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Debt Sustainability in Japan: Macroeconomic and Asset Pricing Perspectives

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Abstract

Debt sustainability has become increasingly important in advanced economies as they grapple with rising public debt levels, challenging monetary policies, and shifting investor expectations. This paper examines Japan's fiscal position from the perspectives of the standard debt sustainability analysis and the asset pricing approaches. The findings suggest that several factors contribute to mitigate debt sustainability risks. Moreover, under favorable conditions, the present value of government debt is consistent with its current market valuation, as it accounts for the country's capacity to repay its debt relying on future primary surpluses and a reduction of its debt stock. However, as the Bank of Japan normalizes monetary policy and scales back from large-scale bond purchases, the sustainability of Japan's debt may come under increasing pressure. These findings underscore the importance of proactive fiscal adjustments to steer the economy towards long-term fiscal stability and enhanced resilience against financial shocks.

Keywords: Japan, debt sustainability, asset pricing, primary surpluses

JEL codes: H30, H63, H68

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1 Introduction

Global public debt is projected to surpass USD100 trillion or 93 percent of global GDP by 2024, with no end in sight to its rising trend. Two out of three countries, however, have managed to stabilize their public debts. Despite this progress, various challenges threaten debt sustainability, including political uncertainty, difficulties in reining in public expenditures, potential underestimation of debt projections, overly optimistic forecasts of primary surpluses, and rising borrowing costs as policy rates rise in the post-Covid period. High debt levels pose serious economic problems. They reduce fiscal space and limit governments' ability to respond to economic downturns. They also crowd out essential growth-enhancing investments and raises the risk of sovereign distress (Brunnermeier et al. 2016, Farhi and Tirole 2018). Furthermore, prolonged debt accumulation increases the likelihood of debt distress and could trigger a broader financial crisis. Accordingly, a smooth transition to fiscal normality requires rebuilding fiscal buffers and reforming fiscal policies to ensure debt sustainability (IMF 2024b).

In this context, assessing the fiscal soundness of sovereign states is crucial for identifying current strengths and weaknesses, and by addressing the latter, maintaining global economic stability and fostering long-term growth. By fiscal soundness we refer to a government's ability to manage public finances sustainably, to minimize sovereign default risk, and to maintain the needed flexibility to respond to economic shocks. A robust fiscal position enables countries to engage in development initiatives, social programs, and public investments without increasing financial vulnerabilities. Conversely, countries that fail to maintain fiscal soundness face higher borrowing costs, restricted access to international financial markets, and a heightened risk of economic crises.

Debt sustainability is a critical concern not only for developing and emerging market economies but also for advanced economies. Until recently, debt sustainability analysis (DSA) was mainly conducted for developing and emerging market economies given the fact that they had experienced numerous fiscal crises in the past (Medas et al. 2018). Such state of affairs was supported by several studies that suggested institutional features in these economies caused them to be more debt-intolerant than advanced economies, with the latter able to sustain higher levels of public debt (Reinhart, Rogoff, and Savastano 2003, Reinhart and Rogoff 2010). However, the European sovereign debt crisis in the 2010s, which threatened the viability of the European Monetary Union, underscored that public debt sustainability in advanced economies cannot be taken for granted. Moreover, as the era of low interest rates come to an end, the high debt ratios in advanced economies could render them more vulnerable to a financial crises than their developing and emerging market counterparts.

Among advanced economies, Japan has the highest general government gross debt-to-GDP ratio in the world, projected by the IMF to reach 241 percent of GDP in 2024. Several factors mitigate fiscal risks, such as the debt being denominated in Japanese yen and primarily held domestically,

and the government's large asset holdings. However, the country is under significant fiscal pressure due to the need to fund support for an aging population and the green transition, all while grappling with sluggish economic growth. Additionally, the rise in interest rates following the economy's exit from deflation would increase future debt servicing costs. Furthermore, as the Bank of Japan (BOJ) gradually scales back its purchases of Japanese government bonds and shifts the purchases back to the market, the market's evaluation of Japan's fiscal position is becoming increasingly important. This situation underscores the importance of analyzing Japan's fiscal position, which could offer valuable lessons for policymakers striving to balance economic growth with debt sustainability in a rapidly changing global landscape. Furthermore, Japan's experience can serve as a case study for other advanced economies grappling with rising public debt and fiscal risks. Maintaining Japan's fiscal stability is not only a national priority but also a matter of global importance, as fiscal instability in Japan could have far-reaching consequences for global financial markets.

This paper examines the soundness of Japan's fiscal position from two complementary perspectives. The first is the standard macroeconomic-based debt sustainability methodology, a cornerstone of the IMF's policy advice (IMF 2022). The second perspective employs the asset pricing-based fiscal capacity methodology introduced by Jiang et al. (2023, 2024), which uses risk-based valuation measures to assess whether the market prices of sovereign debt align with a country's repayment capacity. Additionally, this approach examines whether the government's fiscal projections can justify current debt levels, and whether the market valuation of the government debt is consistent with the country's capacity to repay its debt. By combining these two approaches, this analysis aims to provide a more comprehensive understanding of Japan's fiscal position and identify potential vulnerabilities more effectively.

Our analysis reveals two key findings. First, using market discount rates and assuming that only primary surpluses are used to service debt, Japan's high debt implies that substantial future primary surpluses and additional borrowing will be needed to offset its current valuation. This is especially concerning amid rising interest rates. This result is in line with those of the DSAs conducted by multilateral institutions, which, despite recognizing mitigating factors like long debt maturities and a stable domestic investor base, concluded that managing the risks due to elevated debt levels required the government to undertake gradual fiscal consolidation to rebuild buffers and to reduce the pressures from higher interest rates, healthcare costs, and long-term care for an aging population (IMF 2024a, AMRO 2024).

Our second finding is that while appearing precarious under the conservative assumption that only primary surpluses are used to service the country's debt, Japan's fiscal position improves significantly when government assets are considered. The market value of debt aligns closely with its discounted cash flows, indicating investor confidence in Japan's ability to meet obligations. This confidence likely comes from two key assumptions: that the government's substantial asset holdings provide a buffer against default, and that the debt held by the BOJ does not necessarily require

redemption in the same way as the privately held debt. Under the optimistic scenario[1], fiscal space is evident, with government buffers far exceeding market debt values. These insights highlight the critical role of investor perceptions and policy flexibility in shaping Japan's debt sustainability outlook.

The remainder of this paper is organized as follows. Section 2 explains the macroeconomic and financial perspectives on debt sustainability, highlighting its similarities and their conceptual differences. Section 3 reviews some of the literature on debt sustainability in Japan. Section 4 analyzes debt sustainability in Japan using the standard and asset pricing approaches. This section also discusses the results, followed by the conclusions presented in Section 5.

2 Debt sustainability: the macroeconomic and financial perspectives[2]

2.1 The macroeconomic perspective

The main goal of sovereign risk assessment is to determine whether the government is solvent or not. In the macroeconomics literature, several sustainability assessment approaches have been developed. The main ones are based either on the simulation of medium-term and long-term public debt dynamics, the construction of structural models such as dynamic stochastic general equilibrium models in which governments always pay their debts when they have the available resources, or models of strategic behavior, where governments may choose to default despite having the ability to continue servicing their debt (D'Erasmo, Mendoza, and Zhang 2016).

Policy making institutions favor the debt dynamics approach, which has been integrated in their DSA methodologies, as is the case at the European Central Bank (Bouabdallah et al. 2017) and the International Monetary Fund (IMF 2022).[3] This approach builds upon the intertemporal government budget constraint (IGBC). Satisfying the constraint requires that the value of the outstanding public debt, should be equal to the future primary fiscal balances, $pb_{t+h},\ h = 0, 1, \ldots$, multiplied by the discount factors, $M_{t,t+h},\ h = 1, 2, \ldots$, which yields the following equation:

$$b_{t-1} = pb_t + \sum_{h=1}^{\infty} M_{t,t+h}\, pb_{t+h}. \tag{1}$$

It follows naturally that a violation of the IGBC indicates that the debt is unsustainable since it exceeds the discounted value of present and future primary surpluses. Equation (1) can be extended

1. The optimistic growth scenario and the baseline scenario are derived from the projection scenarios outlined by Cabinet Office (July 2024), specifically the case of transitioning to a new economic stage and the projection based on past trends, respectively.

2. This section draws extensively on D'Erasmo, Mendoza, and Zhang (2016), Willems and Zettelmeyer (2022), and Jiang et al. (2023).

3. The DSA frameworks of these institutions also include other tools beyond those based on debt dynamics. For instance, the IMF complements the debt dynamics analysis with near-term sovereign stress indicators, an evaluation of gross financing needs, and long-term scenario analysis of the impact of climate change, demographics and resource depletion.

to deal with the particular characteristics of a country's sovereign debt profile. For example, the IMF DSA methodology allows for public debt denominated in foreign and domestic currencies and factors in the effect of the exchange rate as well as domestic and foreign inflation. The dynamics of the debt to GDP ratio, Δd_t, are determined by:

$$\Delta d_t = \frac{z_t d^f_{t-1}}{(1+g_t)(1+\pi^f_t)} + \frac{r_t - g_t}{1+g_t} d_{t-1} + \frac{\pi^d_t - \pi^f_t}{(1+\pi^f_t)\rho_t} d^f_{t-1} - pb_t + sfa_t \tag{2}$$

where z is the real exchange rate, g is real GDP growth, r is the domestic real effective interest rate, d^f are the debt to GDP ratio held in foreign currency, $\pi^i, i = d, f$ are the domestic and foreign inflation rates, ρ is the nominal GDP growth rate, and sfa are stock flow adjustments due to other effects (Escolano 2010, IMF 2022).

Macroeconomists and fiscal policy practitioners do not recommend using equation (1) directly. The rationale for the recommendation is that any high debt level as well as any long sequence of primary budget deficits are sustainable as long as the country can run high surpluses for a long period of time afterwards, which might not be a credible policy. Instead, they suggest using the debt dynamics equation to simulate the debt path over a given time horizon, typically in the 5 to 10 years range. In the simulation, the relevant variables in the debt dynamics equation are subject to random shocks consistent either with the country's historical experience or with those implied by an econometric or statistical model. The replications in the simulation generate a distribution of potential debt paths. When the baseline path projected by the economic analysts is compared to the distribution, its relative position suggests whether the debt position would improve or deteriorate.

In addition, framing the sustainability analysis in the context of the debt dynamics serves to identify a debt stabilizing primary balance, which corresponds to a steady state equilibrium in which the debt to GDP ratio remains unchanged, which is consistent with the view that fiscal policy is sustainable if the debt ratio is not unbounded (Blanchard 1984, Kremers 1988, 1989). The computation of this steady state equilibrium requires assuming a steady state value for the discount rate and for other variables. The steady state values can be set equal to historical averages or to those consistent with policy objectives. As an illustration, assuming for a deterministic environment, setting the discount rate equal to m in equation (1) and expressing all the variables as a ratio to GDP, the debt stabilizing primary balance for a desired debt to GDP ratio b^* should be $pb^{ss} = (1-m) \times b^*$. Qualitative judgment and quantitative analysis could serve to evaluate whether these values are realistic. If not, another policy iteration round might be necessary.

2.2 The asset pricing perspective

More recently, debt sustainability has been examined from an asset pricing perspective (Jiang et al. 2022, 2023, 2024). Similarly to the macroeconomic perspective on debt sustainability, the asset pricing perspective begins with the IGBC. This constraint can be interpreted as a sequence of dis-

counted cash flows, where the cash flows correspond to the projected primary budget balances. Cochrane (2005) argues that, under this view, holding government debt is analogous to holding claims on future primary surpluses, which can, in principle, be valued in a manner similar to corporate debt or equity. While both perspectives share the same economic foundations, they diverge in key aspects, resulting in complementary but distinct insights into debt sustainability. We describe the differences between both approaches below.

The first difference between the two approaches lies in the pricing of aggregate growth risk and treatment of the discount rate. The asset pricing perspective rejects the standard macroeconomic practice of using the risk-free rate—typically assumed to be equal to the government borrowing rate—to discount primary budget balances. Instead, it incorporates a risk premium component in addition to the risk-free rate to price aggregate growth risk. The second difference stems from the application of the transversality condition and the no-arbitrage condition. These conditions imply that the expected present-discounted value of debt in the distant future approaches zero as the time horizon extends to infinity. This optimality condition holds as long as the GDP risk premium exceeds the gap between the economic growth rate and the risk-free rate. In other words, the asset pricing perspective asserts that the sovereign risk-free rate can never be lower than the economy's growth rate in every state of the world. This rules out the case of $r < g$ which, until the low rate environment ended in the post-Covid period, was a major concern in economic policy discussions (Blanchard 2019, 2023; Willems and Zettelmeyer 2022).[4]

The rejection is justified on the grounds that surpluses are procyclical, moving in-sync with the business cycle. In asset pricing parlance, budget balances are not zero beta assets. Hence, the appropriate discount rate should be the risk free rate plus a risk premium, as first noted by Bohn (1995). Finally, rather than analyzing debt dynamics and whether debt stabilizes as the economy reaches its long-run steady state, the assessment of a country's fiscal health is based on whether official primary balance projections are consistent with the market valuation of the country's public debt, as in its application to the U.S. by Jiang et al. (2022).

The critical case is when the market value of the government's debt exceeds its discounted value. There are several possible explanations. The first one is that markets expect future primary balances to exceed those used when projecting the discounted value of the debt. This is the case that Jiang et al. (2023) refer to as a reduction of a country's fiscal capacity. Another reason is that markets might be mispricing the country's debt. In this case, a price correction could trigger a disorderly unwinding of debt portfolios. Finally, government bonds might be viewed as safe assets and providing liquidity during periods of stress. In this case, investors would demand returns lower than those associated with having claims on future primary surpluses. We should note, however,

4. There are valid arguments supporting that government debt services unrelated to claims on primary surpluses could at least temporarily justify risk-free rates lower than the growth rate of the economy, as noted in Reis (2022), Jiang et al. (2023), and Willems and Zettelmeyer (2022)

that only a few countries' government bonds, especially the United States, enjoy safe asset status.

The data requirements for the asset pricing perspective are more demanding than those for the macroeconomic perspective. First, the existence of a liquid secondary market for public debt is essential. Second, long-term projections of primary budget balances must be available, or, in their absence, analysts must construct them using reasonable and realistic assumptions. By contrast, the macroeconomic perspective's calculation of the stabilizing primary balance does not require specifying the exact path of primary balances leading to the steady-state equilibrium. Similarly, simulating debt dynamics in the macroeconomic approach typically relies on historical patterns or econometric models.

3 A selective review of the literature on Japan's debt sustainability

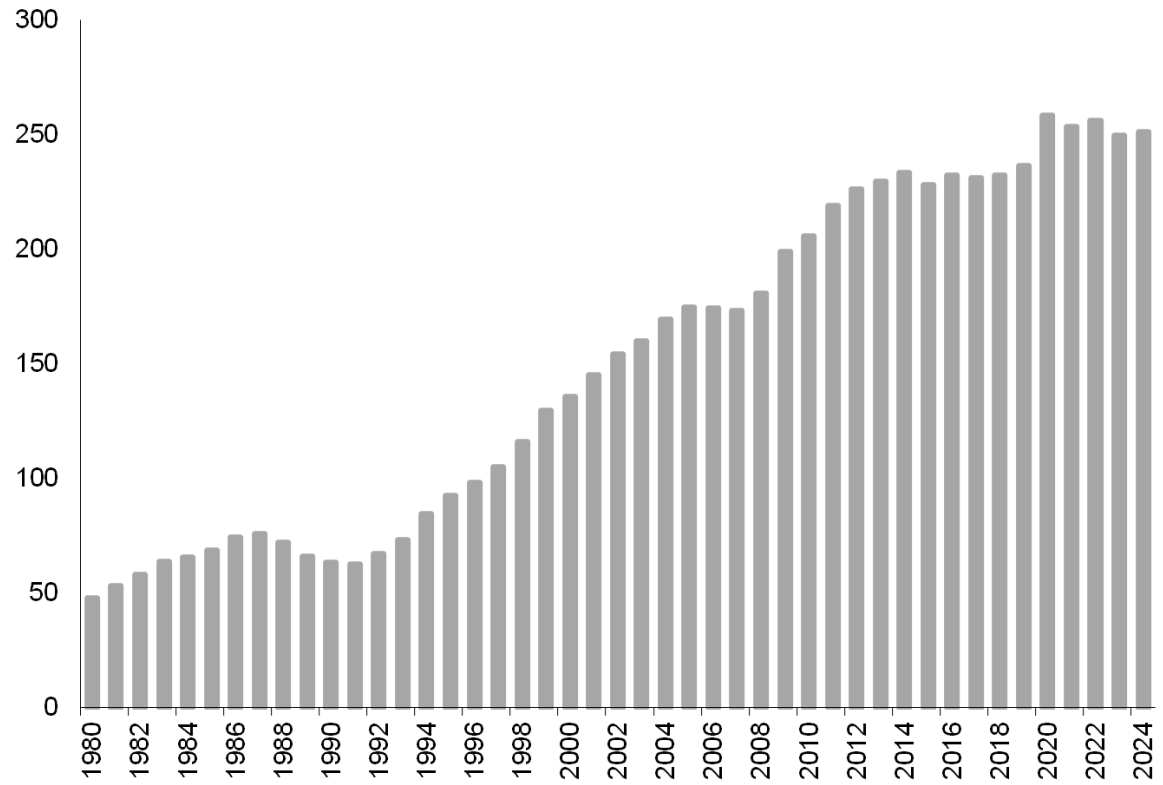
The sustained rise of Japan's general government debt to GDP ratio, climbing from just below 50 percent in the early 1980s to a projected 250 percent in 2024, has garnered significant attention in debt sustainability academic and policy-making discourse (Figure 1).[5] Several studies have examined the welfare costs imposed by high debt levels and their implications for designing sustainable fiscal policies. This concise review necessarily represents only a selective overview of the extensive literature on Japan's debt dynamics.

High debt levels negatively impact welfare by crowding out capital, increasing interest payments, and potentially leading to higher distortionary taxes. Nakajima and Takahashi (2017) evaluated welfare losses using a calibrated heterogeneous agent incomplete market model allowing for increasing fiscal uncertainty at high debt levels. They concluded that the optimal debt ratio was approximately 50 percent. However, welfare gains from reducing the debt ratio to this level were marginal, as the potential benefits of reduced fiscal uncertainty were largely offset by welfare losses associated with increased economic inequality.

Hansen and Imrohoroglu (2013) utilized a standard growth model to estimate the fiscal burden, quantifying the additional taxes needed to finance projected expenditures and stabilize government debt. Their findings suggest that achieving debt sustainability, while maintaining compliance with the intertemporal budget constraint, requires a significant fiscal adjustment, specifically, raising distortionary taxes, such as consumption or labor income tax, to a range of 30 to 40 percent.

5. This refers to gross debt of the general government.

Figure 1: General government debt to GDP ratio, in percent



Sources: IMF; CEIC.

Raising government revenues and debt consolidation are standard tools for ensuring debt sustainability. In this context, Doi, Hoshi, and Okimoto (2011) argued that in the early 2010s, Japan's debt was unsustainable without a permanent and substantial increase in government revenues. They estimated that tax revenues would need to rise from 33 percent to 40-47 percent of GDP. However, the authors concluded that such revenue increases were impractical, given the simultaneous constraints of active fiscal policy and a monetary policy apparently aimed at inflating away the debt. The findings in Futagama and Konishi (2018), based on an endogenous growth model, further supported fiscal consolidation and a reduction in the debt ratio, as both policies could lead to substantial welfare gains. Some of the gains were offset, however, when fiscal consolidation was accompanied by capital, labor and consumption taxes.

The fiscal reaction function, first introduced by Bohn (1998), measures the extent to which the primary fiscal balance adjusts in response to changes in the debt to GDP ratio. This analytical tool is particularly valuable for evaluating debt sustainability and simulating the potential impact of alternative policy scenarios. Conventionally, fiscal policy is considered stabilizing if primary surpluses increase proportionally with rising debt levels. However, a critical challenge emerges at high debt

levels, where political constraints may impair the government's ability to generate primary surpluses. Sakuragawa and Sakuragawa (2020), after estimating the fiscal reaction function for Japan, found that such political constraints were not binding as they were offset by the prevailing negative growth-adjusted bond yields. Yet, this condition has since changed as the BOJ started normalizing rates in late 2024, suggesting a comprehensive reexamination of Japan's fiscal dynamics is needed.

The BOJ holds approximately half of Japan's public debt, which arguably contributes to stabilizing the public debt dynamics. Alberola et al. (2023) contend that traditional macroeconomic DSA frameworks are insufficient to evaluate unconventional monetary policy. Employing a stochastic debt sustainability model with a monetary framework, they demonstrated that the central bank's bond purchases have positively impacted debt sustainability. The unwinding of quantitative easing and subsequent reduction of the central bank's bond holdings could exacerbate debt dynamics unless debt is effectively rolled over. Their findings also suggested that continued quantitative easing might be prudent in the face of persistent global financial tightening.

Similarly, Hansen and Imrohoroglu (2023), using a neoclassical growth model, argued that while the BOJ's massive purchases of government bonds temporarily stabilized debt, the impact would be transitory due to growing demographic pressures. However, the central bank's intervention in the Japanese government bond market resulted in significant losses (Fujiki and Tomura 2017), which, if large enough, could translate into negative equity. Arguably, negative equity may not adversely affect central bank operations (Buiter 2020, Cochrane 2023, Bell et al. 2024), which alleviates some concerns regarding the central bank's holdings of government bonds.

4 Debt sustainability in Japan: standard DSA and asset pricing analyses

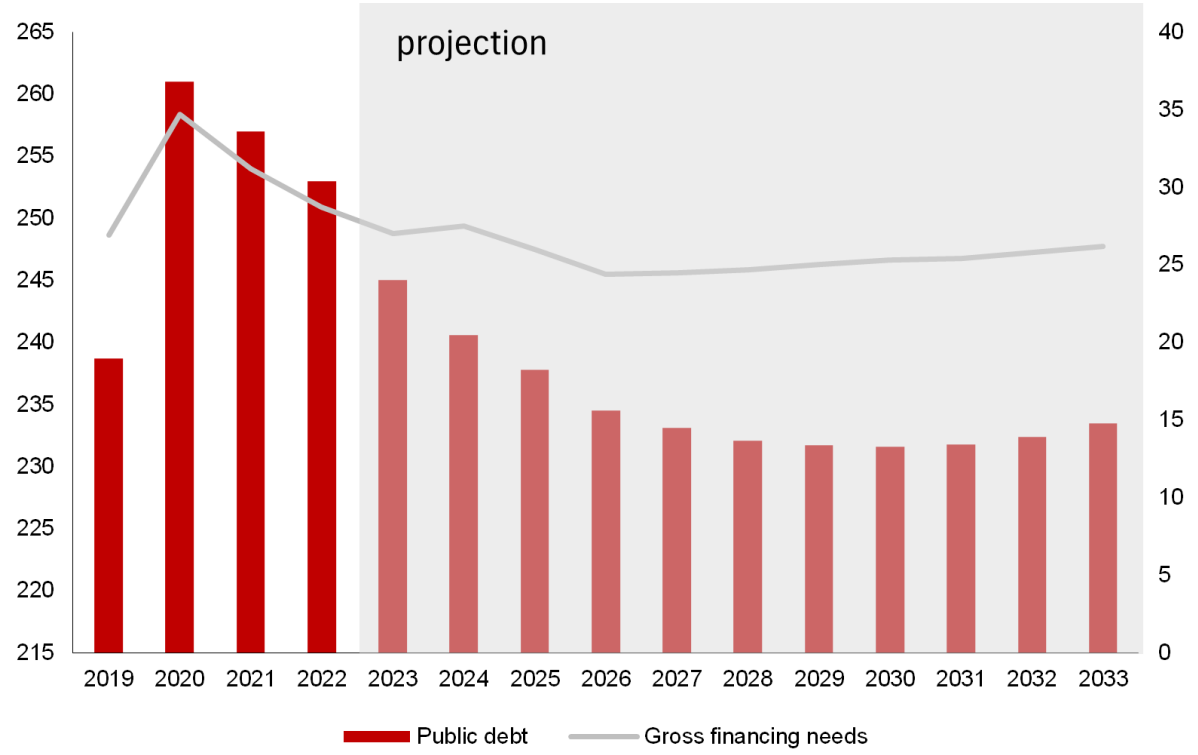
4.1 Standard DSA

This section summarizes the main findings and conclusions of the DSA conducted in the context of AMRO's 2024 country consultation with Japan (AMRO 2025). The DSA examined general government debt, which includes central and local government debt, and social security obligations. The analysis showed that Japan's public debt had been steadily declining since its pandemic-driven peak of 261 percent of GDP in 2020, reaching 245 percent in 2023. However, this reduction was driven more by favorable debt dynamics—strong economic growth and high inflation—than by fiscal consolidation. Despite economic recovery, the primary deficit remained high and was unlikely to meet the balanced budget target by 2025. Over 80 percent of the debt consisted of medium- to long-term instruments, with an average maturity of 9.5 years. Domestic institutions, including the BOJ, insurance companies, and banks, held most of the debt, while foreign investors accounted for just 13 percent of government securities.

The DSA assumed a baseline scenario where economic growth would recover steadily, exceeding potential in 2025 and 2026 before stabilizing at its long-term trend. GDP deflator inflation was

expected to persist through 2025 and 2026 before settling at 1 percent in the long run. The effective interest rate on total debt was projected to rise gradually over the forecast period, influenced in part by policy rate adjustments, while Japan's extended debt maturity helped moderate the pace of this increase.

Figure 2: Public debt and gross financing needs, percent of GDP



Sources: AMRO (2025); Japan Ministry of Finance; Cabinet Office.

The public debt-to-GDP ratio was expected to decline until 2029 but would rise thereafter due to increasing expenditures from an aging population. Higher effective interest rates and lower GDP deflator inflation would push real interest rates up. As a result, the combination of a growing primary deficit and rising real interest rates would outweigh the impact of real growth, driving debt upward from 2030, reaching 233.5 percent of GDP by 2033 (Figure 2). The GFN would rise in 2024 due to extended fiscal support and a supplementary budget, decline in 2025–2026 as support would be phased out, and rise again later due to a widening primary deficit.

While public debt and GFNs projections exceeded international benchmarks, the DSA and macro stress tests considered several mitigating factors that could moderate debt sustainability risk. Due to the long maturity of Japan's debt portfolio, which averages almost 10 years, higher future interest rates would only gradually increase debt servicing costs. Exchange rate risk was minimal, as the debt has been predominantly issued in local currency. Additionally, the large domestic investor

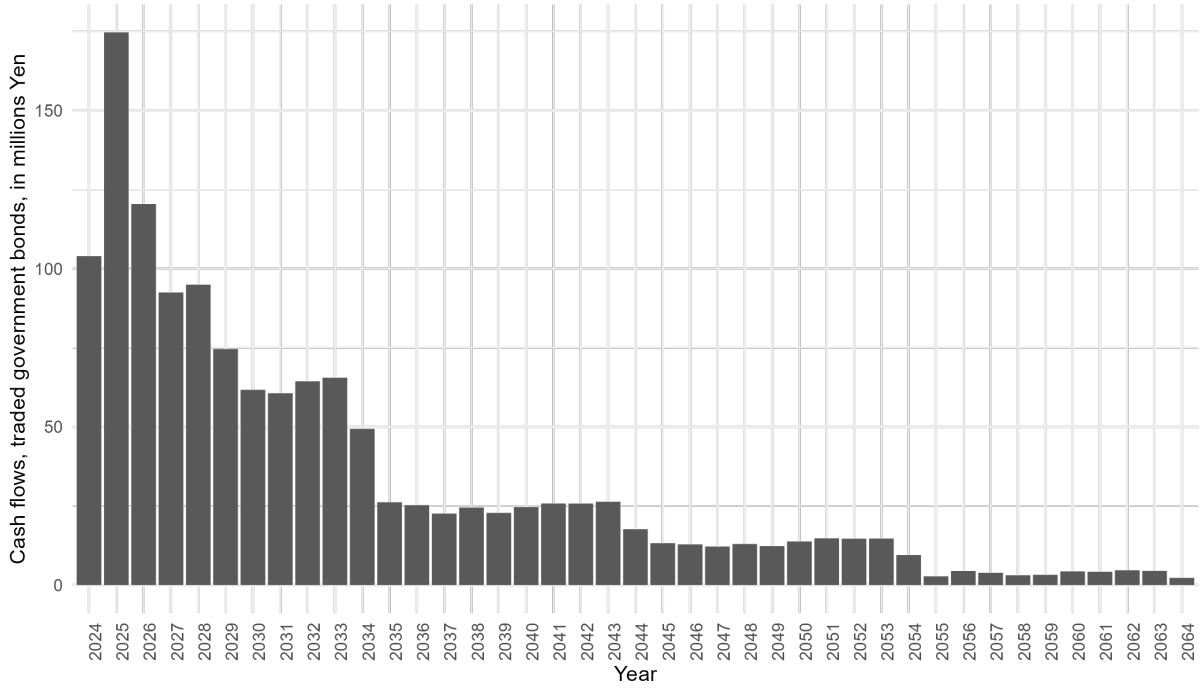
base would provide a stable source of government financing, likely sufficient to meet the country's significant public funding needs. The historical role of the Japanese yen as a safe-haven currency would further bolster investor confidence and support demand for Japanese government bonds (JGBs).

Notwithstanding these mitigating factors, with public debt projected to rise steadily under both the baseline and shock scenarios, the need for gradual fiscal consolidation remained critical. Rising expenditures, particularly due to an aging population, and the potential for increasing interest rates posed risks to long-term debt sustainability. To mitigate these challenges, authorities needed to implement a fiscal consolidation strategy that streamlined expenditures and enhanced revenue mobilization, ensuring a more sustainable debt trajectory.

4.2 Asset pricing analysis

Applying the asset pricing methodology required data on the market value of outstanding government debt, long-term economic and fiscal projections, and appropriate discount rates. We obtained the market value of outstanding government debt from Bloomberg LLC. The market data corresponded to 586 active government securities outstanding as of October 8, 2024, with a notional principal of 1266 trillion yen and a market value of 1233 trillion yen. Principal and coupon payment cash flows are shown in Figure 3.

Figure 3: Cash flows, traded government debt, in million yen



Sources: Bloomberg LLP and authors' calculations.

The analysis errs on the conservative side by assuming that the BOJ acts as the residual claimant, receiving payments only after other bondholders have redeemed their bonds.[6] Hence, future primary surpluses are reserved exclusively for investors in the secondary market.

Past and long-term forecasts for inflation, GDP growth, and fiscal projections were obtained from the official Economic and Fiscal Projections for Medium- to Long-Term Analysis in the Cabinet Office (July 2024) report, which was submitted to the Council on Economic and Fiscal Policy on July 29, 2024.[7] These projections cover both historical and future fiscal trends from 2022 to 2033 under two scenarios: one reflecting a continuation of past trends and another representing a transition to a new economic stage. We refer to the former as the baseline scenario and the latter as the optimistic scenario. In the optimistic scenario, the Cabinet Office assumed higher TFP growth alongside increased labor force participation among women and the elderly. The projected rise in TFP growth was driven by medium- to long-term planned investments in priority areas, while the increase in labor force participation was attributed to heightened labor demand fueled by economic growth.

In the baseline scenario, it was assumed that the debt-to-GDP ratio was at 198 percent in 2025, and then grew to 199 percent by 2033. In the optimistic scenario, the debt-to-GDP ratio was assumed to be at 198 percent and gradually decline to 169 percent by 2033. Our analysis extended the projections until 2064 by assuming a large and permanent reduction in the debt-to-GDP ratio to 160 percent[8] in 2034 which remains constant onward (Figure 4).[9]

Similarly, some adjustments were needed to project GDP growth and the primary balance-to-GDP ratio beyond the official projections that ended in 2033. First, the GDP growth rate was assumed to remain constant at its 2033 value until 2064. Second, past 2033, the primary balance-to-GDP ratio was set equal to its average value computed over the 5-year period ending in 2033 and kept constant until 2064. Under these assumptions, the baseline scenario projection of the primary balance stabilized at approximately 0.26 percent of nominal GDP from 2033 onward, while in the optimistic scenario, it reached 1.57 percent of nominal GDP (Figure 5).

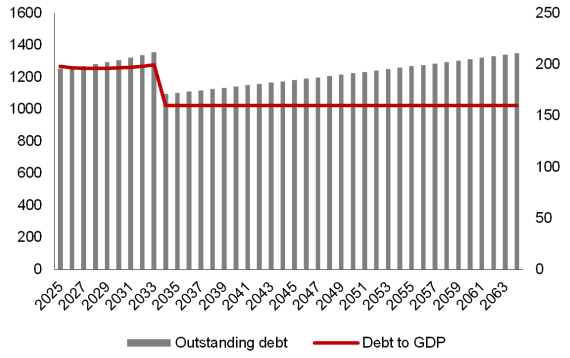
6. Were the central bank not paid, it would incur losses and be saddled with negative equity. However, as noted in the literature review discussion, negative equity should not necessarily have an adverse effect on the bank's operations.

7. The Cabinet Office's projections appear to be more cautiously optimistic compared to those of AMRO and the IMF.

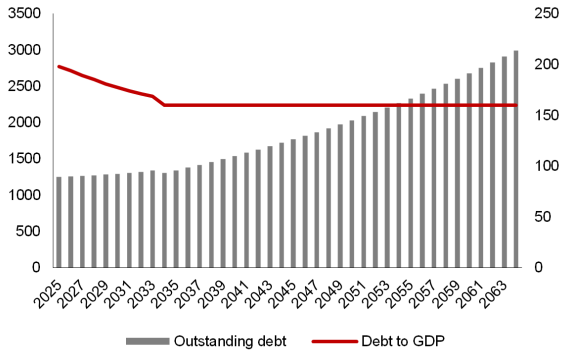
8. This figure is considered consistent with the steady-state value, based on anecdotal evidence gathered through discussions with academics.

9. This figure is considered consistent with the steady-state value, based on anecdotal evidence gathered through discussions with academics.

Figure 4: Debt projection and debt-to-GDP ratio, in trillion yen; in percent



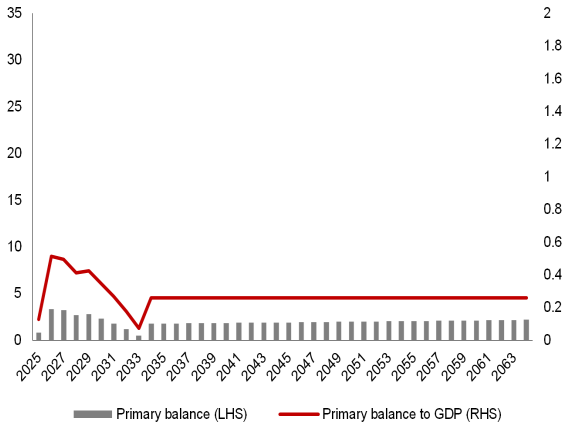
Baseline scenario



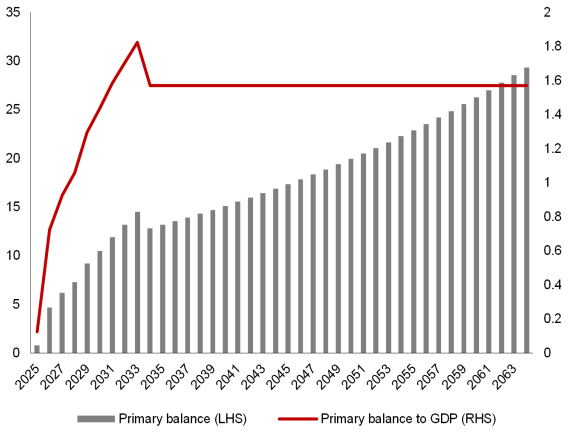
Optimistic scenario

Sources: Cabinet Office and authors' calculations.

Figure 5: Primary balance projections, in trillion yen; in percent



Baseline scenario



Optimistic scenario

Sources: Cabinet Office and authors' calculations.

4.2.1 Construction of discount curves

We constructed the discount rate curve using two different estimates of the sovereign risk premium using October 2024 data.[10] The first estimate, following Jiang et al. (2022), set the sovereign risk premium equal to the economy-wide unlevered equity risk premium (ERP). The second estimate set the premium equal to the price of credit default swap (CDS) contracts. Once the premia were calculated, two discount rates curves were constructed by simply adding them to the risk-free rate curve.

10. Other approaches, such as estimating a general stochastic discount factor, are discussed in Jiang et al. (2024).

The equity risk premium approach assumes that claims on primary budgets are equivalent to claims on GDP and, in turn, equivalent to claims on the dividends of the country's publicly listed stocks (Jiang et al. 2022). In this case, the equity risk premium, corrected after the leverage effect is removed, then serves as a proxy for the sovereign risk premium. Following the suggested methods in Jiang et al. (2023), we first set the country's equity risk premium to 5.27 percent, the January 2025 value calculated by Damodaran (2025) using a discounted dividend model (Damodaran 2024). To compute the unlevered equity risk premium, it was necessary to estimate the equity-to-asset ratio. This ratio was calculated as the average of the ratios of the non-financial firms and the financial firms weighted by total assets.

As of the end of the third quarter of 2024, the equity-to-asset ratio of the nonfinancial firms sector was 0.422, calculated using shareholder equity of ¥866 trillion and total assets of ¥2055 trillion, as reported by the Policy Research Institute of Japan's Ministry of Finance. The equity-to-asset ratio of the financial sector was calculated as follows. First, it was assumed that the debt-to-equity ratio of financial corporations in 2024 remained unchanged at 7.1, the value reported by the OECD at the end of 2023. The corresponding equity-to-asset ratio was 0.123. The total assets of financial institutions were set equal to their September 2024 value of ¥5190 trillion. As a result, the average equity-to-asset ratio was calculated as 0.208:

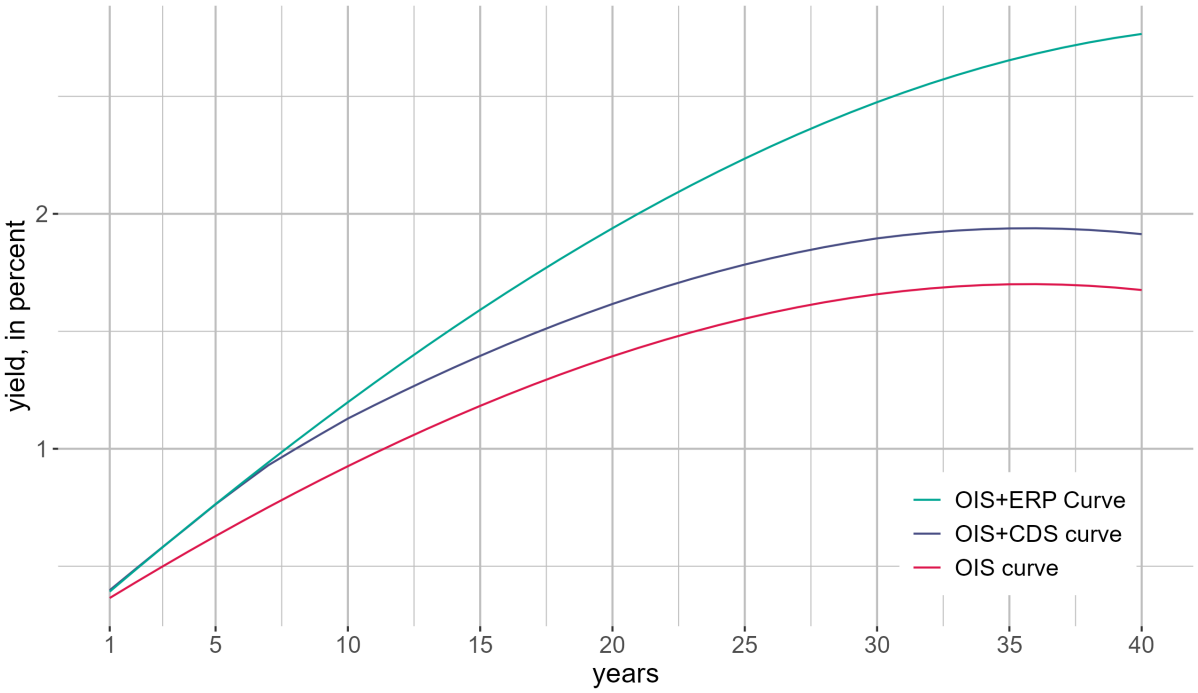
$$0.422 \times \frac{2055}{2055 + 5190} + 0.123 \times \frac{5190}{2055 + 5190}$$

This yielded an unlevered equity risk premium of 1.09 percent. This premium, assumed to be equal to the sovereign risk premium, was held constant for all horizons.

The prices of sovereign credit default swaps (CDS) contracts denominated in Japanese yen were also used as a proxy for the sovereign risk premium. These contract prices are quoted as spreads over the risk-free rate. Since CDS contracts function as insurance against sovereign default, their spreads should reflect fiscal risks (Lando 2020). In principle, no arbitrage arguments suggest that sovereign CDS-bond basis—the difference between the CDS spread and the spread of the sovereign bond referenced by the CDS contract—should be small. Otherwise, basis arbitrage trades would cause the CDS and bond spreads to converge (Duffie 1999, Hull and White 2000). However, arbitrage costs could lead to a persistent positive CDS bond basis, as documented for European countries (Gyntelberg et al. 2017) and emerging markets (Chan-Lau and Kim 2004, Ammer and Cai 2011).[11] In this case, the market value of outstanding government bonds would exceed their net present value calculated using the CDS-based discount factor. CDS spreads data were available for maturities of 1, 2, 3, 4, 5, 7, 10, 20, and 30 years from Refinitiv. Cubic splines were used to interpolate between 1-year to 30-year maturities, With the assumption that the CDS spread for maturities beyond 30 years remained equal to the 30-year CDS spread.

11. See Culp, van der Merwe, and Starkle (2018) for a comprehensive discussion of the CDS-bond basis.

Figure 6: OIS curve, CDS discount curve, and equity premium discount curve



Sources: Refinitiv and authors' calculations.

Once the equity and CDS premia were determined, the only remaining task was to construct the risk-free rate curve. Following Hull and White (2013), the risk-free rate curve was set equal to that of the overnight indexed swap (OIS) rate curve, which has become the standard risk-free benchmark since the 2008 global financial crisis. Japan's OIS rates were obtained from Refinitiv for maturities of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 30 and 40 years. Unobserved values for maturities within this range were estimated by fitting a cubic spline to the observed values. Subsequently, the equity premium discount rate curve and the CDS discount rate were derived by adding each respective premium to the risk-free rate. The corresponding discount rates, along with the OIS curve, are shown in Figure 6.

With the discount rate curves available, two calculations were performed. First, we computed the discounted value of the primary surpluses in both scenarios, to which the discounted value of the debt stock in year 2064—the end of the projection periods—was added. This value was then compared with the market value of the debt to evaluate the consistency of the market valuation with fiscal projections.

To perform this calculation, in equation (1) the equity premium and CDS discount rates were substituted for the discount factor $M_{t,t+h}$, while the primary surpluses were used as the cash flows. Second, we evaluated whether the market was correctly pricing the cash flows associated with the

coupon and principal repayments of traded government securities. This calculation included only traded government securities, which had a market value of ¥1233 trillion as of October 6, 2024, according to Bloomberg.

Additionally, for this second evaluation, we computed the internal rates of return (IRR) consistent with the discounted value and market value of government debt, respectively, by solving:

$$0 = \sum_{t=0}^{T} \frac{pb_t}{(1+IRR)^t} - D_0, \tag{3}$$

where D_0 was set first to the discounted value of the debt and then to its market value. The IRR derived from the market value may differ from the IRR based on the discounted debt value. This difference could reflect the market's valuation of the services provided by government debt, such as seigniorage and its role as a liquid, safe-haven asset. Alternatively, it might indicate market mispricing, with the gap representing the additional potential cost the government could face to service its debt if prices realign with fundamentals. Determining the primary driver of this IRR difference likely requires evidence beyond the DSA itself.

4.2.2 Results

We first assume that only the primary surpluses are used to offset the gross debt of the general government under both the baseline and optimistic scenarios (Table 1). This is a highly conservative assumption, as it implies that government's substantial assets are never used to service debt payments (Figure 7).

Table 1: Key findings in asset pricing approach, in trillion yen

	Market value	Discounted cash flow	Discounted primary balances and debt projections	
			Baseline	Optimistic
	(1)	(2)	(3)	(4)
OIS + CDS	1233	1216	690 (57.5 + 632.5)	1863.7 (461.8 + 1401.9)
OIS + ERP	1233	1236	506.6 (53.2 + 453.3)	1418.8 (414 + 1004.8)

Source: Authors' calculations.

In the baseline scenario, the discounted value of the projected primary balances was estimated at ¥57.5 trillion when discounted using the CDS discount curve, and ¥53.2 trillion when discounted using the equity premium discount curve. The corresponding discounted values of the debt stock outstanding in 2064 are ¥632.5 trillion and ¥453.3 trillion, respectively, yielding total discounted values of ¥690 trillion and ¥506.6.

If the government were to rely exclusively on primary surpluses and the outstanding debt stock,

the valuation gap between their discounted values and the market value of debt would range from 45 percent to 60 percent, depending on the discount curve used. This raises concerns about the potential risk of a large market correction in the JGB market, very similar to the risk Jiang et al. (2022) identified in the US Treasuries market. However, such a correction would also depend on bond investors assuming that only primary surpluses will be used to meet debt obligations.

It is instructive to contrast these results with those obtained by Jiang et al. (2023) for the US. Their analysis found that a debt-to-GDP ratio as high as 252 percent could be sustained and consistent with the debt market value only if fiscal surpluses were three times as high as those projected by the authorities. The US market value of debt, according to them, suggested that investor sentiment and perceptions were the main drivers for the apparent mispricing of the debt. Under the baseline scenario, Japan faced a similar situation and could have encounter serious fiscal challenges if market conditions had deteriorated.

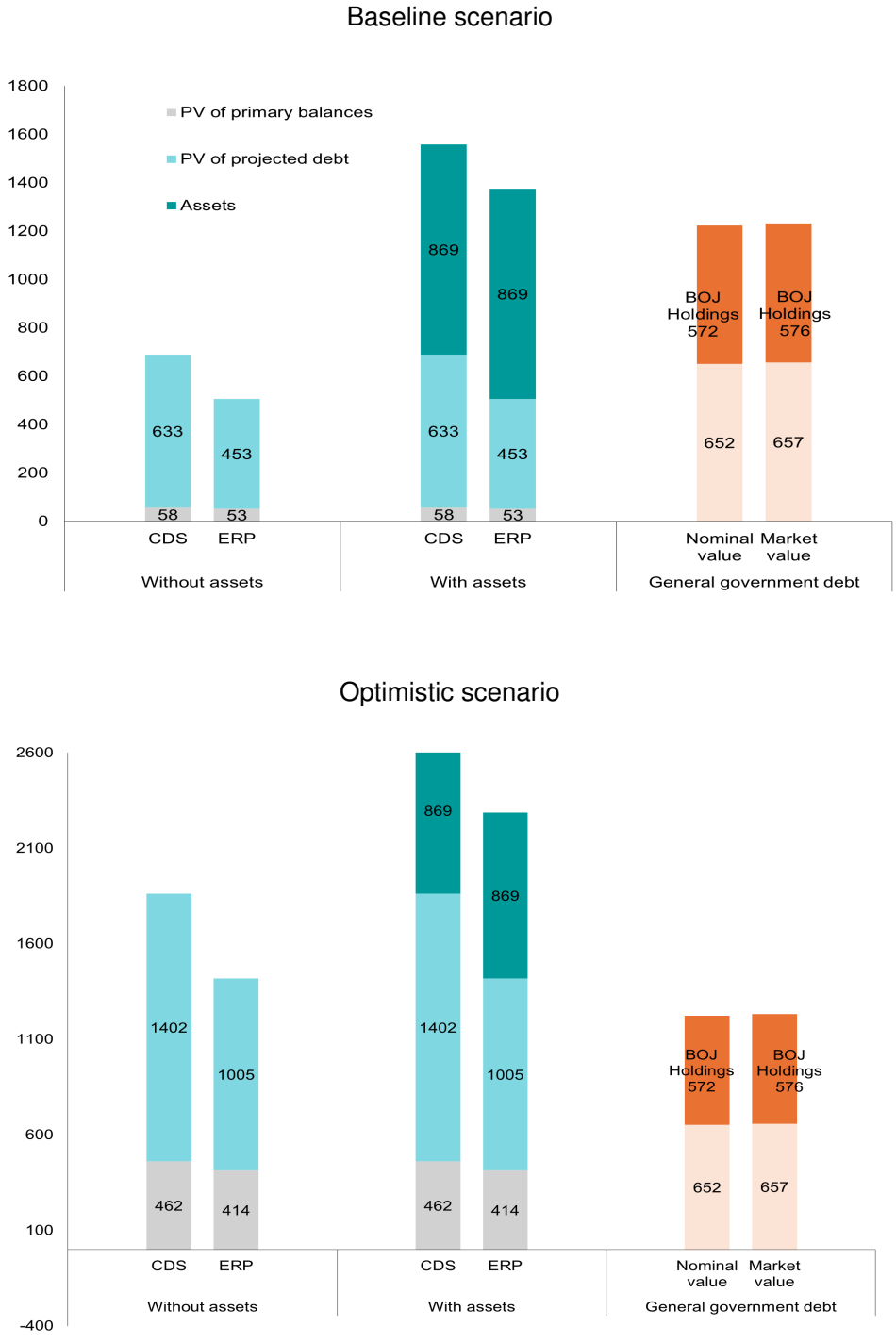
However, the risks disappear altogether under the optimistic scenario. The total discounted values of the primary balances and the outstanding debt stock were ¥1864 trillion and ¥1419 trillion, respectively, when discounted using the CDS and ERP discount curves. In this case, Japan's fiscal space becomes evident, as the market value understates the total discounted values by 12 percent and 34 percent, depending on whether the CDS or the ERP discount curve is used.

Beyond analyzing discounted primary surpluses, we also examined discounted cash flows and compared them to the market value of debt. Our findings revealed no significant discrepancies between the market value of debt and the discounted cash flows, regardless of whether the ERP or CDS discount rates were applied. The resulting estimates were ¥1,216 trillion (1.5 percent below the market value) and ¥1,236 trillion (0.2 percent above the market value), respectively. This suggests that investors believe the debt is priced appropriately given the current risk environment and expected future payments—a belief that might be supported by two assumptions: first, the government's substantial asset holdings minimize the risk of a sovereign default; and second, the government does not necessarily have to redeem the sizable debt owed to the Bank of Japan. In the following paragraphs, we examine whether the data supports these assumptions.

When taking into account the large holdings of assets by the government, we find a more optimistic outlook. Figure 7 illustrates the results for each scenario through three key visualizations: (i) the discounted values of the primary surpluses and projected debt (left panel); (ii) the resulting buffer after incorporating the Q3 2024 value of general government assets (middle panel); and (iii) the market value of outstanding government debt, broken down into debt held by the BoJ and debt held by investors (right panel).[12]

12. The results in Table 1 compare the values shown in the left and right panels in Figure 7.

Figure 7: Key findings in asset pricing approach with assets, in trillion yen



Sources: Authors' calculations; Japan Ministry of Finance; Bank of Japan; Cabinet Office; Bloomberg; CEIC.

When general government assets are included to meet debt obligations, government buffers in the baseline scenario exceed the market value of debt—reaching ¥1,559 trillion and ¥1,375 trillion under the CDS and ERP discount rates, respectively—comfortably surpassing the market value of debt at ¥1,233 trillion. Moreover, the buffers are large enough to pay both the private debt holders as well as the BoJ. Under the optimistic scenario, the buffers are even larger - ¥2733 trillion and ¥2288 trillion under the CDS and ERP discount rates.

To place these results in the context of the DSA, we computed the IRRs implied by the market valuation of the debt (1.31 percent), the equity premium valuation (1.49 percent), and the CDS valuation (1.28 percent), all of which are very similar and about twice the value of the 0.7 percent effective interest rate reported in the AMRO DSA in 2024. The lower IRR in the DSA suggests that the government had previously issued debt at relatively low interest rates, keeping current debt servicing costs manageable. This difference is largely due to Japan's prolonged low-interest-rate environment before 2022, which provided favorable borrowing conditions. However, the higher market-implied rates signal that new borrowing may come at a significantly higher cost than existing debt. Consequently, as market rates continue to rise, the government could face increasing refinancing costs in the future. This is consistent with the projected effective interest rate that is expected to rise to 1.3 in 2033.

In summary, our findings suggest that Japan's fiscal position, while appearing precarious under the conservative assumption that only primary surpluses service debt, improves significantly when government assets are considered. The market value of debt aligns closely with its discounted cash flows, indicating investor confidence in Japan's ability to meet obligations. This confidence likely stems from two key assumptions: that the government's substantial asset holdings provide a backstop against default, and that debt held by the BOJ does not necessarily require redemption in the same manner as privately held debt. Under the optimistic scenario, fiscal space is evident, with government buffers far exceeding market debt values. These insights highlight the critical role of investor perceptions and policy flexibility in shaping Japan's debt sustainability outlook.

5 Conclusions

Japan, among advanced economies, has the highest debt-to-GDP ratio, which leads to examining whether its debt will be sustainable going forward. We studied this issue from two complementary perspectives, the conventional DSA approach and the asset pricing approach. The DSA suggested that the high public debt levels and gross financing needs, which currently exceed international benchmarks, have not yet posed substantial risks to debt sustainability because there are several mitigating factors, including the debt's long-term maturities, little debt issued in foreign currency, and a stable domestic investor base. However, with public debt projected to increase steadily in both baseline and shock scenarios, the importance of gradual fiscal consolidation remains crucial.

The asset pricing analysis suggested that under the authorities' baseline scenario and assuming that only primary surpluses are used to cover the debt service, complacency is not warranted: the discounted value of the primary surpluses and the long-term debt-to-GDP ratio target largely exceed the then–current market debt valuation. This could subject the country to the risk of a drastic market correction if debt investors reprice their debt holdings and are forced to rebalance their portfolios.

This adverse outcome, however, seems unlikely once government assets are included in the analysis as the fiscal outlook improves significantly. The resulting buffers after including government assets exceed the market value of the debt in both the baseline and optimistic scenarios, indicating a stronger financial position than previously assumed. This seemed to be the view of the market consensus: despite the high debt-to-GDP ratio, the country had always been able to roll over its debt with ease, and the market value of its debt was aligned with the discounted principal and coupon payments when discounted using the sovereign risk premia implied by the CDS market. Moreover, the buffers available to the government covered both the debt owed to the BoJ and private debt holders. Finally, under stress conditions it was likely that the government might defer payments to the BoJ to be able to pay back other debt holders first, which further contributed to the market view of JGBs as default-free assets.

The seemingly sanguine market view should not be taken for granted, as investor sentiment can shift rapidly as market conditions change. This was evident in 2024 when changing investor sentiment triggered a massive unwinding of the yen carry trade (Aquilina et al. 2024, Shi and Pande 2024). In addition, according to Japan Ministry of Finance (2024), many of the government assets are either not readily marketable or could lose significant value in a fiscal crisis. Hence, steering the economy toward the optimistic scenario should remain a policy priority. Japan has benefited from stable debt dynamics supported by past central bank policies and strong domestic investor demand. However, these conditions should not be taken for granted. As the Bank of Japan gradually shifts away from its prolonged accommodative stance, rising interest rates could increase borrowing costs and introduce new fiscal challenges. Even if markets remain accommodative and tolerate deviations from fiscal fundamentals for an extended period, this will only amplify future risks.

In the future, Japan's ability to maintain debt sustainability will depend on a combination of prudent debt management, revenue-enhancing strategies, and structural reforms. Incorporating government assets into fiscal planning strengthens Japan's position, but maintaining investor confidence requires proactive measures. Transparent fiscal governance, clear communication with market participants, and policies that promote long-term economic growth will be crucial to mitigating volatility. In conclusion, while Japan's debt sustainability remains resilient for now, the evolving economic landscape necessitates continued vigilance. Policymakers must strike a delicate balance between maintaining fiscal credibility and managing economic growth, ensuring that Japan's fiscal framework remains robust in the face of mounting global economic and geopolitical uncertainties.

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