Green Fiscal Reforms and the Demographic Squeeze: Lessons from Japan

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1. Introduction

Population aging is becoming one of the global concerns of the twenty-first century. As the proportion of retirees grows relative to the working population, there can be increased pressure on pension systems and public finances, raising concerns about the sustainability of social security systems. To mitigate the distributional concerns across generations, "green fiscal reforms" could be an attractive approach. The reform raises additional revenues from carbon tax but redistributes back to the economy through the reduction of other existing tax rates, such as personal and corporate income taxes. This paper investigates how green fiscal reforms play a role in the economy under demographic changes to better understand the intergenerational inequality of carbon taxes. We answer this important question by conducting an ex-ante numerical simulation analysis using an applied general equilibrium (CGE) model of the Japanese economy.

Japan provides a unique opportunity for the rest of the world to learn from regarding the intergenerational inequity of green fiscal reforms. The speed of population aging is the fastest in the world. There are three factors that contribute to this. First, it has the highest proportion of elderly citizens in the world. Second, its birth rate is substantially low, which is well below the replacement level of 2.1. Third, its life expectancy is one of the highest in the world. Although the rate of population aging in other countries may not be as fast as in Japan, many are expected to follow what Japan is experiencing in the near future. In addition, Japan has not yet implemented a national carbon pricing policy (CPP). For these reasons, findings from this paper would be informative for the policy designs for countries that have yet to implement a national CPP.

2. Methodology and Data

We build on Williams et al. (2015) by using a modified dynamic general equilibrium overlapping generations (OLG) model, calibrated for the Japanese economy. Agents live for 55 years, allocating time endowments to either labor or leisure. Pensions are modeled based on the Japan Pension Service schedule.[**] The steady-state baseline assumes a -0.67% annual population growth rate and a 3% annual total factor productivity growth rate. The steady-state baseline serves as a reference for two shocks that we consider: demographic changes and carbon taxes. First, we incorporate low-variant population projections from the UN (2022)[††], stabilizing after 2070, to model demographic changes. Next, we introduce a $100/t CO2e carbon tax, increasing by 3% annually.

We examine the effect of demographic changes by exploring ways to compensate for tax revenues due to

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[**] See Japan Pension Service. 2024. “National Pension System.” Japan Pension Service.
[††] See UN. 2022. “World population prospects: The 2022 revision.” United Nations Population Division.

population declines. We experiment with two budgetary proposals, raising all tax rates and reducing pensions. We then introduce a carbon tax and investigate how different ways of recycling revenues from the carbon tax affect the economy differently. We explore four policy approaches. The first is to reduce the capital tax, and the second is to reduce the labor tax. The third is to reduce VAT, while the fourth is to provide lump-sum rebates across the economy.

3. Results & Conclusion

The figure below presents the welfare results for each generation by year of birth for various combinations of responses to demographic change (Baseline, Tax Rates, and Transfers) and carbon tax revenue recycling options (Capital, Labor, VAT, and LumpSum). The impact of demographic change and the choice of instruments used to adapt to it are large relative to the impact of the carbon tax. Overall, reducing transfers in response to demographic change results in the highest welfare and lowest inequality between generations. The impact of demographic change is muted relative to tax rate adaptations, particularly up to t25. Both Transfers and Tax Rates see increased factor supplies following increased prices with growing scarcity, but it is greater in the Transfers scenario due to decreased household budgets from lower transfers and lower tax rates relative to the Tax Rates scenario.

The VAT recycling scenarios tend to have a slightly positive welfare effect for the oldest generations, as they reap the benefits of lower VAT taxes and bear the costs of demographic change and carbon regulation for relatively fewer years than younger generations. Capital tax recycling results in the highest welfare due to efficiency gains; lump sum transfers result in the lowest welfare with no improvement to the efficiency of the tax system; VAT and labor taxes yield similar welfare results.

These indicate that the erosion of the tax base due to aging populations increases the efficiency gained from reducing distortionary taxes. This effect is magnified by the fiscal response to demographic change, where non-distortionary measures such as reducing transfers may allow carbon tax recycling to increase welfare beyond pre-tax levels.

4. Reference

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