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journal homepage: [www.elsevier.com/locate/jedc](http://www.elsevier.com/locate/jedc)The implications of a graying Japan for government policy<sup>☆</sup>R. Anton Braun<sup>a,\*</sup>, Douglas H. Joines<sup>b</sup><sup>a</sup> Federal Reserve Bank of Atlanta, 1000 Peachtree Street, N.E. Atlanta, GA 30309, United States<sup>b</sup> Marshall School of Business, University of Southern California, Los Angeles, CA 90089-0804, United States

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## ABSTRACT

Japan is in the midst of a demographic transition that is both rapid and large by international standards. As recently as 1990 Japan had the youngest population among the Group of 6 large, developed countries. However, the combined effects of aging of the baby-boomer generation and low fertility rates have produced very rapid aging. Japan now finds itself with the oldest population among the Group of 6 and its population will continue to age at a rapid pace in future years. Aging is already placing a burden on government finances and Japan's ability to confront the negative fiscal implications of future aging is constrained by its very high debt–GDP ratio. We find that Japan faces a severe fiscal crisis if remedial action is not undertaken soon and analyze alternative strategies for correcting Japan's fiscal imbalances.

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## 1. Introduction

Japan is in the midst of a demographic transition that is both rapid and large by international standards. In 1990 the share of the population aged 65 and older was 12 percent. According to this metric Japan had the youngest population in the Group of 6 large industrialized economies. By 2005, the elderly share of the population had risen to 20 percent and Japan had the highest fraction of elderly people in the Group of 6. Government projections by the National Institute of Population and Social Security (IPSS) indicate that this figure will reach 40 percent by 2060.

The graying of Japan to date, in conjunction with sluggish growth since 1990, has been associated with a large increase in the stock of government debt. Net government debt in Japan has risen from 8 percent of GDP in 1990 to 150 percent of GDP in 2012.<sup>1</sup> Expenditures on social insurance have risen sharply over this period, from 16.6 percent of total government general account expenditures in fiscal year 1990 to 31.4 percent in fiscal year 2013. Interest payments on government debt have risen from 20.7 percent to 24.0 percent of total government expenditures over the same period despite a substantial decline in the interest rate on government debt.

<sup>☆</sup> These are our views and not those of the Federal Reserve System.

\* Corresponding author.

E-mail addresses: [r.anton.braun@gmail.com](mailto:r.anton.braun@gmail.com) (R.A. Braun), [joines@marshall.usc.edu](mailto:joines@marshall.usc.edu) (D.H. Joines).

<sup>1</sup> Our calculations; see the appendix for details. For purposes of comparison the Japanese Ministry of Finance reports a net debt–GDP ratio of 134 percent in 2012.

Japan's high debt–GDP ratio is worrisome because government outlays for public pensions and medical expenses will rise further as the population continues to age. One way to assess the capacity of a country to support pay-as-you-go programs for the elderly is to consider the old-age dependency ratio, which we define as the ratio of the population aged 65 and above to that aged 18–64. According to IPSS projections Japan's old-age dependency ratio will peak at levels that exceed 87 percent.

In this paper we use a general equilibrium model with a rich demographic structure to analyze the fiscal implications of the graying of Japan. We find that even if one factors in planned increases in taxes and planned reductions in public pension benefits, current fiscal policies are not sustainable. If no additional actions are taken to correct the fiscal imbalances, we project a sovereign debt crisis by 2039. We then examine alternative ways to avoid this outcome that vary in terms of their reliance on tax changes and expenditure cuts, and we analyze how these alternatives affect the lifetime net tax liabilities and utility of different cohorts.

Our model projections posit time-varying fertility rates and cohort-specific mortality rates that are derived from long-term population projections produced by the IPSS. Their medium scenario projections imply that the population will decline from 127.2 million in 2013 to 45.9 million in 2110. These dramatic changes are driven by the current age structure of the population. In particular, the number of females of child-bearing age is low and will decline for decades to come, even with plausible assumptions about an increase in the fertility rate.<sup>2</sup> The population will not stabilize until the next century and possibly late in the next century depending on how rapidly the fertility rate increases. These facts imply that Japan's demographic transition and the consequent economic effects will play out over the course of a couple of centuries rather than decades. Our simulations deal with this entire transition path, and it is important to do so. Individuals in our model are forward-looking, and future events recursively affect decisions made today.

Public pensions and government medical expenditures in our model capture key institutional features of these programs in Japan. In particular, we model the public pension reforms legislated in 2004 that call for a gradual rise in contributions, partial indexation of benefits to inflation, demographic adjustments to benefits, and a commitment to maintain a floor of 50 percent on future public pension replacement rates. Japan offers public insurance for medical expenses and long-term care insurance. Our model features age-dependent medical and long-term care expenses and copayments. These features of the model, combined with time-varying demographics, generates variation in aggregate government healthcare expenditures.

In order to be conservative, we assume that the government's plan to increase the consumption tax to 10 percent is implemented and make very optimistic assumptions about the effects of the Abe administration's fiscal and monetary stimulus programs on inflation and economic activity.

A population with an older age distribution requires more revenue to maintain current promises to the old. We document the long-run size of these funding needs by conducting a steady-state analysis. Current tax rates on capital in Japan are already so high that it is not feasible to generate enough government revenue by increasing them. Increasing the labor income tax is feasible but entails very large steady-state output losses as compared to a higher consumption tax. We thus focus on the consumption tax in our dynamic simulations.

The steady-state analysis is informative about what policies are sustainable, but it is silent about how urgent the need is to correct the fiscal imbalances created by a graying Japan. We next use dynamic simulations to address this issue by asking: How long can the can be kicked down the road? This analysis indicates that if no further actions are taken, a fiscal crisis will occur by 2039. The cost of a fiscal consolidation at that point would require increasing the consumption tax rate to over 50 percent. Because the costs of such a sudden increase in the consumption tax are large, particularly to the aged, we conjecture that some form of sovereign default would have to be part of any solution.

Another way to get a handle on the size of Japan's fiscal imbalances is to consider how much the consumption tax rate would have to increase to achieve solvency immediately. Our projections indicate that solvency could be restored if the consumption tax rate were increased to 36 percent in 2019 and kept at this level forever.

Both of these scenarios place a particularly heavy burden on today's elderly who in many cases are not able to re-enter the labor market and thus have no recourse but to sharply reduce their consumption expenditures. This leads us to consider a scenario where the consumption tax rate increases gradually in tandem with pension and healthcare outlays to the elderly. In this scenario the consumption tax rate gradually rises to 30 percent in 2037, but then must increase further to a peak level of 46 percent before falling back to a terminal value of 26 percent.

We also consider a range of measures for reducing government expenditures. Perhaps the most successful among these policies is to gradually increase healthcare copayments for the elderly to the level of working-age individuals (30 percent). This policy places a significant dent in the funding needs of the government and stimulates economic activity. This is the only simple policy we have found in which the peak consumption tax rate is under 25 percent, a level comparable to those in Denmark and Finland.

A number of other researchers have investigated Japan's fiscal problems. [Imrohorglu and Sudo \(2010\)](#) consider the implications of an increase in the consumption tax on fiscal balance in Japan using a representative agent model. Their findings suggest that an increase in the consumption tax from 5 percent to 15 percent is not sufficient to restore fiscal balance unless expenditures are also contained. Using a similar model, [Hansen and Imrohorglu \(2013\)](#) find that a fiscal

<sup>2</sup> We extrapolate the IPSS projections beyond 2110 under the assumption that the fertility rate eventually increases to a value that is consistent with a stable population.

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