of aging and improve welfare?
  - UHI policy reform: an increase in co-payment
  - Financing policy reform: an increase in consumption tax

What We Do

- Construct a dynamic stochastic general-equilibrium life-cycle model to study impacts of aging
- Policy experiments
  1. UHI policy reform: changes in the UHI co-payment
  2. Financing policy reform: using consumption tax to prevent high labor tax burden
- Welfare analysis
  1. Steady state comparison – Welfare implications for *future* generations
  2. Transition – Welfare implications for *current* households and the likelihood of implementing the potential reforms.

Main Results – Impact of Aging

- Impacts of aging on PUHI cost
  - If medical price is constant:
    - An additional 8.9% labor tax will be needed with the 2050 age structure compared with the tax rate in 2010
  - If annual medical price growth rate 0.6%:
    - An additional 13.7% labor tax with the 2050 age structure

Main Results – Policy Experiments

- Both UHI policy reform (raising co-payment) and Financing policy reform (raising consumption tax) improve welfare significantly in the future steady state (2050 age structure).
- Transition and Welfare for Current Generation
  1. Only very young people have welfare gains
  2. An increase in co-payment causes a huge loss for the old
     - higher out-of-pocket expenditure
     - more risk
     - no time for preparation in advance
  3. Low agreement rates for both reforms – the tax reform gets more support

Previous Studies

- Health insurance (Theoretical/Quantitative)
  - Attanasio, Kitao, and Violante (2010), Jeske and Kitao (2009)
- Health insurance and medical expenses (Empirical)
  - French (2005), French and Jones (2007), De Nardi, French and Jones (2009), Finkelstein (2007)
- Health care in Japan (Empirical)
  - Kan and Suzuki (2005), Iwamoto (2010), Kondo and Shigeoka (2011)

Road Map

1. Introduction
2. Model
3. Calibration
4. Results – Steady state comparison
5. Results – Transition
6. Conclusion

Model

- A general equilibrium life cycle model with following features:

1. A continuum of finitely-lived individuals
2. Individuals face three uncertainties
   - (i) labor productivity, (ii) medical expenditure, and (iii) mortality
3. Incomplete market (borrowing constraint)
4. Public health insurance provides universal coverage

Demographic Structure

- An agent lives for at most J periods. Age $j \in \{20, \ldots, 65, \ldots, 100\}$
  - facing survival probability ρ_j from age j to $j+1$
  - $\rho_J = 0$
  - choosing labor supply until $j^{ss} = 65$
- Size of cohort, measured by μ_j for age j, grows at a rate g

$$\mu_{j+1} = \frac{\rho_j}{1+g}\mu_j$$

$$\sum_{j=1}^{J} \mu_j = 1$$

Shocks

1. Labor productivity: z
   - labor income: $w\eta_j zn$
   - η_j: age specific efficiency; n: labor hours
2. Medical expenditure: $q \cdot x_j(h)$, $h \in \{h_g, h_f, h_b\}$
   - q: relative price of medical care
3. Survival probability: ρ_j

Health insurance

- Public UHI
  - ω_j: coverage rate of health insurance (age-dependent)
- Out-of-pocket medical care payment

$$(1-\omega_j)qx_j(h)$$

Preferences

- Period utility function of a household:

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

  - c: consumption, n: hours worked
  - γ: parameter for ies/risk aversion, σ: utility parameter of leisure
  - β: discount factor

Household's Problem

- State vector: $s = (j, a, z, h)$
- A household's problem can be expressed by:

$$V(s) = \max_{c,n,a'} \left\{ u(c,n) + \rho_j \beta \mathbb{E}\left[V(s') \right] \right\}$$

- s.t. constraints

Constraints

- Constraints

$$
\begin{aligned}
(1+\tau_c)c + a' &= W + T, \\
W &\equiv y(n,j,z) + (1+(1-\tau_k)\,r)\,(a+b) - \left(1-\omega_j\right) qx, \\
y(n,j,z) &= (1-\tau_l-\tau_{ss}-p^{\text{med}})w\eta_j zn + ss(j) \\
T &= \max\{0, (1+\tau_c)\underline{c} - W\} \\
ss_j &= \begin{cases} ss & \text{if } j \geq j^{ss}, \\ 0 & \text{otherwise.} \end{cases}
\end{aligned}
$$

- Accidental bequest b:

$$
b' = \frac{\int (1-\rho_j)a' d\Phi(s)}{1+g}
$$

Production

- A representative firm's production function:

$$Y = F(K, L) = AK^{\theta}L^{1-\theta}$$

  - A: TFP
  - θ: capital share
- Aggregate capital and labor

$$L = \int \eta_j z n(s) d\Phi(s),\ K = \int a d\Phi(s)$$

where $\Phi(s)$ is the population distribution over the sate variables.

Government Budget Constrains

- Government spendings consist of:
  1. Public UHI
  2. G: government consumption (exogenous)
  3. Social security system: PAYG

Government Budget Constrains

- Government's budget constraint:

$$\underbrace{\int [\tau_l w \eta_j zn + \tau_k r(a+b) + \tau_c c] d\Phi(s)}_{\text{Tax Revenue}} = \underbrace{\psi \int (\omega_j qx) d\Phi(s)}_{\text{PUHI subsidy}} + \int T d\Phi(s) + G$$

  - ψ: a fraction of UHI cost is financed by government revenue
- National health care system:

$$\underbrace{\int (p^{\text{med}} w \eta_j zn) d\Phi(s)}_{\text{Premium}} = (1-\psi) \int (\omega_j qx) d\Phi(s)$$

Government Budget Constrains (cont.)

- Social security system (self-financed):

$$\int (\tau_{ss} w \eta_j z n) d\Phi(s) = \int ss_j d\Phi(s).$$

Recursive Competitive Equilibrium

1. Households' optimization problem is solved
2. Firm's optimization problem is solved
3. Government's budget constraints are satisfied
4. All markets (goods, capital and labor) clear
5. Distribution of population over sate space $\Phi(s)$ is stationary (in a steady state)

Idiosyncratic Wage Risk

- Approximate wage shock z by AR(1) process

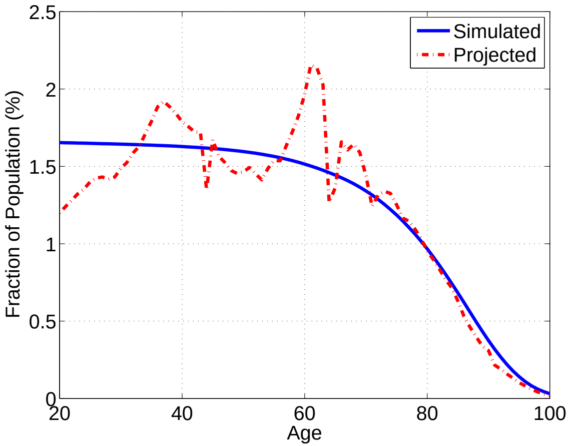
$$\ln z_{j+1} = \lambda \ln z_j + \varepsilon_j, \ \varepsilon \sim \mathcal{N}(0, \sigma_\varepsilon^2)$$

  - λ: persistence of shock
- Adopted form Abe and Yamada (2009)

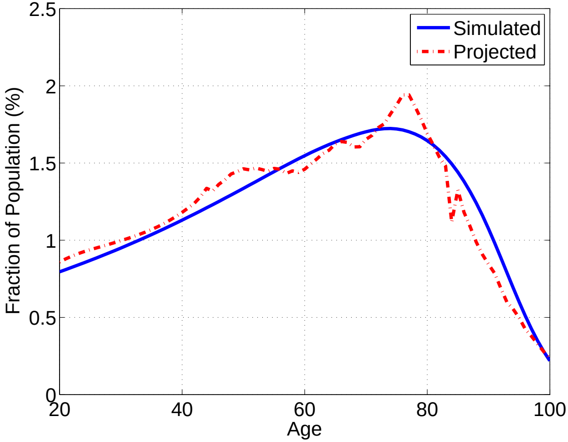
Demographic Structure

- Survival rate $\{\rho_{j,t}\}$
  - The National Institute of Population and Social Security Research (IPSR)
  - Projection from 2005–2055

Demographic Structure in 2010



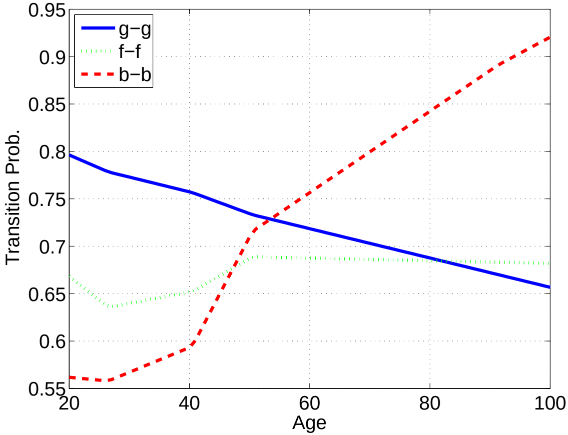
Demographic Structure in 2050



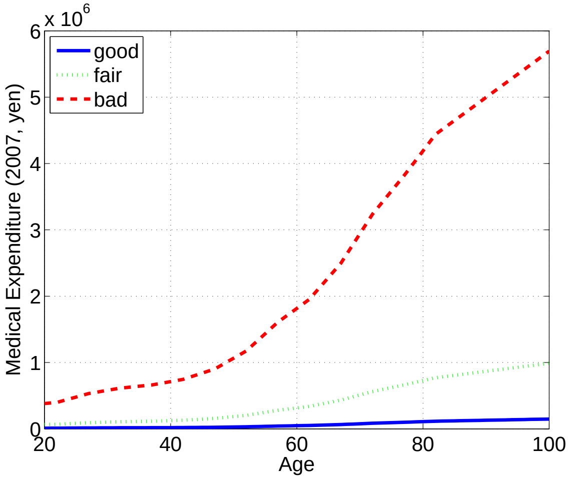
Medical Expenditure

- Transition of medical expenditure: Kan and Suzuki (2005)
  - individual health insurance claim data
  - studying transition of medical expenditure in 5 age groups
- Aggregate medical expenditure: Estimates of National Medical Care Expenditures (Ministry of Health, Labour, and Welfare)
- Medical expenditure: $x_j(h)$, $h \in \{h_g, h_f, h_b\}$ (bottom 50%, middle 40%, top 10% in each j)
- Adjust the level such that X/Y ratio matches the data

Medical Expenditure: Transition Probabilities



Medical Expenditure: Health Status



Public Universal Health Insurance/Tax System

- Co-payment rate depends on age (benchmark)
  1. $\omega_j = 30\%$: $j \in \{20, \ldots, 69\}$
  2. $\omega_j = 20\%$: $j \in \{70, \ldots, 74\}$
  3. $\omega_j = 10\%$: $j \in \{75, \ldots, 100\}$
- Tax system
  - $\tau^c = 5\%$: consumption tax (benchmark)
  - $\tau^k = 39.8\%$: capital income tax (İmrohoroğlu and Sudo)
  - $\tau_t^{ss} \in \{16.058\%, \ldots, 18.3\%\}$ – social security has to be self-financed based on the tax.

Parameters

Parameters		Value
Discount factor	β	0.98
Intertemporal elasticity of substitution	γ	2.0
Share of labor supply	σ	0.33
Capital share	θ	0.377
Depreciation rate	δ	0.08
Persistence of labor productivity shock	λ	0.98
Std. dev. of labor productivity shock	σ_ε	0.09
Government share of PUHI cost	ψ	0.25
G/Y		12.5%
Price of medical expenditure	q	$\{1, 1.27\}$

Welfare Measure

- How to evaluate welfare change?
  - Certainty equivalent consumption variation (CEV)
- Social welfare measure:
  - Measure 1: *ex-ante* value

$$SW1 = \int V(j, h, a, z) d\Phi(j, h, a, z | j = 20, a = 0)$$

  - Measure 2: social average

$$SW2 = \int V(j, h, a, z) d\Phi(j, h, a, z)$$

Result: Steady State Comparison

	Benchmark	Only Price	Only Aging	Aging & Price
Age structure	2010	2010	2050	2050
Medical price	$q = 1$	$q = 1.27$	$q = 1$	$q = 1.27$
Change in K	0.00%	-1.47%	-0.52%	-4.67%
Change in L	0.00%	-0.18%	-16.63%	-17.23%
K/Y	2.52	2.50	2.81	2.75
X/Y	7.1%	9.1%	12.1%	15.7%
Tax burden				
1) Labor tax: τ_l	7.6%	8.7%	12.2%	14.1%
2) Premium: p^{med}	5.5%	7.1%	9.8%	12.7%
1)+2): $\tau_l + p^{\mathrm{med}}$	13.1%	15.7%	22.0%	26.8%
Increased burden	-	2.6%	8.9%	13.7%

Result: UHI Policy Reform

	Current system	UHI policy ω_j	
		30%	35%
Change in K	0.00%	14.00%	19.10%
Change in L	0.00%	2.01%	2.79%
K/Y	2.75	2.95	3.02
Tax burden			
1) Labor tax: τ_l	14.1%	13.3%	13.0%
2) Premium: p^{med}	12.7%	10.0%	9.1%
1)+2): $\tau_l + p^{med}$	26.8%	23.2%	22.1%
Welfare comparison			
CEV(new-born, h =good)	0.00%	9.65%	12.63%
CEV(new-born, h =fair)	0.00%	9.67%	12.63%
CEV(new-born, h =bad)	0.00%	9.73%	12.64%
CEV(all population)	0.00%	1.29%	2.02%

Result: Financing Policy

	Current system	Financing Policy τ_c	
		10%	15%
Change in K	0.00%	5.20%	10.26%
Change in L	0.00%	1.07%	1.99%
$K\,/\,Y$	2.75	2.81	2.89
Tax burden			
Labor tax: τ_l	14.1%	9.9%	5.7%
Premium: p^{med}	12.7%	12.4%	12.1%
Total: $\tau_l + p^{\text{med}}$	26.8%	22.3%	17.9%
Welfare comparison			
CEV(new-born, h =good)	0.00%	3.68%	7.02%
CEV(new-born, h =fair)	0.00%	3.69%	7.04%
CEV(new-born, h =bad)	0.00%	3.74%	7.12%
CEV(all population)	0.00%	1.19%	2.14%

Decomposition of Welfare

- Decompose the welfare effect into
  1. Distribution effect:
     Keep average c and n the same as in the benchmark, only the allocations over life cycle change.
  2. Level effect:
     Average c and n change to new steady state level.

Decomposition of Welfare(cont.)

Table: Decomposition of welfare change

	UHI policy reform Co-payment rate	Financing policy τ_c
	30%	10%
CEV (total)	9.66%	3.65%
Level	4.93%	1.64%
Only c	5.90%	2.43%
Only n	-0.92%	-0.78%
Distribution	4.86%	2.03%
Only c	3.41%	1.53%
Only n	1.44%	0.50%

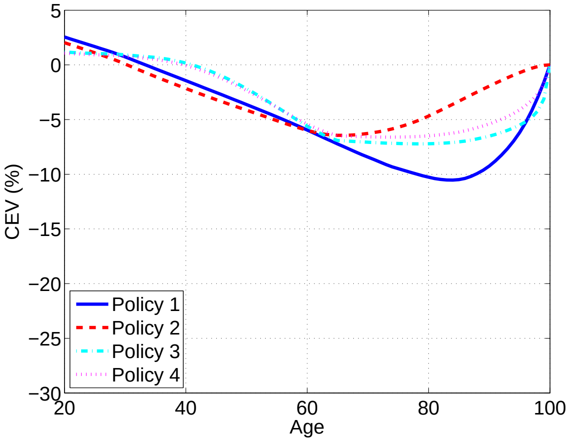
Transition Dynamics

- Compute transition paths from 2010 to 2200:
- New policy implemented in 2011
- Policy experiment plans:
    1. Policy 1(Immediate UHI reform): Co-payment rate increases to 30% suddenly in 2011
    2. Policy 2(gradual UHI reform): Co-payment rate increases 1% per year to 30%.
    3. Policy 3(immediate financing policy reform): Consumption tax increases to 10%
    4. Policy 4(gradual financing policy reform): Consumption tax increases 1% per year to 10% .

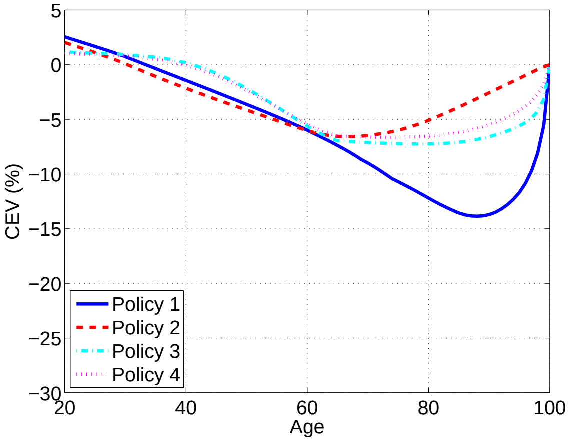
Welfare Implications

- Welfare implications
  1. Redistribution between the young and the old
     - Co-payment increase: forcing the old to share more UHI cost and face more risk
     - Consumption tax increase: milder impact on the old (c is smoother than x over age)
  2. Redistribution between the healthy and the unhealthy
     - Co-payment increase: forcing the unhealthy to share more UHI cost and face more risk
     - Consumption tax increase: the healthy share more (they have higher c than the unhealthy)

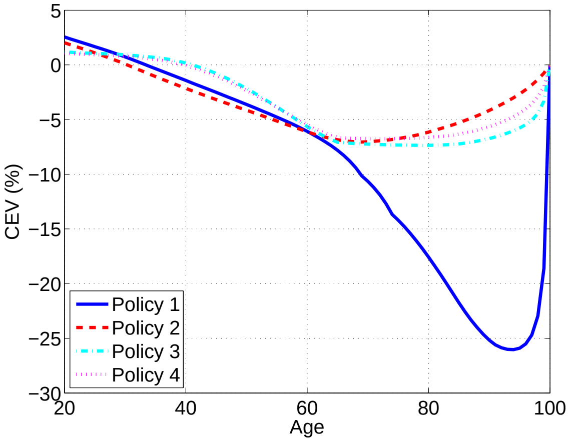
Transition Dynamics: Health = good



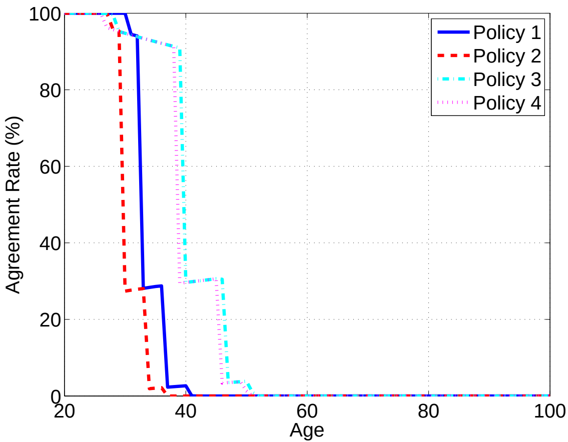
Transition Dynamics: Health = fair



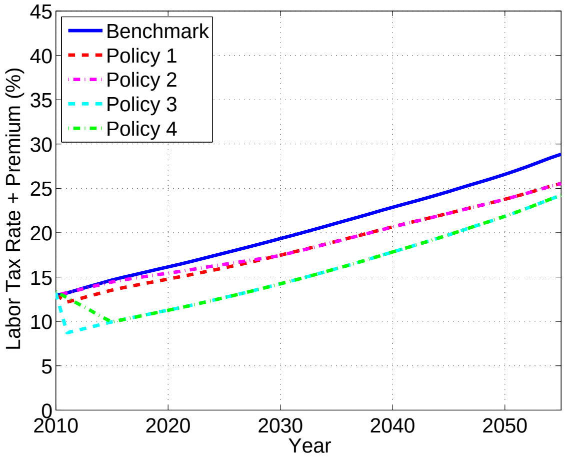
Transition Dynamics: Health = bad



Agreement Rate



Tax Burden: Labor Tax + Premium



Concluding Remarks

- Impact of population aging
  - Additional 9 – 14% of labor tax will be needed to finance the Public UHI if the population age structure is like in 2050.
- Policy implications
  1. Welfare for future generation:
     - Both the UHI reform (co-payment increase) and financing policy reform (τ_c increase) improve social welfare.
  2. Implication for implementation of reforms:
     - The majority will face welfare losses.
     - Immediate reforms will hurt current old people a lot.
  3. Suggestion and discussion
     - Reforms that reduce tax burden on the young are necessary, but compensation is needed.
     - How?