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Mitsuru Katagiri (Hosei University)
Junko Koeda (Waseda University)
Hiroaki Miyamoto (Hitotsubashi University)
Makoto Nirei (University of Tokyo)
Takashi Unayama (Kyoto University)

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Fiscal Projection and Debt Sustainability in Japan

Mitsuru Katagiri[1], Junko Koeda[2], Hiroaki Miyamoto[3], Makoto Nirei,[4] Takashi Unayama[5]

Abstract

Japan's government debt, at approximately 2.5 times its GDP, is the highest among advanced economies, raising significant concerns about fiscal sustainability. With rising inflation and shifts in monetary policy, increasing interest rates may further exacerbate these concerns. This paper employs the debt sustainability analysis methodology to assess Japan's long-term fiscal sustainability. Under current fiscal and monetary policies, our baseline scenario projects a persistent primary deficit, resulting in a divergent debt-to-GDP trajectory. To analyze Japan's fiscal outlook comprehensively, we also examine alternative scenarios, including low inflation, rising interest rates, low labor supply and higher economic growth.

Keywords: Fiscal sustainability; Public debt; Japanese economy; Debt sustainability analysis; Fiscal projection

JEL Classifications: E62; H60, H68

[1] Faculty of Business Administration, Hosei University
[2] School of Political Science and Economics, Waseda University
[3] Institute of Economic Research, Hitotsubashi University. Corresponding author.
[4] Department of Economics. University of Tokyo
[5] Institute of Economic Research, Kyoto University

1. Introduction

Japan is currently facing a significant fiscal challenge, with its government debt surging to approximately 2.5 times its GDP. This surge is fueled by prolonged low economic growth and escalating social security costs due to an aging population. The growing concerns about fiscal sustainability are not to be taken lightly. Since the spring of 2022, global inflationary pressures have led to rising inflation and wages in Japan. Consequently, in March 2024, the Bank of Japan made a significant policy pivot, shifting its long-standing accommodative monetary policy towards tightening.[6] This policy pivot, with its potential to lead to rising interest rates, could significantly increase debt servicing costs and exacerbate fiscal pressures. Against the backdrop of a declining population and an inflationary environment, the sustainability of Japan's fiscal policy warrants a thorough examination.

This paper provides a comprehensive analysis of Japan's fiscal sustainability using a debt sustainability framework similar to those employed by IMF (2016) and CBO (2023). Our analysis initiates with forecasts of key macroeconomic variables, including economic growth rates, interest rates, and population trends. These projections are then utilized to estimate consistent interest rates via a term structure model. Subsequently, these interest rates estimate and projected macroeconomic variables are linked to fiscal variables to project future fiscal balances and the debt-to-GDP ratio. By integrating demographic projections, productivity estimates, and current fiscal and monetary policies, our method clarifies the relationship between assumptions and simulation results, making causal relationships and policy implications easier to understand and verify.

In the baseline scenario, we project Japan's fiscal balance and government debt trajectory by assuming that productivity growth remains low, demographic trends continue as expected, and the Bank of Japan maintains its 2% inflation target. Our simulation analysis indicates that while the primary fiscal balance remains in deficit, the debt-to-GDP ratio initially decreases but eventually rises and diverges. This suggests that fiscal sustainability may appear achievable in the short term, but in the long term, it is not sustainable.

This initial decline in the debt-to-GDP ratio occurs because nominal GDP grows faster than debt, primarily due to a time lag in the adjustment of interest payments on government bonds. As inflation rises, the average yield on government bonds increases slowly, and since much of the government debt

[6] In March 2024, the Bank of Japan ended its 11-year period of extensive monetary easing and, for first time in 17 years, raised short-term interest rates to 0% to 0.1% from -0.1%. Furthermore, the Bank of Japan decided to raise the short-term policy interest rate to approximately 0.25% in July.

is nominal, nominal GDP begins to increase immediately.

A noteworthy aspect of our baseline case is that the economic growth rate exceeds the interest rate for most of the projection period. While this situation could, under certain conditions, prevent the debt-to-GDP ratio from diverging despite a moderate primary deficit, our analysis shows that it eventually follows a divergent path. This finding suggests that maintaining fiscal sustainability in Japan remains challenging even under optimistic assumptions of higher economic growth relative to interest rates.

The long-term divergence of the debt-to-GDP ratio necessitates significant adjustments such as substantial expenditure cuts, tax increases, or sharp inflation rises. Therefore, we also consider a case where the primary fiscal balance remains nearly zero over the long term. In this scenario, we assume a mechanical annual tax increase equivalent to 0.1% of GDP starting in 2026, continuing until 2060, to achieve a zero primary fiscal balance by 2060. This translates to a gradually increasing consumption tax rate, reaching about 19% by 2060. Under this scenario, the debt-to-GDP ratio stabilizes in the long run.

One key advantage of our analytical approach is its flexibility in adjusting economic assumptions and clearly illustrating the relationship between these assumptions and the resulting outcomes. This allows us to effectively analyze how changes in assumptions about future inflation, labor force participation, and productivity impact the debt-to-GDP trajectory.

Our analysis indicates that if the inflation rate fails to reach the Bank of Japan's 2% target in the long run, or if labor force participation among women, the elderly, and foreign workers does not significantly improve, the debt-to-GDP ratio could diverge more rapidly than projected in the baseline scenario. These findings underscore the need for comprehensive fiscal reforms and policies to enhance economic growth and ensure sustainable public finances.

Literature Review: The most relevant study to our research is Nirei et al. (2024), which also employs an accounting approach to assess the long-term fiscal sustainability of Japan. Nirei et al. (2024) assume that interest rates converge to the level of economic growth rates, showing that government debt will diverge in the long run. Other notable studies using the accounting approach include Broda and Weinstein (2005), Doi, Hoshi, and Okimoto (2011) and Hoshi and Ito (2014). Broda and Weinstein (2005) concluded that minor tax-to-GDP ratio adjustments could achieve fiscal sustainability. In contrast, Doi, Hoshi, and Okimoto (2011) indicated that a significant tax increase, equivalent to an additional 11% of GDP, might be necessary to stabilize the debt-to-GDP ratio, especially with more recent data inputs. Hoshi and Ito (2014) demonstrated through simulations under various scenarios

that Japan's fiscal situation is not sustainable and that sufficiently large tax increases and/or expenditure cuts would be necessary to place government debt on a sustainable path. Alberola et al. (2023) used a stochastic debt sustainability analysis incorporating monetary policy to assess the impact on sovereign debt if the Bank of Japan exits its unconventional monetary policies. They found that ending large-scale monetary easing policies increases risks to debt sustainability.

Many studies have also employed macroeconomic models to assess fiscal sustainability in Japan. Arai and Ueda (2013) utilized a straightforward overlapping generations model to evaluate sustainable primary deficits over the long term. Braun and Joines (2015) employed a large-scale overlapping generations model that meticulously accounted for Japan's pension and healthcare systems. They argued that without reform, achieving fiscal sustainability would require a substantial increase in the consumption tax rate, potentially reaching 30-45%. Imrohoroglu, Kitao, and Yamada (2016) developed a sophisticated overlapping generations model to project government debt, incorporating detailed descriptions of Japan's pension system. Hansen and Imrohoroglu (2016) used a standard Neo-classical growth model to analyze debt sustainability in Japan. Hansen and Imrohoroglu (2023) updated their previous study by considering the effects of the Bank of Japan's asset purchasing program on government bond returns.

The consensus among recent studies is clear: Japan's current fiscal trajectory is unsustainable. Without significant policy changes, the debt-to-GDP ratio will continue to rise. In addition to the studies mentioned above, research by Doi (2009), Doi and Ihori (2009), Sakuragawa and Hosono (2011), Ito (2011), Ito, Watanabe, and Yabu (2011), and Ostry et al. (2010) all underscore the urgent need for drastic fiscal policy reforms. Imrohoroglu and Sudo (2011) highlight that achieving fiscal sustainability without policy changes would require an unlikely surge in productivity growth.

The remainder of the paper is organized as follows: Section 2 describes our analytical framework for assessing fiscal sustainability. Section 3 explains the assumptions and parameters used in our numerical analyses. Section 4 provides a quantitative analysis, presenting baseline and risk scenarios and exploring the role of inflation. Section 5 discusses alternative scenarios. Section 6 concludes with a summary of findings and recommendations for future research.

2. Analytical Framework for Assessing Fiscal Sustainability

This section presents an analytical framework to assess fiscal sustainability. Following methodologies

employed by the IMF (2016) and CBO (2023), this analysis adopts an *accounting approach*.[7][8] This involves exogenously given assumptions regarding key economic and social variables such as future economic size, interest rates, and population. These assumptions are then used to link fiscal variables to these economic and social factors, allowing for projections of future fiscal balances and government debt-to-GDP ratios. In this analysis, fiscal sustainability is defined as the stabilization of the government debt-to-GDP ratio.

This method has several advantages compared to the one using macroeconomic models. While our method cannot consider endogenous responses of household's and firm's behavior to fiscal policy, it clarifies the relationship between the assumptions and the simulation results, making the causal relationships and policy implications easier to understand and verify. This approach is valuable for conducting quantitative simulations of fiscal sustainability, as it provides clear insights into future fiscal conditions under specific economic assumptions.

The model consists of three primary components: the determination of economic growth rates via the production function, the estimation of interest rates, and the projection of fiscal expenditures and revenues.

Estimating Growth Impact

A production function approach is used to estimate long-term output, taking demographic factors into account. We employ the following Cobb-Douglas production function:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha},$$

where Y is real output, A represents the total factor productivity (TFP), K is the capital stock, L is aggregate labor, and α is the capital share.

Aggregate employment is decomposed using age-gender cohort-specific information:

$$L_t = \sum_{j=1}^{j} N_t^j \times LFP_t^j \times E_t^j,$$

[7] For conducting quantitative simulations of fiscal sustainability, there are two main approaches: accounting methods, which project future fiscal conditions based on fixed economic assumptions, and macroeconomic models, which consider the interrelationships between the economy and fiscal variables. Each approach has its own advantages and disadvantages.

[8] Ueda and Sugiura (2010) is a pioneering study on Japan's fiscal sustainability using an accounting approach.

where j indicates the age-gender cohort, N is the number of individuals in each cohort, and LFP and E denote cohort-specific labor force participation and employment rates, respectively.

In logarithmic terms, the output is expressed as:

$$Log(Y_t) = \log(A_t) + \alpha \times Log(K_t) + (1-\alpha) \times Log \sum_{j=1}^{j} N_t^j \times LFP_t^j \times E_t^j. \quad (1)$$

This equation can be used to obtain historical TFP estimates.

The capital stock K is estimated using the perpetual inventory method, where the capital stock in each period equal to net capital formation plus the estimated stock in the previous period. Thus, we have

$$K_t = (1-\delta)K_{t-1} + I_t,$$

where I is investment, and δ is the depreciation rate.

Using (1) and TFP estimates, we project long-term potential GDP under various demographic scenarios. Capital accumulation follows balanced-growth conditions:

$$g_t^Y = \frac{g_t^A}{1-\alpha} + g_t^L,$$

where g^Y is the growth rate of output, g^A is the growth rate of TFP, and g^L is the growth rate of labor.

Assuming a constant capital-to-labor ratio and unchanged TFP from its historical average, different population (labor force) projection scenarios yield different paths of aggregate labor and output. It is important to acknowledge that these are clearly simplification, as demographic factors could also affect productivity (e.g., Feyrer, 2007) and investment (e.g., Higgins, 1998).

Interest Rates

This study explicitly considers the movements of macroeconomic variables to derive nominal long-term interest rates. Specifically, we employ a term structure model that integrates information on bond yields of various maturities and macroeconomic variables, such as real GDP growth and inflation rates.

Traditional term structure models often do not account for the lower bound of interest rates. Given that Japan has experienced a prolonged period of low interest rates for over a quarter of a century, ignoring

the lower bound may lead to an underestimation of interest rate volatility and result in unrealistically low interest rates in simulations.

To address these issues, we employ the model of Koeda and Wei (2023), which combines standard term structure models (Wright, 2011; Joslin et al., 2014) and shadow rate term structure models (Wu and Xia, 2016; Krippner, 2013). Koeda and Wei's model accounts explicitly for the lower bound of interest rates, providing a more accurate estimation of interest rate movements and enhancing the reliability of our fiscal sustainability projections.

Revenue and Expenditure Projections

We next provide an explanation of the projections for revenues and expenditures. Tax and non-tax revenues are primarily influenced by economic growth rates and price levels, while expenditures are affected by economic growth rates, prices, population dynamics, and wages. Revenues and expenditures are categorized into those of the central and local governments.

We first examine revenues. Central government revenues consist of tax revenues, current and capital transfers from local governments, and other income. Similarly, local government revenues comprise tax revenues, current and capital transfers from the central government, and other income.

Our projections assume that the revenue share of GDP for both central and local governments remains consistent with historical data. This assumption is based on potential output, without any anticipated changes in tax policy or administration. However, it is important to note that demographic changes could lead to revenue-to-GDP elasticities that differ from one. For instance, aging populations might shift the composition of tax revenues. It is also possible that tax revenue as a share of GDP could increase, as older age groups continue to pay income and consumption taxes even if they are no longer contributing to output.

We next turn to expenditures. Central government expenditures consist of employee compensation, intermediate consumption, social security benefits, current and capital transfers to local governments, and other spending. Local government expenditures similarly include employee compensation, intermediate consumption, social security benefits, current and capital transfers to the central government, and other spending. Social security benefits are further subdivided into public pension costs, medical costs, nursing care costs, cash benefits for social assistance, and other expenditures.

Estimating future pension costs involves using population projections and the average benefits per

person in each age cohort. This estimation is complex, as the average benefits per person can change over time within the same age cohort. For simplicity, we use the pension benefit increases projected in the Ministry of Health, Labour and Welfare's 2019 Pension Financial Verification.

For healthcare, we extend the per capita medical expenses in each medical insurance system by the nominal GDP growth rate per capita. By accounting for future population projections, we calculate the total healthcare benefits. We then extend the public burden of healthcare by the growth rate of total healthcare benefits to estimate future costs.

For nursing care, we extend the per capita facility and home services costs by the nominal wage growth rate. We assume that the future certification or utilization rates remain constant and calculate the number of certified or utilizing individuals by age group. By multiplying these numbers by the per capita costs for each service and care level, we estimate the total costs for each facility and home service. Summing these costs and subtracting the self-pay portions gives us the total public nursing care benefits.

Putting It All Together

The final step is to calculate the fiscal balance. The primary fiscal balance (*PB*) is derived from the central and local governments' revenues and expenditures. Gross financing needs (*GFN*) are calculated as:

$$GFN_t = i_{t-1}D_{t-1} + X_t - PB_t,$$

where i is the effective nominal interest rate on debt, and X denotes the portion of the debt stock D that matures. We assume that maturing bonds are rolled over and that primary fiscal deficits are financed entirely by issuing new bonds.

The debt stock is given by:

$$D_t = (1 + i_{t-1})D_{t-1} - PB_t.$$

We note that our debt figures exclude social security funds, thus differing from general government debt figures.

It is useful to rewrite this in terms of ratios to GDP in nominal terms, indicated by lower letters. Thus, we have the following expression of the government debt-to-GDP ratio:

$$d_t = \frac{1+i_{t-1}}{1+g_{t-1}} d_{t-1} - pb_t, (2)$$

where g is the growth rate of nominal GDP.

Following Blanchard (1990) and other previous works, we define a fiscal policy as sustainable if the current policy can be continued indefinitely with a stable government debt-to-GDP ratio. In other words, fiscal is considered sustainable if the debt-to-GDP ratio does not diverge in the long run.

Equation (2) shows that the public debt sustainability is influenced by two main factors; the difference between interest rates and nominal GDP growth rates (interest-growth differential), and the primary fiscal balance. If the interest rates on government bonds are higher than the GDP growth rate, the debt-to-GDP ratio will increase unless the government can achieve a large enough primary fiscal surplus. On the other hand, if interest rates are lower than the GDP growth rate, the debt-to-GDP ratio can remain stable or even decrease, as long as the primary fiscal deficit is not too large. This relationship indicates that managing the interest-growth differential and maintaining a favorable primary balance are crucial for ensuring long-term fiscal sustainability.

3. Assumptions and Parameters

In this section, we detail the assumptions and parameters used in the baseline projections. Our model assumes continued population decline, low productivity growth, and that interest rates do not significantly exceed growth rates. We maintain the assumption that the Bank of Japan's monetary policy will achieve a 2% inflation target.

TFP growth rates are estimated from historical data, showing significant variation depending on the sample period. The baseline assumes a continuation of the recent low productivity growth, setting TFP growth at 0.5%.

The capital share is set at 1/3, consistent with existing research, resulting in a labor share of 2/3. This implies an annual labor productivity growth rate of 0.75%.

Real GDP growth is calculated by adding labor force growth rates to per capita productivity growth rates. We use population and labor force participation forecasts from the National Institute of Population and Social Security Research and the Japan Institute for Labour Policy and Training (JILPT).

JILPT presents three scenarios for labor force participation rates. In our baseline scenario, we adopt its median estimate which assumes moderate increases in labor force participation among women and the elderly due to supportive economic and employment policies.[9] Under this scenario, the labor force participation rate rises from 62.5% in 2022 to 63.9% in 2030 and 64.4% in 2040. We also consider a low participation scenario where the participation rate remains at 2022 levels. Under this scenario, the labor force participation rate is expected to decline to 60.9% in 2030 and 59.2% in 2040. As JILPT's projections only extend to 2040, we assume the 2040 rates remain constant beyond that year. For our analysis, we use trend labor force growth rates which are derived by filtering out cyclical fluctuations using an Hodrick-Prescott (HP) filter.

We assume that the Bank of Japan's monetary policy successfully achieves a long-term inflation target of 2%. Specifically, we anticipate that inflation expectations will gradually rise, reaching the 2% target by 2029. Once the 2% target is reached in 2029, we assume it will maintain thereafter. Based on Cabinet Office (2024)'s estimates, the inflation rate is projected to be 1.5% in 2025. From 2025 onward, we assume that inflation rate will increase by 0.125% each year until it reaches reach 2% in 2029. Our analysis assumes that changes in the GDP deflator mirror the inflation rate.

Nominal wage growth is calculated by adding the inflation rate to the per capita productivity growth rate. The nominal wage growth rate for the projection period is estimated to be 2.75%.

Interest rates are projected using the term structure model of Koeda and Wei (2023) that considers the lower bound of interest rates.[10] Model parameters are estimated using data from the sample period 1990Q1 to 2023Q4. Based on these estimates, we project the interest rate paths that are consistent with real GDP growth rates and CPI inflation rates under various scenarios. Simulated yield curves are presented in Appendix.

For the years 2023 to 2025, we align our revenue and expenditure projections with the values provided by the Cabinet Office (2024). Beyond 2026, revenue projections are extended based on the nominal GDP growth rate. Expenditures, particularly for social security benefits, follow specific assumptions. Public pension costs are based on the Ministry of Health, Labour and Welfare's pension financial verification (Case V). Healthcare and nursing care public burdens are calculated by extending per capita costs according to age-specific population projections. Other expenditures are assumed to increase at the same rate as nominal GDP growth.

[9] It is termed as the "Growth Baseline and Gradual Participation Scenario".
[10] For a detailed methodology and discussion on interest rate projections applied in this paper, see Koeda (2024).

4. Quantitative Analysis

In this section, we conduct a comprehensive quantitative analysis to assess the fiscal sustainability of Japan. Our approach involves several scenarios to capture the potential trajectories of key economic variables and their impact on fiscal stability. The baseline projections form the foundation of our analysis, providing a reference point for comparing alternative scenarios. By examining the role of inflation and different risk scenarios, we aim to understand the dynamic interplay between macroeconomic factors and fiscal sustainability, thus offering robust insights into Japan's long-term fiscal outlook.

4-1. Baseline Projections

We first present the results of the baseline projections. Table 1 summarizes the estimates for several macroeconomic variables and government revenues and expenditures. Figures 1 and 2 illustrate the projected values for the primary fiscal balance and public debt GDP ratio.

The projected nominal GDP shows an average growth rate of approximately 2.6%. Compared to 2020, the nominal GDP is expected to increase by 1.3 times by 2030 and by 2.9 times by 2060. The ratio of revenue to GDP for both central and local governments remains constant at 23%, attributed to revenue growth in line with the nominal GDP growth rate.

In contrast, the expenditure as a percentage of GDP is expected to rise over the medium to long term. While it is 23.4% in 2025, it is projected to increase to 24.8% by 2030 and to 26.2% by 2060. A detailed examination of expenditure reveals that spending on pensions, healthcare, and nursing care will all increase as a percentage of GDP, with healthcare and nursing care expenditures experiencing particularly significant growth.

When viewed as a percentage of GDP, while revenues remain stable in the long term, the increase in expenditures leads to a widening primary balance deficit. In 2025, the primary balance is projected to be a deficit of 0.4% of GDP.[11] This deficit is expected to widen to 0.8% by 2030 and further to 3.2% by 2060. Figure 1 illustrates the projected trajectory of the primary balance, clearly indicating that the primary balance remains consistently in deficit.

[11] In the simulation analysis presented in this paper, the primary balance for FY2025 is assumed to be in deficit based on the Cabinet Office's estimates from January 2024. However, in July 2024, the Cabinet Office released revised estimates projecting a surplus in the primary fiscal balance for FY2025. This revision is attributed to increased corporate earnings due to yen depreciation and higher tax revenues driven by inflation. While the impact of exchange rate fluctuations on fiscal sustainability is beyond the scope of the model used in this paper, as discussed later, rising inflation can reduce the debt-to-GDP ratio in the short to medium term.

We turn to consider the trajectory of public debt.[12] As seen in Figure 2, the public debt ratio (gross government debt as a percentage of nominal GDP) decreases until the mid-2030s, after which it reverses and continues to increase, following a divergent path in the long term. The persistent primary balance deficit is the primary reason for the lack of long-term fiscal sustainability.

In the short term, the debt ratio declines because the rate of increase in nominal GDP due to inflation is higher than the rate of debt growth. This occurs because it takes some time for the interest payments on government bonds to increase. In the short to medium term, the average yield on government bonds rises only gradually in response to rising inflation. Since much of the government debt is nominal, the debt stock remains unchanged despite the rise in inflation, while nominal GDP starts to increase immediately due to inflation.

4.2 Role of Inflation

We now examine how the inflation rate affects fiscal sustainability. Japan's economy has long suffered from deflation, but since 2022, inflation has accelerated due to global inflationary pressures and rising import prices.

In the benchmark scenario, we assumed that the Bank of Japan would achieve its 2% inflation target by 2029. Here, we examine the implications of this assumption. Specifically, we consider a scenario where the 2% target is not achieved in the long term. In this scenario, based on the Cabinet Office (2024)' s long-term projections, the inflation rate is assumed to be 1.1% in 2026, 0.8% in 2027, and then stabilize at 0.8%.

Similar to the benchmark scenario, the debt-to-GDP ratio initially declines in the low-inflation case, but the duration and magnitude of the decline differ (Figure 2). Firstly, the period during which the public debt ratio decreases is shorter in the low-inflation scenario. While the benchmark scenario sees the debt ratio starting to rise around 2040, in the case of low inflation, it begins to rise in the late 2020s. Additionally, the peak decline in the debt ratio is about 13 percentage points lower in the low-inflation scenario compared to the benchmark. Moreover, in the long term, the debt ratio diverges sharply in the low-inflation scenario, indicating a more significant lack of fiscal sustainability.

[12] When evaluating fiscal sustainability, government assets could also be considered. While tangible assets such as infrastructure are necessary for administrative services and not easily liquidated, financial assets such as securities and foreign reserves can be utilized. Therefore, we also analyzed a case considering the net debt-to-GDP ratio, which subtracts highly liquid financial assets from government debt. The qualitative results broadly remain the same.

Compared to the benchmark case, the threat to fiscal sustainability arises because the average yield on government bonds increases only modestly in response to a decline in the inflation rate. Given that government debt is nominal, the debt stock remains unchanged even as the inflation rate decreases, while the denominator—nominal GDP—shrinks due to the lower inflation, leading to a higher debt-to-GDP ratio. Note that although not explicitly stated in Figure 2, the primary fiscal balance in the low-inflation scenario remains consistent with the benchmark case.

As evidenced by the comparison with the benchmark case, the impact of inflation on the debt-to-GDP ratio is significant and cannot be ignored. Conversely, if inflation rises, particularly in the short to medium term, the debt-to-GDP ratio is likely to decline. However, this decline is not a free lunch; it represents a temporary inflation tax imposed on holders of government bonds and money.

4-3 Low Labor Supply Scenario

In the benchmark case, we assumed a moderate increase in labor force participation, particularly among women and the elderly. Here, we analyze a low labor force participation scenario. In this scenario, the labor force participation rate declines from 62.5% in 2022 to 60.9% in 2030 and 59.2% in 2040. Compared to the benchmark, the labor force participation rate in 2040 is 5.2 percentage points lower. As a result, the average real economic growth rate from 2025 to 2060 is projected to be -0.08%, significantly lower than the benchmark rate of 0.09%.

Figure 2 shows the projected debt-to-GDP ratio. The pattern of movement is broadly similar to the benchmark scenario: the debt-to-GDP ratio declines in the short term but eventually rises, following a divergent path. However, the short-term decline in the debt-to-GDP ratio is smaller, and the point at which it starts to rise occurs earlier compared to the benchmark. By 2060, the debt-to-GDP ratio is approximately 5 percentage points higher than in the benchmark scenario.

5. Discussion

5-1 PB Zero Scenario

In the benchmark projections, the persistent primary fiscal deficit leads to a divergent debt-to-GDP ratio. This scenario implies that at some point, significant fiscal adjustments such as drastic expenditure cuts, tax increases, or a sharp rise in inflation would be inevitable. Here, we explore the "PB Zero Scenario," where the primary fiscal balance is maintained close to zero over the long term to stabilize the debt.

Specifically, we assume a mechanical annual tax increase equivalent to 0.1% of GDP starting from 2026, continuing until 2060 when the primary fiscal balance reaches zero. This translates to an incremental increase in consumption tax, reaching approximately 19% by 2060.[13] It is important to note that while tax increases can impact economic activity, for simplicity, we assume no adverse effects on economic growth in this scenario.

Figure 2 illustrates the trajectory of government debt as a percentage of GDP under the PB Zero Scenario. The debt-to-GDP ratio declines until around 2050, after which it slightly increases but stabilizes at approximately 160%.

In this scenario, we mechanically assume an annual improvement in the primary fiscal balance equivalent to 0.1% of GDP for 35 years. To achieve this target, a combination of measures such as (i) increasing direct tax rates and social insurance contributions, (ii) raising the consumption tax, and (iii) restraining the growth of medical and nursing care benefits can be considered. It is important to note that the economic impacts of these measures vary from different perspectives. The most significant difference lies between the first two measures and the third. The first two options primarily affect the distribution among households without directly influencing the allocation between production and consumption sectors. In contrast, restraining the growth of benefits can directly impact the production and consumption levels within the medical and nursing care sectors.

5-2 Risk of Rising Interest Rates

The debt-to-GDP ratio is determined by the difference between the economic growth rate and the average interest rate on the debt, as well as the primary fiscal balance. Even with a persistent primary balance deficit, if the economic growth rate exceeds the interest rate, the debt-to-GDP ratio may not diverge. This phenomenon, where interest rates are lower than economic growth rates, has been observed in many advanced economies and has sparked debates about fiscal policy (Blanchard, 2019, 2023; Cochrane, 2021; Mian, Straub, and Sufi, 2022; Reis, 2022).

However, in our baseline projections, despite $r - g < 0$ for much of the period, fiscal sustainability is not maintained due to the persistent primary balance deficit. If the interest rate exceeds the economic

[13] Implementing a tax increase equivalent to 0.1% of GDP annually over 35 years until 2060 is projected to improve the fiscal balance by 4.2% of GDP. On the other hand, the net fiscal impact of a 1% increase in the consumption tax rate is estimated at 0.48% of GDP. Therefore, the equivalent consumption tax rate adjustment was calculated by dividing the 4.2% improvement by 0.48%. A consumption tax rate of 19% would be roughly comparable to the standard value-added tax (VAT) levels in major European countries.

growth rate (i.e., $r > g$), fiscal sustainability becomes more challenging.

This is especially plausible in the context of continued population decline and negative growth, potentially reverting to a low-interest and deflationary environment. Moreover, scenarios such as rare events could also cause $r > g$. For instance, during the global financial crisis and the COVID-19 crisis, nominal GDP fell due to negative growth, and large-scale fiscal expenditures worsened the primary fiscal balance, further deteriorating the already high debt-to-GDP ratio.

Here, we consider the risk of rising interest rates. We simulate the impact of a mechanical 1 percentage point increase in interest rates on the debt ratios under both the baseline and PB Zero scenarios. The results are shown in Figure 3.

In both scenarios, the debt-to-GDP ratio follows a divergent path, with the ratio in 2060 being approximately 45 percentage points higher in the PB Zero scenario. This clearly demonstrates the impact of $r > g$. If interest rates consistently exceed the economic growth rate, maintaining fiscal sustainability requires achieving a primary budget surplus.

5-3 Impact of Economic Growth

When discussing fiscal sustainability, the focus often centers on government actions such as tax increases and reductions in social security benefits. However, achieving economic growth in the private sector is equally crucial for stabilizing debt levels. Previous research underscores that improving the primary fiscal balance and reducing real debt through inflation and economic growth are key factors in reducing high debt-to-GDP ratios (e.g., Reinhard and Sbrancia, 2015).

As highlighted earlier, the debt-to-GDP ratio is significantly influenced by the difference between the economic growth rate and interest rate. Consequently, economic growth plays a crucial role in enhancing fiscal sustainability by boosting the growth rate. Although nominal economic growth through price increases can raise nominal interest rates in the long term, making it neutral to the debt-to-GDP ratio, real economic growth remains the key factor.

We now analyze the debt-GDP ratio trajectory when the real economic growth rate is elevated due to an increase in TFP. The baseline projection sets the TFP growth rate at 0.5%, in line with the recent business cycle average and the Cabinet Office's current projection scenario. For this scenario, we adjust the TFP growth rate to 1%. This higher TFP growth rate is supported by the Cabinet Office's long term projections and Fukao (2023), which estimates the recent productivity growth rate at 0.6%

and suggests upper estimates ranging 0.9% to 1.2%. Setting the TFP growth rate at this level reflects a more optimistic view of Japan's potential for productivity improvements driven by technological advancements, structural reforms, and increased investment in innovation.

Figure 3 shows the trajectory of the debt-to-GDP ratio with a TFP growth rate of 1%. Compared to the baseline case, the short-term reduction in the debt-to-GDP ratio is approximately 10 percentage points larger, and the period of decline is also extended. This projection indicates that economic growth contributes to improving the debt-to-GDP ratio, as interest rates are estimated to follow growth rates with a lag (Figure 4). However, starting around 2040, the debt ratio begins to rise again, returning to the 2025 level by the late 2050s.

5-4 Labor Market Reform

In the previous section, we demonstrated that an increase in the economic growth rate can reduce the debt-to-GDP ratio and enhance fiscal sustainability. While that analysis focused on growth driven by an increase in TFP, economic growth can also be achieved through an increase in the labor force. Our Low Labor Supply Scenario analysis, which considered slower labor force growth than the baseline, indicated that an increasing labor force contributes to lowering the debt-to-GDP ratio.

One potential way to simultaneously achieve productivity growth and labor force expansion is through labor market reforms that enhance labor mobility. Japan’s labor market is characterized by rigid employment practices such as lifetime employment and seniority-based wages. Compared to the United States, which has a more fluid labor market with an average monthly job-to-job transition rate of approximately 2%, Japan’s annual job change rate is around 5%, about one-fifth that of the United States. Additionally, the average tenure in Japan is 13 years, compared to just 4 years in the United States, more than three times longer.

Japan’s labor market is also marked by a dual structure comprising regular and non-regular workers. Although it is difficult to generalize about the productivity of regular versus non-regular workers, non-regular workers earn approximately 30% less than regular workers and have limited access to training and development opportunities, suggesting lower productivity.

A fluid labor market enables the reallocation of labor from declining sectors to growing sectors, thereby optimizing the allocation of human resources and enhancing productivity. Increasing labor market fluidity is also expected to lower the barriers between regular and non-regular workers, enhancing the productivity of non-regular workers through market mechanisms.

While a quantitative analysis of these impacts is beyond the scope of this paper, our qualitative assessment suggests that labor market reforms could significantly contribute to fiscal sustainability by improving productivity and increasing the labor force. Future research should focus on quantifying these impacts to provide more concrete evidence of the benefits of labor market reforms.

6. Conclusion

Japan's fiscal sustainability is under significant strain, and recent shift in the Bank of Japan's monetary policy could influence fiscal dynamics, while the impact remains uncertain. This paper comprehensively assesses Japan's fiscal outlook using debt sustainability analysis. The baseline scenario projects that, while a temporary decline in the debt-to-GDP ratio may occur due to inflation, the long-term trajectory is unsustainable, with the debt-to-GDP ratio eventually diverging.

Our findings highlight several critical insights. Firstly, maintaining fiscal sustainability remains challenging even under optimistic assumptions where the nominal economic growth rate exceeds the interest rate for most of the projection period.

Secondly, the analysis underscores the necessity for fiscal adjustments to stabilize the debt-to-GDP ratio in the long run. The scenarios explored indicate that without substantial policy changes, such as substantial expenditure cuts, tax increases, or sharp inflation rises, Japan's fiscal path remains unsustainable. Particularly, a scenario where the primary balance remains nearly zero over the long term through annual tax increases demonstrates that the debt-to-GDP ratio can be stabilized. This would require a gradual increase in the consumption tax rate, reaching levels comparable to those of major European countries by 2060.

Additionally, while the debt-to-GDP ratio is projected to diverge in the long term, it is important to note the short-term effects of inflation, which temporarily lower the ratio. This occurs because nominal GDP grows faster than debt due to a lag in the adjustment of interest payments on government bonds. As inflation rises, the average yield on government bonds increases slowly, leading to an immediate increase in nominal GDP. However, policymakers must recognize that this short-term reduction is not a solution to long-term fiscal sustainability. The temporary decrease in the debt-to-GDP ratio might lead to complacency, potentially slowing down necessary fiscal reforms. Policymakers should remain vigilant and address the long-term challenges to ensure fiscal health.

To address the fiscal challenges, Japan must consider a combination of strategies. These include

structural reforms to boost productivity, policies to increase labor force participation, particularly among underrepresented groups, and fiscal measures to manage public debt effectively. Enhancing productivity through technological advancements and labor market reforms can provide a sustainable growth path. Additionally, increasing the labor force participation rate among women, the elderly, and foreign workers can help mitigate the adverse effects of an aging population.

There are several areas for further research. Firstly, it is important to consider the impact of exchange rate movements, as these can significantly affect fiscal dynamics. Secondly, incorporating the heterogeneity of economic agents into the analysis could provide a more nuanced understanding of fiscal sustainability. Understanding how different sectors and demographics respond to fiscal and economic policies will be crucial for crafting effective long-term strategies.

Appendix

We apply a methodology discussed in Koeda (2024) to project interest rates. Figure A1 shows the average yield curve based on model simulations. Additionally, Figure A2 illustrates the long-term trajectory of 10-year bond yields under the baseline projection. The paths are color-coded according to their probability of occurrence. It is important to note the wide range of potential interest rate paths.

Figure A1 Simulated yield curves in years

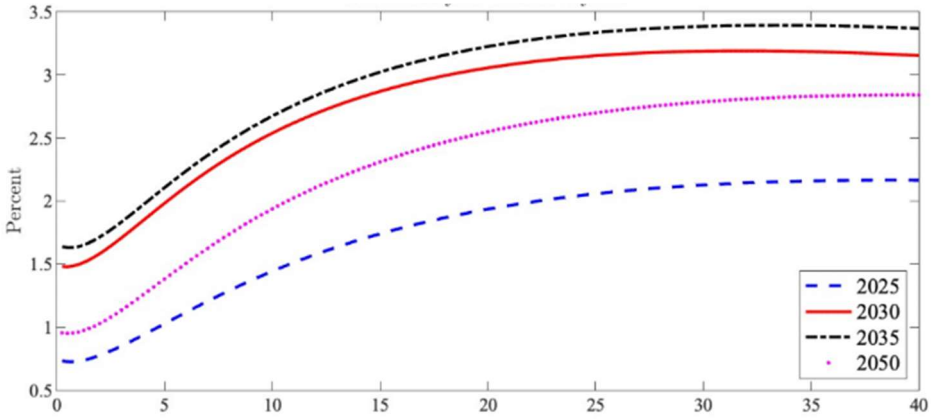
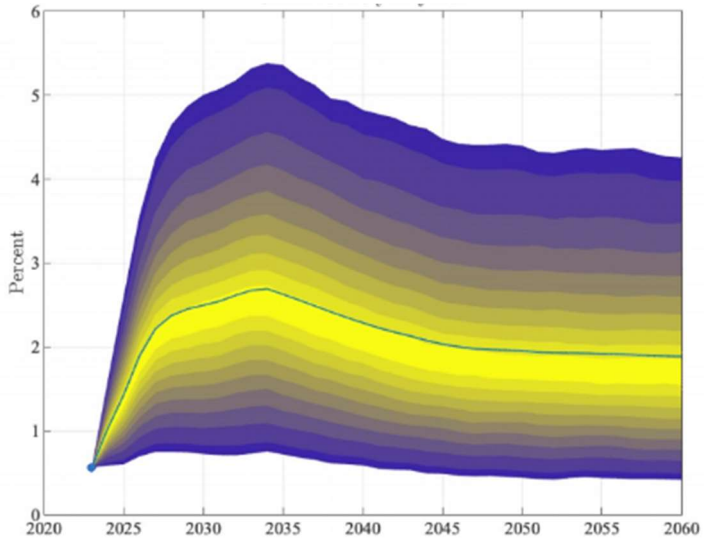


Figure A2 Simulated 10-year yields



References

- Alberola, E., Cheng, G., Consiglio, A., & Zenios, S. A. (2023). Unconventional monetary policy and debt sustainability in Japan. *Journal of the Japanese and International Economies*, 69, 101274.
- Blanchard, O. J. (1990). Suggestions for a new set of financial indicators. *OECD Department of Economics and Statistics Working Paper*, No. 79.
- Blanchard, O. J. (2019). Public debt and low interest rates. *American Economic Review*, 109(4), 1197–1229.
- Blanchard, O. J. (2023). *Fiscal policy under low interest rates*. Massachusetts: MIT Press.
- Braun, R. A. & Joines, D. (2015). The implications of a greying Japan for public policy. *Journal of Economic Dynamics and Control*, 57, 1–23.
- Broda, C. & Weinstein, D. E. (2005). Happy news from the dismal science: Reassessing Japanese fiscal policy and sustainability. In T. Ito, H. Patrick, & D. E. Weinstein (Eds.), *Reviving Japan's Economy* (pp. 39–78). Massachusetts: The MIT Press.
- Cabinet Office. (2024). *Economic and Fiscal Projections for Medium to Long Term Analysis*.
- Cochrane, J. H. (2021). r<g. *Mimeo*.
- Congressional Budget Office (2023). *The LongTerm Budget Outlook.*
- Doi, T. (2009). "Zaisei Shutsudo no Utage no ato ni," in T. Ito & N. Yashiro (Eds.), *Nihon Keizai no Kassei-ka (Revitalizing Japan's Economy)* (pp. 155–189). Tokyo: Nihon Keizai Shimbun-sha.
- Doi, T. & Ihori, T. (2009). *The Public Sector in Japan: Past Developments and Future Prospects*. Cheltenham, UK: Edward Elgar.
- Doi, T., Hoshi, T., & Okimoto, T. (2011). Japanese government debt and sustainability of fiscal policy. *Journal of the Japanese and International Economies*, 25(4), 414–433.
- Enrique, A., Cheng, G., Consiglio, A., & Zenios, S. A. (2023). Unconventional monetary policy and debt sustainability in Japan. *Journal of the Japanese and International Economies*, 69, 101274.
- Feyrer, J. (2007). Demographics and productivity. *The Review of Economics and Statistics*, 89(1), 100–109.
- Fukao, K. (2023). *Nihon no senzai seichoritsu kojo ni nani ga hitsuyo ka: JIP database 2023 wo tsukatta bunseki* (What is Needed to Improve Japan's Potential Growth Rate: Analysis Using the JIP Database 2023). Research Institute of Economy, Trade and Industry, RITEI Policy Discussion Paper Series 23-P-028.
- Hansen, G. & Imrohoroglu, S. (2016). Fiscal reform and government debt in Japan: A neoclassical perspective. *Review of Economic Dynamics*, 21, 201–224.

- Higgins, M. (1998). Demography, national savings, and international capital flows. *International Economic Review*, 39(2), 343–369.
- Hoshi, T. & Ito, T. (2014). Defying gravity: Can the Japanese sovereign debt continue to increase without a crisis? *Economic Policy*, 29(77), 5–44.
- IMF (2016). *How to assess fiscal implications of demographic shifts: A granular approach*. How to Notes. Washington, DC.
- Imrohoroglu, S. & Sudo, N. (2011). Will a growth miracle reduce debt in Japan? *IMES Discussion Paper No. 2011-E-1*.
- Imrohoroglu, S., Kitao, S., & Yamada, T. (2016). Achieving fiscal balance in Japan. *International Economic Review*, 57(1), 117–154.
- Ito, A., Watanabe, T., & Yabu, T. (2011). Fiscal policy switching in Japan, the US, and the UK. *Journal of the Japanese and International Economies*, 25(4), 380-413.
- Ito, T. (2011). 'Sustainability of Japanese sovereign debt', in T. Ito & F. Parulian (Eds.), *Assessment on the impact of stimulus, fiscal transparency and fiscal risk*. ERIA Research Project Report 2010-01, pp. 29–76.
- Joslin, S., Priebsch, M., & Singleton, K. J. (2014). Risk premiums in dynamic term structure models with unspanned macro risks. *Journal of Finance*, 69, 1197–1233.
- Koeda, J. (2024). Interest rate projections using macroeconomic scenarios: A macro-finance approach. *Mimeo*.
- Koeda, J. & Wei, B. (2023). Forward guidance and its effectiveness: A macro-finance shadow-rate framework. *Federal Reserve Bank of Atlanta Working Paper Series*, 2023-16, 1–61.
- Krippner, L. (2013). A tractable framework for zero-lower-bound Gaussian term structure models. *CAMA Working Paper*, 49/2013.
- Mian, A., Straub, L. & Sufi, A. (2022). A Goldilocks theory of fiscal deficits. *NBER Working Paper No. 29707*.
- Ministry of Health, Labour and Welfare. (2019). *Future Outlook for Public Pension Finance (Financial Verification)*.
- National Institute of Population and Social Security Research. (2023). *Population Projections for Japan (2023 Estimates)*.
- Nirei, M., Unayama, T., Katagiri, M., & Koeda, J. (2023). The long-term outlook for Japan's economy and public finance amidst population decline: Envisioning household conditions in 2060. NIRA Opinion Paper, No. 76. (in Japanese).
- Ostry, J. D., Ghosh, A. R., Kim, J. I., & Qureshi, M. S. (2010). Fiscal space. *IMF Staff Position Note*, September 1, 2010.
- Reinhart, C. M. & Sbrancia, M. B. (2015). The liquidation of government debt. *Economic Policy*, 30(82), 291–333.

· Reis, R. (2022). Debt revenue and the sustainability of public debt. *Journal of Economic Perspectives*, 36, 103–24.
· Sakuragawa, M. & Hosono, K. (2011). Fiscal sustainability in Japan. *Journal of the Japanese and International Economies*, 25(4), 434–446.
· The Japan Institute for Labour Policy and Training. (2024). *2023 nendoban rodoryoku jukyu no suikei (sokuho) - rodoryoku jukyu model ni yoru simulation* (FY2023 Labor Supply and Demand Estimates (Preliminary Report) - Simulation by the Labor Supply and Demand Model).
· Ueda, J. & Sugiura, T. (2005). Simulation analysis of fiscal sustainability. *Financial Review*, 100, 158–187. (in Japanese).
· Wright, J. H. (2011). Term premia and inflation uncertainty: Empirical evidence from an international panel dataset. *American Economic Review*, 101, 1514–1534.
· Wu, J. C. & Xia, F. D. (2016). Measuring the macroeconomic impact of monetary policy at the zero lower bound. *Journal of Money, Credit and Banking*, 48, 253–291.

Table 1 Baseline Results

	2020	2025	2030	2040	2050	2060
Nominal GDP	539	626	715	965	1218	1569
		116%	133%	179%	226%	291%
Real GDP	529	572	590	605	606	604
		108%	103%	103%	100%	100%
Revenue (% of GDP)	23	23.0%	23.0%	23.0%	23.0%	23.0%
Tax	20%	20.5%	20.5%	20.5%	20.5%	20.5%
Expenditure	32.0%	23.4%	23.9%	24.8%	25.5%	26.2%
Pension	2.3%	2.3%	2.2%	2.3%	2.4%	2.5%
Healthcare	2.6%	3.0%	3.4%	3.9%	4.4%	4.9%
Nursing care	0.9%	1.3%	1.5%	1.7%	1.8%	1.9%
Primary Fiscal Balance	-50	-2	-6	-16	-30	-50
	-9	-0.4%	-0.8%	-1.7%	-2.5%	-3.2%
Interest rate payment	5	11	23	43	56	76
	1%	2%	3%	4%	5%	5%
Debt	1124	1242	1303	1692	2463	3432
Debt-to-GDP ratio	209%	198%	182%	175%	202%	219%

Figure 1 Primary fiscal balance (% of GDP)

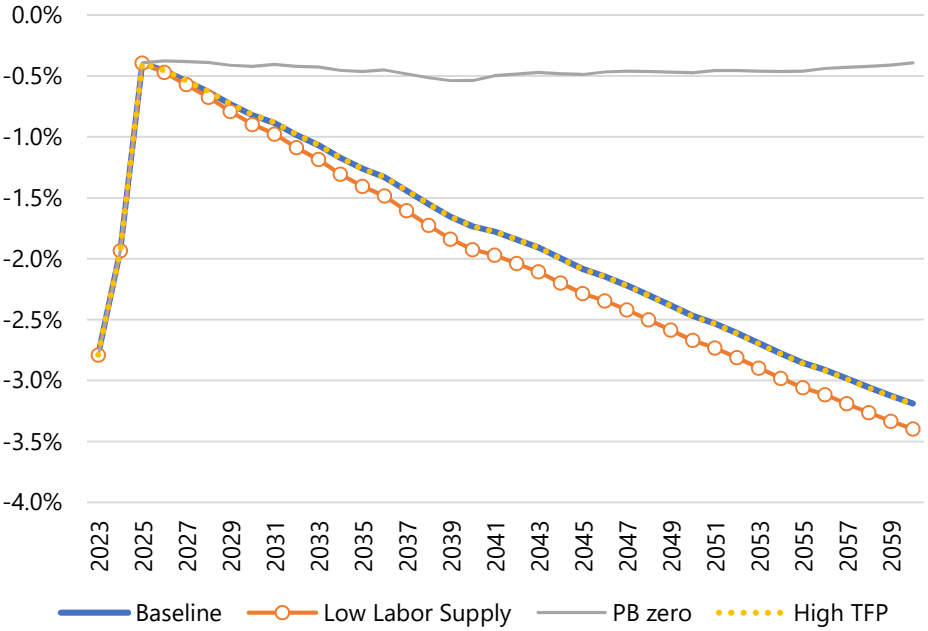


Figure 2 Trajectory of the Debt-GDP ratio (gross, % of GDP)

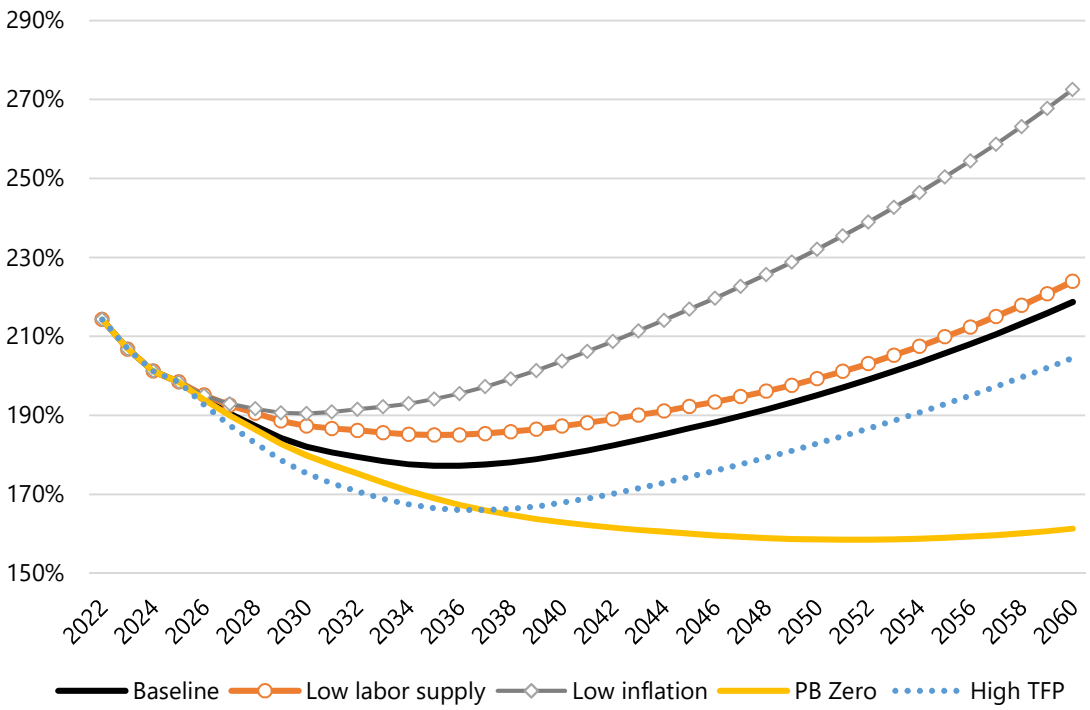


Figure 3 The risk of rising interest rates

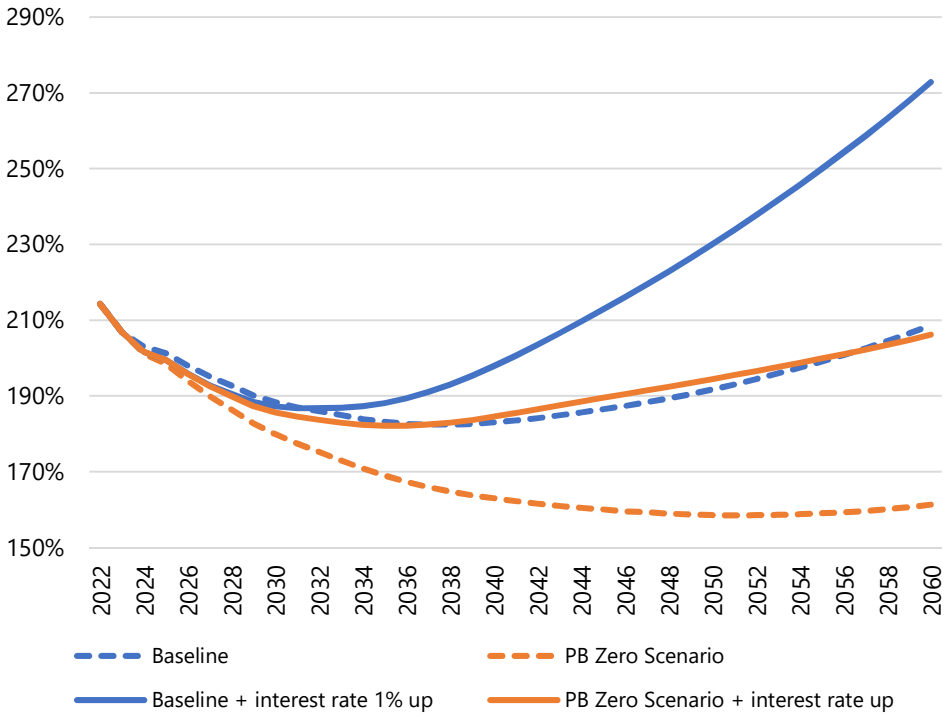


Figure 4 Nominal growth rate and interest rate in high TFP scenario