Aging and Deflation from a Fiscal Perspective

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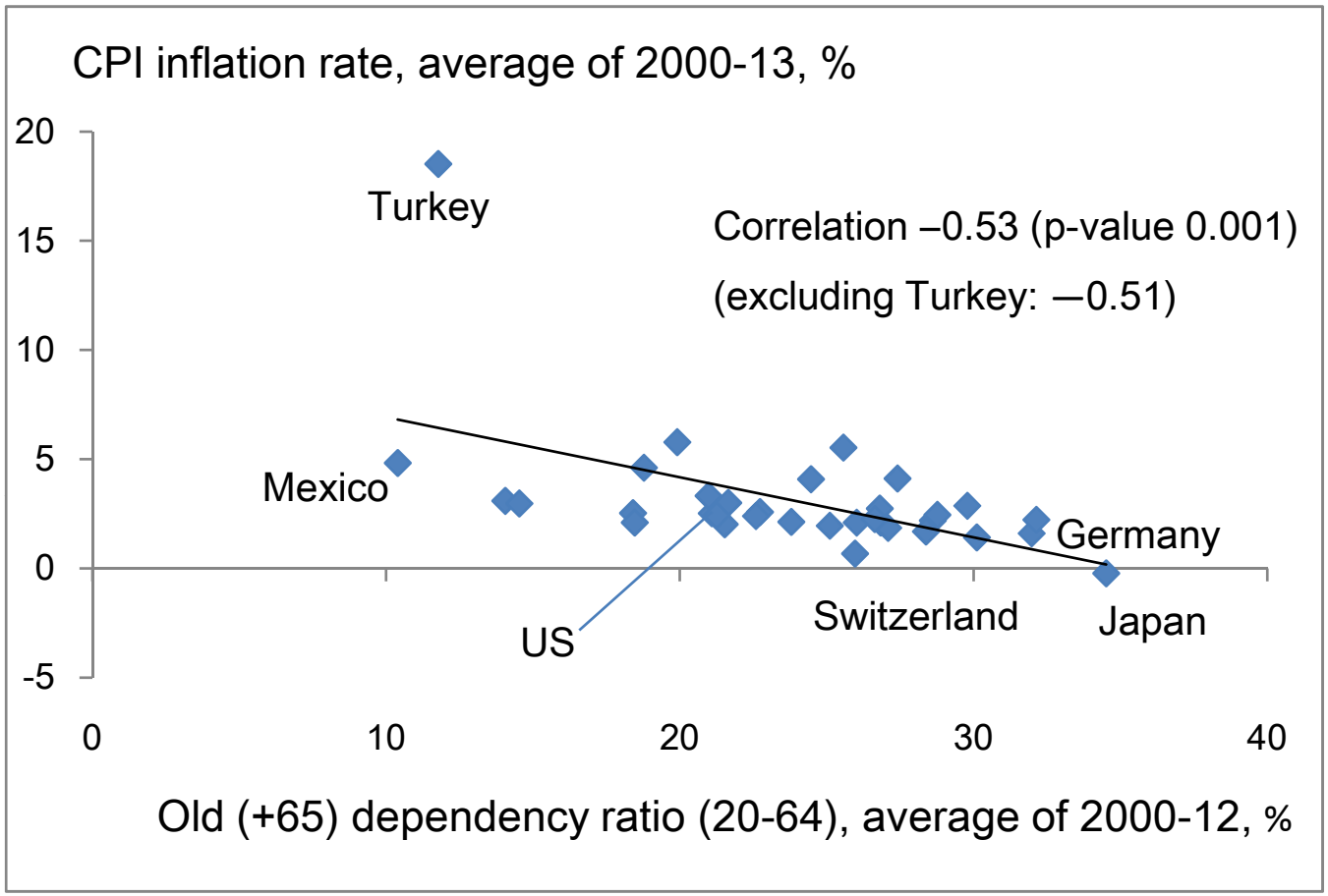
Negative Correlation bw Aging and Inflation in OECD Countries

Aging correlated with deflation



Motivations

We aim to analyze theoretically

- the reason for the concurrent population aging and deflation and
- the impact of price changes on income distribution across generations.

What We Do

- We extend the standard **fiscal theory of the price level (FTPL)**.

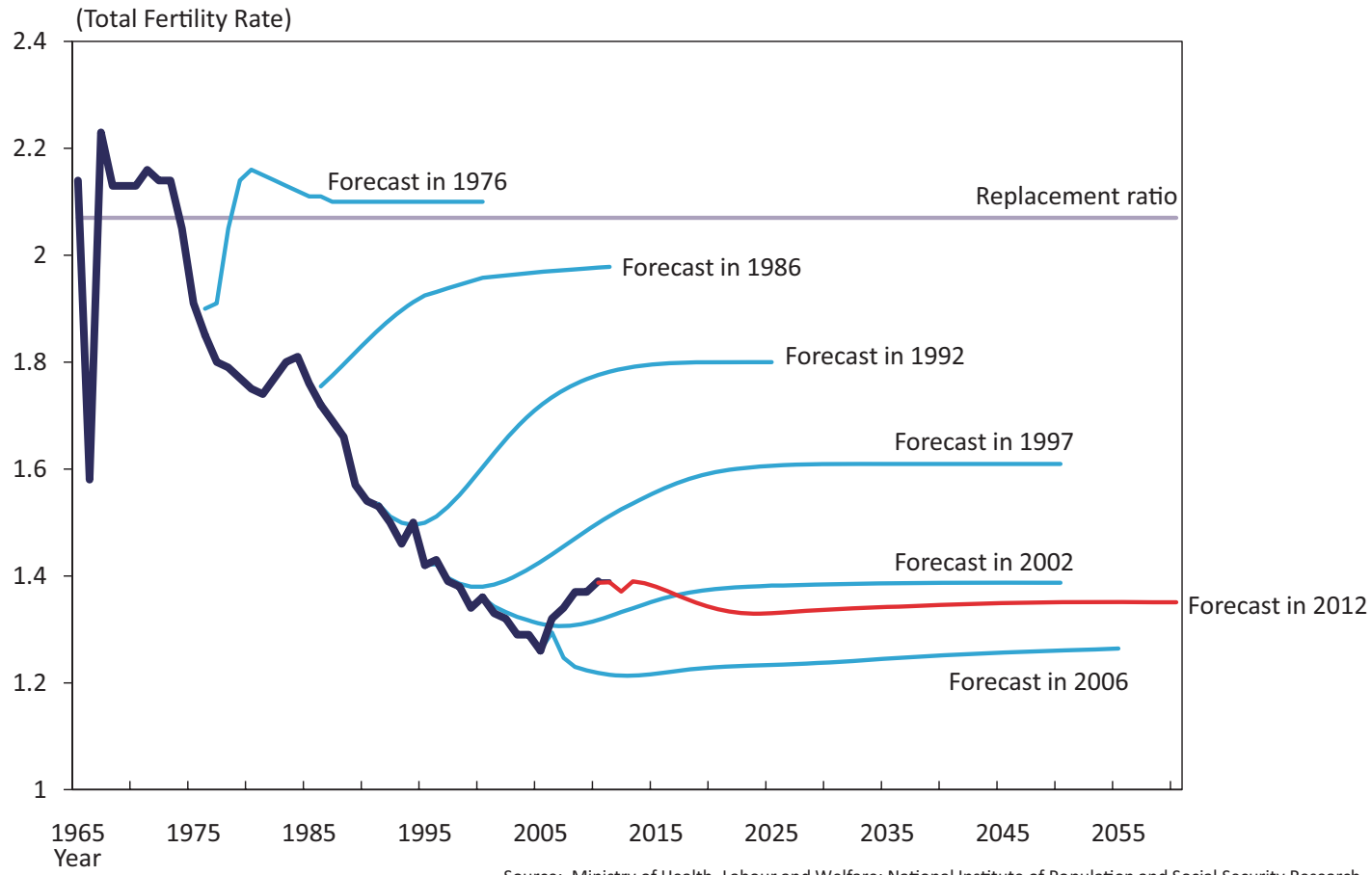
1. We embed the FTPL into a standard overlapping generation (OLG) model
   - to examine political and economic impacts of demographic changes.
2. We consider endogenous policy making.
   - Succession of short-lived governments choose income tax rates and bond issues.

What We Find

- The accumulation of government debt does not become a burden on future generations,
  - because of price adjustments.
- The effects of aging depend on its causes.
  - Aging is deflationary when caused by an increase in longevity
  - but inflationary when caused by a decline in birth rate.
  - Numerical simulation shows that aging over the past 40 years in Japan generated deflation of about 0.6 percentage points annually.

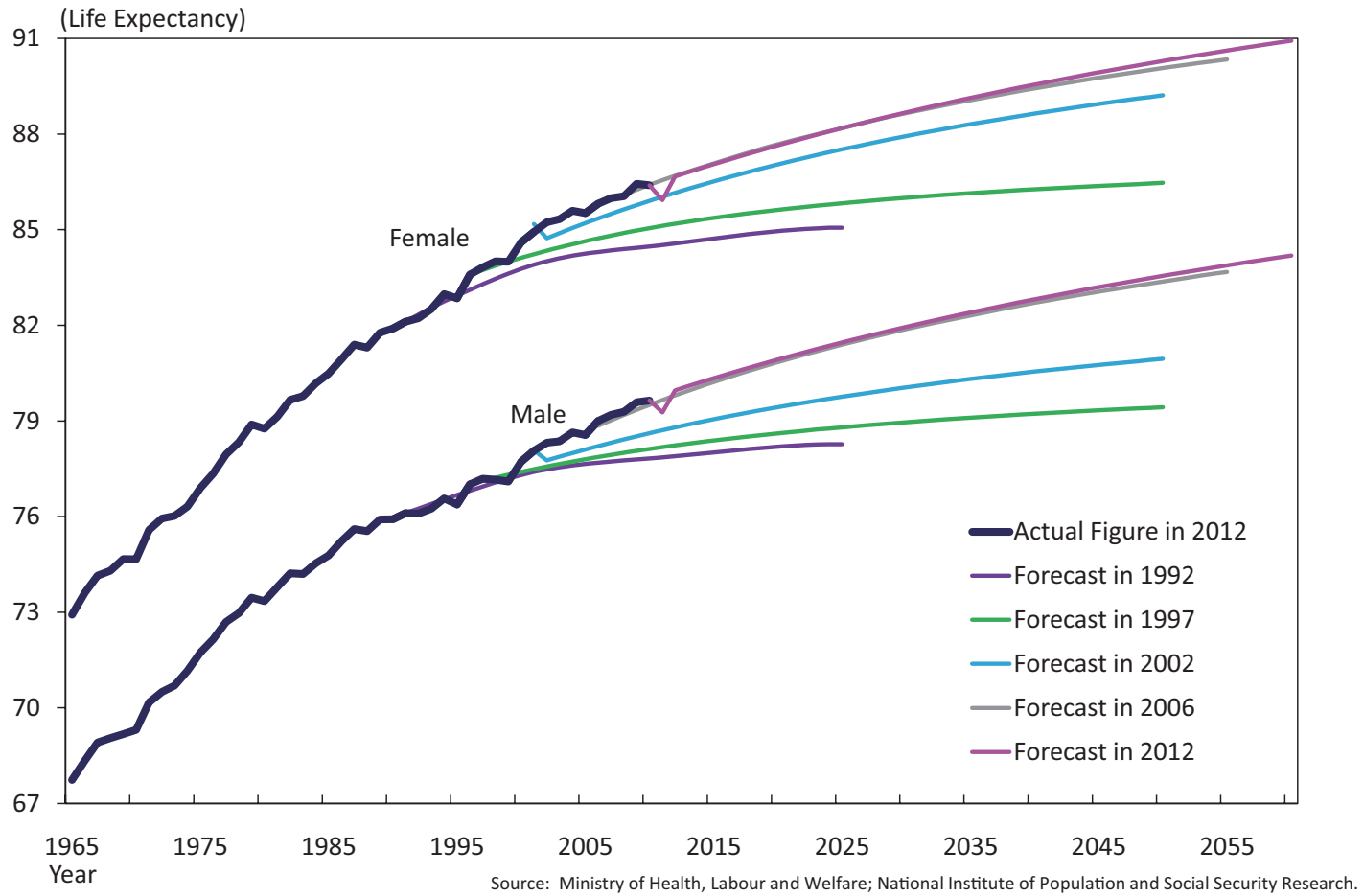
Revisions in the Japanese Total Fertility Rate Forcast

A part of Japanese population aging is an unexpected phenomenon.



Source: Ministry of Health, Labour and Welfare; National Institute of Population and Social Security Research.

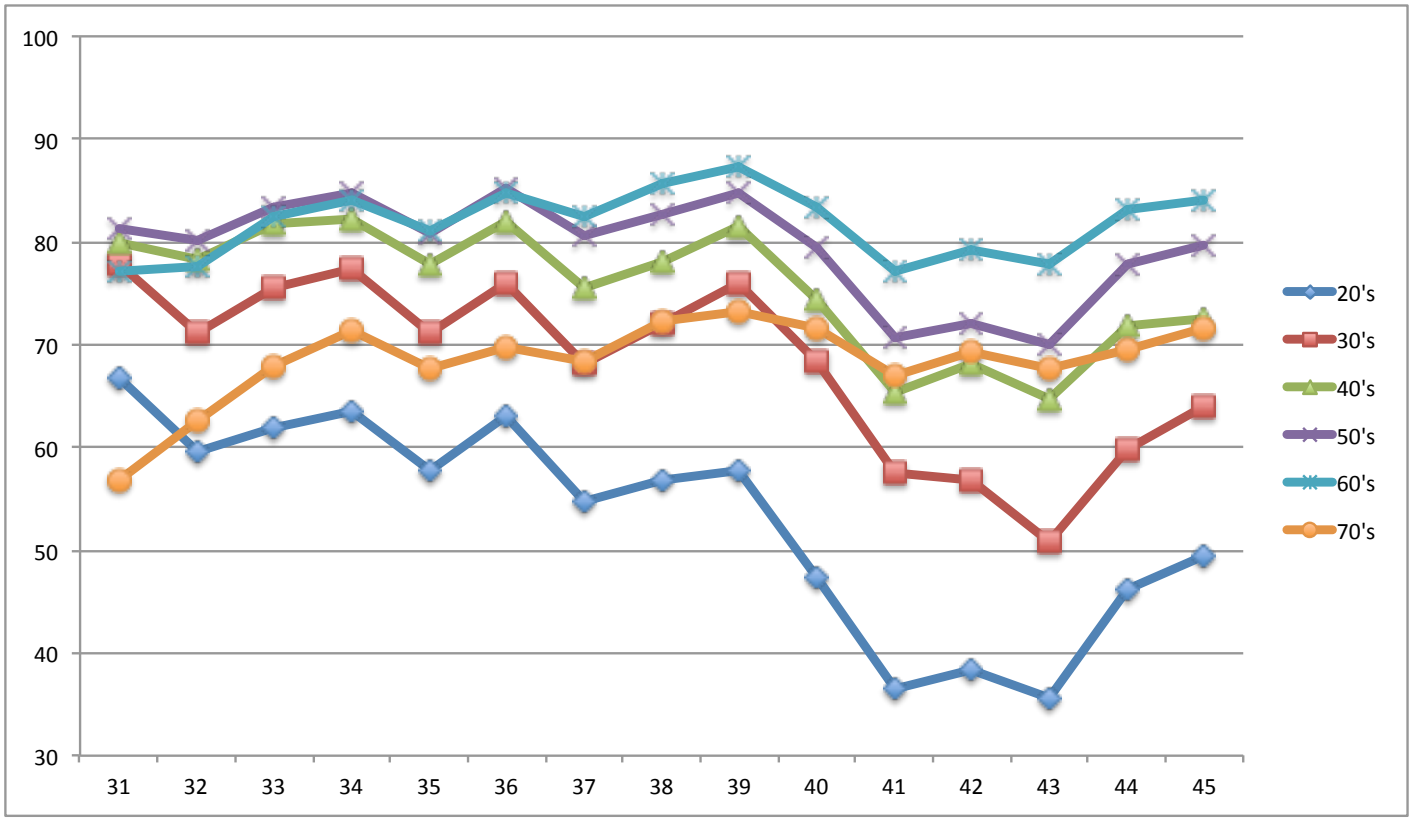
Revisions in the Japanese Life Expectancy Forcast



Source: Ministry of Health, Labour and Welfare; National Institute of Population and Social Security Research.

Voter Turnout Rates by Age in Japan

Voter turnout rates for the young generation especially 20's, 30's, and 40's are declining and the gap between generations is widening.



Note: The turnout rates by age in the Japanese lower house elections No.31–45 (from 1967 to 2009) are depicted.

Literature Review

- FTPL
  - Leeper (1991), Sims (1994), Woodford (1995), and Cochrane (2005), Cushing (1999) and Braun and Nakajima (2012), Sims (2013)
  - These studies do not endogenize political decisions on fiscal policy variables.
- Fiscal burden; Strategic debt accumulation
  - Bowen *et al.* (1960), Barro (1974), Tabellini and Alesina (1990), Persson and Svensson (1989), Rohrs (2010), Song, Storesletten, and Zilibotti (2012), and Ono (2013)
  - All these previous studies, however, assume that government debts are specified in real terms and therefore adjustments in the price level do not change the intertemporal budget constraint of the public sector.

Model

Model Features

- Endowment economy. No physical capital.
- OLG model. The economy consists of the young N_t and the old $\theta_t N_{t-1}$.
  - Each individual will live at most for two periods with a survival probability θ_t^j. No aggregate uncertainty.
  - $n_t = N_t / N_{t-1}$ represents a birth rate.
  - Insurance firms faced with perfect competition.
- Monetary policy is passive.
- Govt remains in power only for one period.
  - Income tax only, which is imposed on the young.
  - Govt determines bond issues and tax rates. No expenditure.

Household

Each young household in period t maximizes the expected utility:

$$\log c_t^y + \beta\theta_{t+1} \log c_{t+1}^o \tag{1}$$

st

$$c_t^y + \frac{\theta_{t+1}}{r_{t+1}} c_{t+1}^o = 1 - \tau_t, \tag{2}$$

where $r_{t+1} \equiv R_t P_t / P_{t+1}$ is the real interest rate a young household faces in period t.

Government

Fiscal balance:

$$R_{t-1}B_{t-1} = B_t + P_t N_t \tau_t. \tag{3}$$

Market clearing for government bonds:

$$N_t A_t = B_t. \tag{4}$$

Recap: Fiscal Theory of Price Level (FTPL)

- Today's price level P_t is determined to balance govt's intertemporal budget in real terms [Leeper ('91), Woodford ('01) etc.] .

$$\frac{RB_{t-1}}{P_t} = T_t - G_t + \sum_{s=t+1}^{\infty} \left(\prod_{k=t+1}^{s} r_k \right)^{-1} (T_s - G_s)$$

Price

- The fiscal balance equation together with market clearing for government bonds yields the equilibrium price level in period t:

$$\left(\frac{R_{t-1}B_{t-1}}{N_{t-1}}\right)\frac{1}{P_t} = \frac{n_t(\tau_t + \beta\theta_{t+1})}{1+\beta\theta_{t+1}}. \tag{5}$$

- A higher τ_t and a higher θ_{t+1} deflate P_t, but a lower n_t inflates it.
- But τ_t is endogenous. $\rightarrow$next analysis.

Indirect Utility

$$v_t^y = (1+\beta\theta_{t+1})\log(1-\tau_t) + \beta\theta_{t+1}\log r_{t+1} + \beta\theta_{t+1}\log\frac{\beta}{1+\beta\theta_{t+1}} \tag{6}$$

$$v_t^o = \log\frac{R_{t-1}B_{t-1}}{\theta_t N_{t-1}P_t} \tag{7}$$

Optimization Problem Facing Short-lived Governments

- Tax rates and bond issues are chosen by a succession of short-lived governments.
- Each government remains in power just for one period and chooses policies to maximize

$$W_t = \gamma_t v_t^o + v_t^y, \tag{8}$$

  - following the spirit of the probabilistic voting model,
  - where γ_t represents the political bias toward the well-being of the old, and v_t^o and v_t^y represent the indirect utility of the old and the young, respectively.

- The policy decisions of successive governments are usually considered intertemporally linked by the inheritance of outstanding debts.
- In our model, the previous problem is reduced to

$$\gamma_t \log(\tau_t + \beta\theta_{t+1}) + (1 + \beta\theta_{t+1}) \log(1 - \tau_t) + \beta\theta_{t+1} \log r_{t+1} \qquad (9)$$

subject to the FTPL equation for the next period:

$$\frac{r_{t+1}}{n_{t+1}} = \frac{1 + \beta\theta_{t+1}}{\beta\theta_{t+1}(1 - \tau_t)} \frac{\beta\theta_{t+2} + \tau_{t+1}}{1 + \beta\theta_{t+2}}.$$

B_{t-1} **does not appear here!**

- This suggests that government $t - 1$'s decision has **no influence** on government t's policy choice.

Intuition

- Let us examine whether an increase in B_{t-1}, resulting from a reduction in τ_{t-1} influences τ_t.
- It will affect government t's policy decision if and only if it becomes indebted more in real terms to the old in period t.
- However, those bonds are valued through (5),

$$\left(\frac{R_{t-1}B_{t-1}}{N_{t-1}}\right)\frac{1}{P_t} = \frac{n_t(\tau_t + \beta\theta_{t+1})}{1+\beta\theta_{t+1}},$$

  such that in the absence of any tax changes occurring in current and future periods, the price level P_t increases at the same rate as the nominal value of bond issues does, leaving their real value B_{t-1}/P_t unchanged.
- With such a price level adjustment, in turn, government t need not change τ_t.

Markov Perfect Equilibrium

Assume in $W_t = \gamma_t v_t^o + v_t^y$

$$\gamma_t = \frac{\omega\theta_t}{n_t}, \tag{10}$$

and $\theta_t = \theta_{t+1} = \theta$ and $n_t = n_{t+1} = n$ (surprise changes). Then, we have

$$\tau_t = 1 - \frac{1+\beta\theta}{1+\omega\theta/n} \tag{11}$$

$$r_{t+1} = \frac{\omega}{\beta} \tag{12}$$

$$P_t = \left(\frac{R_{t-1}B_{t-1}}{N_{t-1}}\right)\left(\frac{1}{\omega\theta} + \frac{1}{n}\right). \tag{13}$$

Results

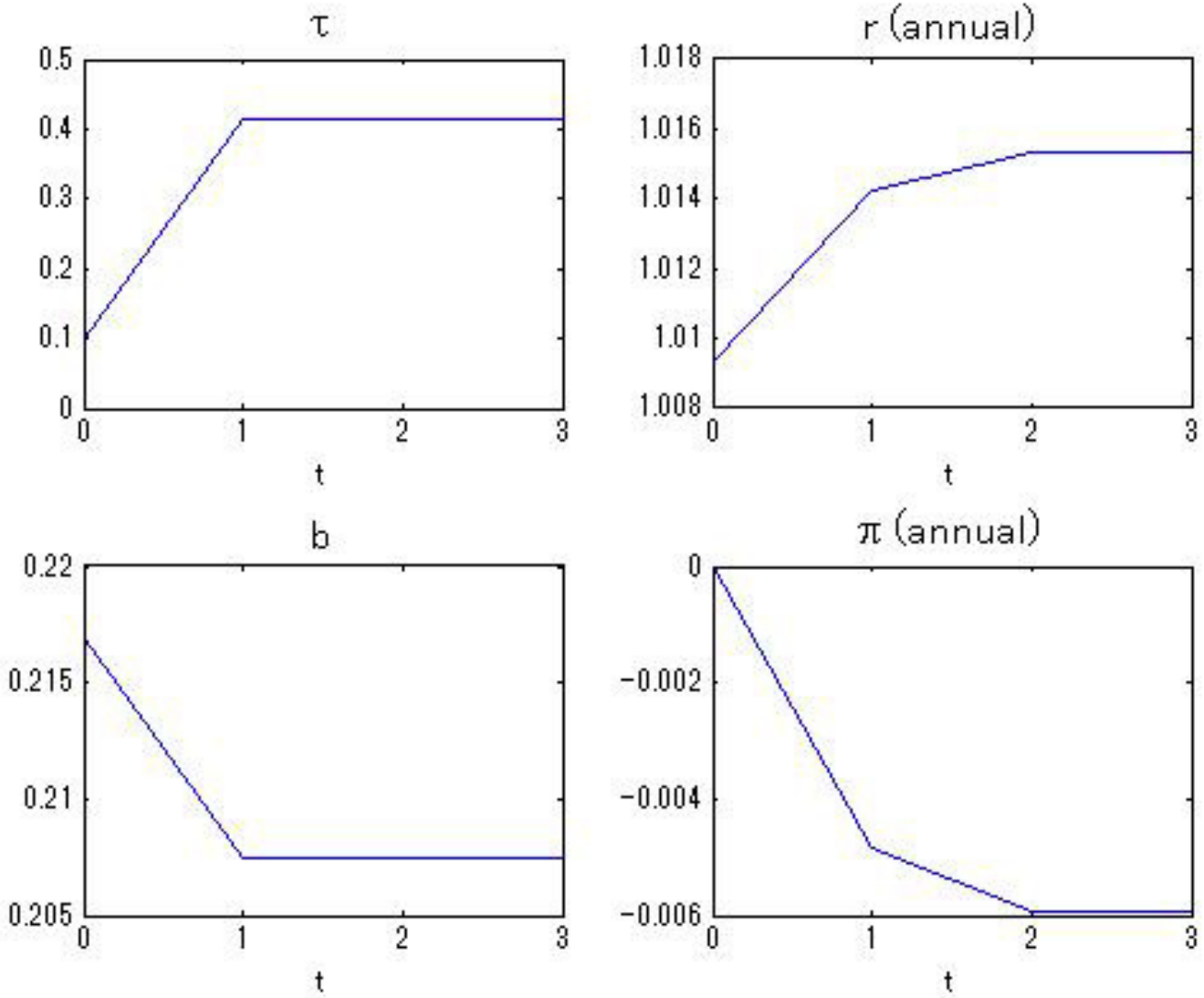
	τ_t	Bond (b_t)	P_t	r_{t+1}
Political weight on the old $\omega_t \uparrow$	$+$	$-$	$-$	$+$
Birth rate $n_t \downarrow$	$+$	$-$	$+$	0
Longevity $\theta_t \uparrow$	$+$	$+$	$-$	0

- The price level response to demographic aging depends on its causes.
- If the birth rate declines, a contraction in the tax base will reduce the fiscal surplus and the government will be induced to generate inflation in order to maintain solvency.
- In contrast, in case of an unexpected increase in life expectancy and the old survive longer than expected, the government will be inclined to favor them because of their shortage in savings for their retirement period and their strengthened political power relative to the younger generation. In such a situation, the government will opt to suppress inflation and support the older generation's well-being with deflation.

Quantitative Investigations Using a Generalized Model

Calibration

- A period consists of 40 years.
- Frisch elasticity $\upsilon = 0.5$; $\beta = 0.99^{40}$; government spending $g^C = g^T = 0.01$.
- In 1976, $\theta = 0.482$; $n = 1.058$; $\omega = 0.969$.
  - Forecasts of the National Institute of Population and Social Security Research (IPSS)
  - Voter turnout rates in the election No. 34 held in 1976.
- In 2012, $\theta = 0.781$; $n = 0.629$; $\omega = 1.230$.



Note: $t = 0$ corresponds to 1974. At $t = 1$, unexpected demographic and political changes occur, which corresponds to the year 2012. From $t = 2$ onward, demographic and political parameters are unchanged. The inflation rate at $t = 0$ is set 0.

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Concluding Remarks: Future Work

- Our study represents a first step toward embedding the FTPL in a politico-economic framework.
- Two main challenges.
  - Address Japan's accumulation of government bonds over the past 40 years. Our finding that aging improves fiscal balances by increasing the tax rate imposed on the young seems questionable in reality.
  - Introduce foreign investors buying government bonds into the model. It is well known that around 90% of Japanese government bonds are held by domestic investors.