Online Appendix
Females, the Elderly, and Also Males: Demographic Aging and Macroeconomy in Japan

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1 Alternative Policy Scenarios: Public Pension

Replacement Rate: In the baseline simulations, we assume that the replacement rate of the public pension, summarized by the parameter value of κ, remains unchanged during the transition. In this section, we consider a scenario in which the replacement rate is reduced by 20% gradually over a 30-year period.[1]

Figure 1 compares the paths of capital, interest rate and equilibrium tax rate in the experiment to those of the baseline transition. Expecting lower pension benefits from the government, individuals will save more and aggregate capital will be higher than in the baseline transition. Additional saving will make capital more abundant relative to labor and reduce the cost of capital, as shown in the path of the interest rate in Figure 1b.

Figure 1c shows a change in equilibrium consumption tax rates. There is not much difference initially since the replacement rate is reduced gradually, but the fiscal burden eventually will be lower by more than 6 percentage points of total consumption by 2070.

The fiscal burden declines not only because of lower government expenditures on public pensions, but also because of a combination of other factors. In an economy with lower pensions, output also rises because of increased individual savings and higher aggregate capital, and wages increase too.[2] As a result, the ratio of pension benefits relative to GDP

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[1]The decline of 20% is equivalent to the projected change in the pension benefits under the Actuarial Valuation by the MHLW when the adjustment of benefits under the macroeconomic slide works as expected. See below for details about Actuarial Valuation in 2014. https://www.mhlw.go.jp/file/06-Seisakujouhou-12500000-Nenkinkyoku/2014_Actuarial_Valuatin_3.pdf

[2]Note that we assume exogenous labor supply, but if labor responds positively to the policy change, effects on output may be larger and our estimates may be considered conservative.

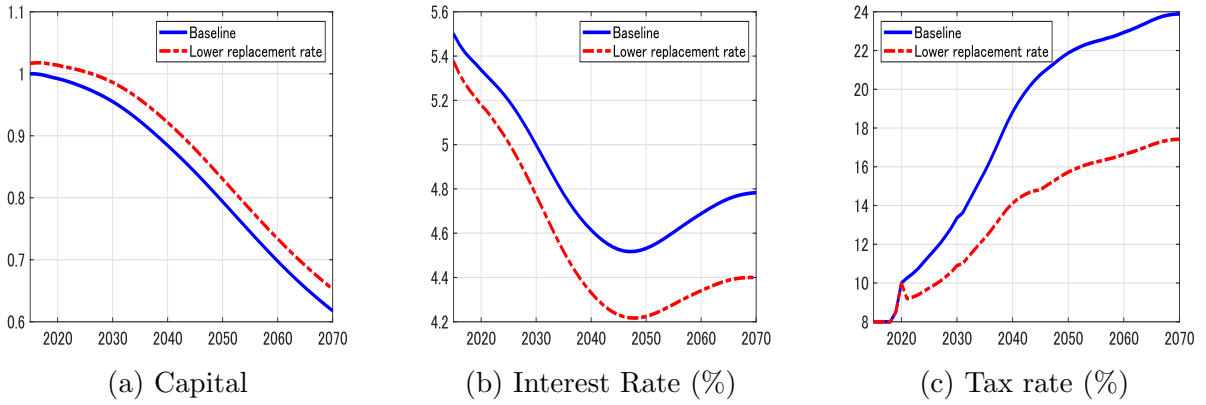(a) Capital   (b) Interest Rate (%)   (c) Tax rate (%)

Figure 1: Pension Scenario: 20% Decline in the Replacement Rate

also falls, contributing to a major decline in tax rates needed to finance the demographic transition.

Normal Retirement Age (NRA): We also simulate the transition assuming two scenarios, in which the pension eligibility age is raised from the current NRA of 65 to 67 and 70, respectively. We assume that the retirement age is raised gradually by one year at five-year intervals, starting in 2020.

Figure 2 shows the paths of aggregate capital, interest rate and equilibrium tax rate. As in the experiment lowering the replacement rate, reform will give additional incentives to save for retirement and increase capital. Quantitatively, effects are larger when the NRA is raised to a higher age. With the NRA of 70, the fiscal burden will be significantly reduced and the equilibrium tax rate in the early 2040s will be similar to the current level. The magnitude of the change in the tax rate under this scenario will be similar to that of lowering benefits by 20% by 2070.
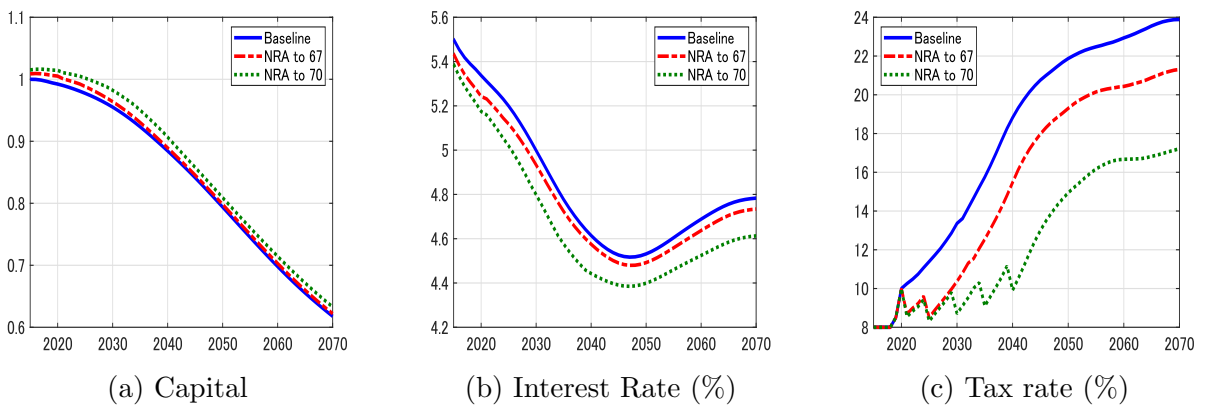

(a) Capital   (b) Interest Rate (%)   (c) Tax rate (%)

Figure 2: Pension Scenario: Increase in NRA to 67 and 70

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