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Japan's Debt Puzzle: Sovereign Wealth Fund from Borrowed Money

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Abstract

We analyze the risks associated with Japan's prolonged low-interest rate policies amid a global environment of rising rates. To finance its persistent deficits, the Japanese public sector depends on inexpensive domestic funding to invest in risky assets both domestically and internationally, effectively creating a sovereign wealth fund fueled by borrowed money. Ultimately, these risks fall on Japanese bondholders, depositors, and taxpayers. While the U.S. faces similar fiscal pressures, it is unlikely to adopt Japan's approach.

JEL Classifications: G12, E62
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1 Introduction

Japan presents a striking puzzle in public finance. Government debt exceeds 200 percent of GDP, budget deficits have persisted for decades, and economic growth has been sluggish. Yet inflation has remained subdued, and no major debt crisis has emerged. Understanding how Japan has managed to defy standard debt sustainability logic is the starting point for our analysis.

The key lies in the Japanese public sector's operation of a de facto sovereign wealth fund. Unlike countries such as Norway and Saudi Arabia, which fund such vehicles with national savings from natural resources, Japan finances its investments largely through domestic borrowing at very low floating interest rates. While the risk premia on these investments have generated strong returns over the past two decades and supported debt sustainability, this strategy exposes the government to considerable interest rate and exchange rate risks, which are especially salient in an environment of rising rates. In this paper, we explore these risks and discuss lessons from the Japanese experience with a high debt to GDP ratio for other advanced economies, including the United States.

Advanced economies around the world are experiencing a demographic transition and a secular slowdown in long-term economic growth rates. Japan is at the leading edge of this transition (See United Nations, World population prospects). As the growth rate of the Japanese economy has slowed and its population has aged more quickly than expected, the Japanese government has run large budget deficits over the past three decades. These deficits are primarily driven by large transfer payments, especially to older Japanese households. The debt-to-GDP ratio in Japan has grown to more than 200 percent in 2023, which is the highest among advanced economies (See OECD General government debt dataset).

This essay begins with an overview of how Japan accumulated so much debt. We then

turn to a consolidated balance sheet of the entire Japanese government sector, including the annual government budget, various government funds including the public pension funds, and the central bank, the Bank of Japan. We show that Japan's government runs, in effect, a sovereign wealth fund on borrowed money, using a substantial share of its extremely high levels of debt to fund the purchase of risky financial assets. Japan's government keeps its costs of borrowing very low, by methods that include the extraordinary monetary easing policies of the Bank of Japan and favorable regulatory treatment for Japan's financial institutions that hold government debt. Yields on Japanese government bonds have remained among the lowest in the world for decades. The Japanese government has used its cheap domestic funding to take highly levered, long positions in risky assets, including foreign equities and bonds. This strategy involves absorbing a number of risks, including risks of movements in interest rates, exchange rates, and equity prices. But over the past decade, the government has earned an additional 6 percent of GDP per annum above its funding costs by investing in risky assets. Even though low-interest-rate policies and the risk premia earned from risky investments help debt sustainability, the Japan's government cannot make the risks disappear, and so they ultimately have to be borne by its taxpayers, bondholders, and bank depositors.

The United States faces growing fiscal pressures similar to those Japan encountered decades ago, with rising government debt and persistent deficits driven by budgetary reactions to events like the global financial crisis of 2008-09 and the Covid pandemic, as well as longer-term trends of an aging population and increasing social security and healthcare costs. Could the US run a sovereign wealth fund and address its government debt burden with borrowed money? We will explain why the United States is unlikely to replicate Japan's model.

How Did Japan Accumulate So Much Public Debt?

As of 2023, Japan's debt-to-GDP ratio surpassed 200 percent, the highest among advanced economies. This substantial public debt stems from decades of persistent fiscal deficits and prolonged economic stagnation, primarily driven by demographic aging. Moreover, its accumulation of debt reflects intricate dynamics between fiscal authorities, the central bank, the social security fund, and other public institutions. This section outlines the historical context and key policy decisions that have shaped Japan's rising debt burden.

Aging Population and Growing Social Security Deficits

Japan's demographic transition started earlier than in other countries. Its fertility rate fell below the replacement level of 2.1 children per woman in the mid-1970s. Over the following decades, Japan's fertility rate continued to decline steadily, while its life expectancy increased. By 2001, the proportion of the population aged 65 and older had reached 18.4 percent, a level comparable to that of the United States in 2024 (based on World Bank estimates.). Over the past two decades, the aging of Japan's population has accelerated. As of 2024, 30 percent of Japan's population is 65 or older, and projections indicate this share will rise to 36 percent within two decades. Japan's total population peaked in 2010 and has since begun to decline. The combination of an aging society and a shrinking workforce has significantly contributed to Japan's prolonged economic stagnation (Fernández-Villaverde, Ventura, and Yao, 2025).

In Japan, "social security" refers to a suite of programs that includes public pensions for the elderly, but also health insurance, services for the elderly and disabled, unemployment insurance, maternity leave and day care, and safety net programs for those with low incomes.

The funding for these programs comes from a mixture of earmarked taxes on wages, as well as general revenues and government borrowing. As Japan's population continues to age and economic growth remains subdued, the annual social security deficit has expanded sharply since 2000, rising from 4.1 percent of GDP in 1998 to a peak of 9.4 percent in 2011 before moderating slightly to 7.6 percent in 2023. In response, the Japanese government introduced social security reforms in the early 2010s. These reforms sought to control medical expenditures, to extend social security coverage, especially for non-regular workers, and to boost labor force participation among women and the elderly. While these measures helped slow the growth of the deficit, it remains substantial, hovering around 8 percent of GDP.

In comparison, since 1998, Japan's general government has run an average primary deficit of 5.1 percent of GDP. Notably, this figure is smaller than the social security deficit, implying that, excluding social security expenditures, the Japanese government would have maintained a fiscal surplus. Despite fiscal consolidation efforts, including two consumption tax hikes in 2014 and 2019, the primary deficit remains significant and insufficient to restore fiscal balance.

Evolution of Public Debt and Growth of the Social Security Fund

Japan's persistent primary fiscal deficits have been financed by a rise in government debt, which has increased by 125 percent of GDP since 1997. The evolution of general government debt since 1997 closely mirrors the cumulative primary fiscal deficits, which amount to 133 percent of GDP. The debt is financed in part by bond issuance, but central and local governments have historically relied on loans and intergovernmental financing. Before 2000, the Japanese government relied on the Fiscal Investment and Loan Fund (FILF), a large state-run lending program, as a major source of funding (Doi and Hoshi, 2002). In turn, FILF was

funded automatically by deposits from the social security fund and Japan's "postal savings bank." Most Japanese households traditionally did not participate in financial markets directly, but instead saved in deposits. One of the largest deposit-taking institutions was run by Japan's Postal Service. FILF then used this stable low-cost funding for public investment projects and to provide targeted loans. By the late 1990s, its loan portfolio had surpassed 100 percent of GDP, in part because Japan's postal savings bank had become the world's largest deposit-taking institution. However, as Japan moved to privatize the postal savings bank in the early 2000s, FILF's access to this low-cost funding source declined. Although the program remained sizable, its operations shrank significantly, with its asset position falling from 107 percent of GDP in 1997 to 51 percent in 2012. After the privatization of the postal savings bank in 2007, the Japanese government increasingly turned to bond markets where it had to pay higher interest rates, further driving up public debt.

To finance large social security deficits, the Japanese government chose to issue bonds rather than drawing down social security reserves. Thus, despite persistent and substantial social security deficits, the public pension fund continued to grow over time, with its net asset position rising from 36 percent of GDP in 1997 to approximately 60 percent in 2024. Had the government used these reserves to offset deficits instead of issuing bonds, the level of outstanding public debt would be significantly lower.

This policy decision appears to be linked to shifts in the portfolio strategy of the social security fund. In 1997, over two-thirds of its assets (equivalent to 27 percent of Japan's GDP) were invested in Japan's Fiscal Investment and Loan Fund (FILF). However, as FILF transitioned to bond market financing, the social security fund adjusted its holdings, reducing direct lending to FILF from 27 percent of GDP in 1997 to 4.3 percent in 2012 while increasing its holdings of Japanese government bonds from 2.4 percent to 16 percent of GDP. In effect,

although the social security fund decreased direct financing to FILF, it continued to provide capital indirectly through Japanese government bond markets.

Since 2012, the social security fund has increased its exposure to riskier assets. In 2013, a government panel recommended a major reallocation of government-run pension funds into higher-yield investments (Hoshi and Yasuda, 2015). Following this shift, three-quarters of public pension fund assets were allocated equally across three categories of risky assets: domestic equities, foreign equities, and foreign bonds (each at 25 percent). Over the past decade, these investments have generated strong realized returns, boosting the net asset position of public pension funds from around 40 percent of GDP to over 60 percent of GDP.

Unconventional Monetary Policy of the Bank of Japan

Japan has been stuck in a low-growth regime since the early 1990s. After some years of attempting to stimulate the economy with large budget deficits and low interest rates, in April 1999 the Bank of Japan made the bold commitment to holding short-term rates at zero until deflationary concerns were dispelled. In 2001, the Bank of Japan took an additional step and started large-scale asset purchases to stimulate the economy—and also coined the phrase "quantitative easing" to describe this policy. Its main stated objective was to increase bank reserves, with the assumption that banks would deploy these reserves in lending to firms and households. Just as Japan completed the liberalization of its capital markets, the Bank of Japan intensified its large-scale asset purchases as part of the ambitious government spending program since 2012 referred to as "Abenomics," after the name of then-Prime Minister Abe Shinzo. In effect, the Japanese government replaced the cheap funding it had obtained through the postal savings bank before capital-market liberalization with bank reserves held at the Bank of Japan.

In 2016, the Bank of Japan shifted to a policy of explicit "yield curve control," which refers to managing the yield paid on bonds of different maturities. In this case, the bank announced a willingness to purchase bonds as needed to impose a target for the 10-year yield of zero percent. The hope was that by announcing the target, bond markets would gravitate to this target yield with only modest intervention needed. However, this scenario did not materialize. Over the past decade, the Bank of Japan has purchased more long-dated Japanese government bonds each year than the total annual issuance. By the end of 2023, the Bank of Japan owned ¥581 trillion (nearly $4 trillion in US dollars) in long-dated Japanese government bonds, more than half of outstanding Japanese bonds. In this way, Japan's government removed all interest rate ceilings as part of capital market liberalization, but then it effectively imposed a new cap on interest rates through yield curve control. This large expansion of the Bank of Japan balance sheet blurs the line between the central bank and public financial institutions, making it essential to view these entities as a whole.

Sovereign Wealth Fund with Borrowed Money

Japan's public sector runs a risky sovereign wealth fund funded with money borrowed at very low rates through various channels. To get a complete picture of Japan's fiscal position, we need to (i) go beyond central and local governments to include public pension funds, public financial institutions, and the central bank; (ii) conduct a comprehensive assessment of all liabilities including other borrowing instruments, such as government loans; (iii) account for the public sector's assets and their portfolio composition. The public sector of Japan holds large positions in risky assets, and their returns fluctuate based on investment strategies. Evaluating fiscal positions solely through the lens of gross government debt can present a

highly distorted picture of the overall fiscal health of the country.

Consolidated Public Sector Balance Sheet

To develop a better understanding of Japan's public finances, we analyze the consolidated balance sheet of the Japanese public sector, following the work by Chien, Cole, and Lustig (2023). The consolidated government includes the Bank of Japan, public financial institutions, and the general government, which consists of the central government, local governments, and the public pension funds. Table 1 provides a snapshot of the consolidated balance sheets in the last quarter of 1997 and 2012, as well as the second quarter of 2024. The first and last dates were chosen to represent the start and end of our dataset. The end of 2012 marks the beginning of the significant policy shift implemented under "Abenomics." All numbers are expressed as a percentage of GDP.

The total size of the public sector's balance sheet has expanded significantly over the past 27 years. In 1997, financial assets were 135 percent of GDP and total liabilities at 160 percent of GDP. By 2024, financial assets and total liabilities rose to 192 percent and 270 percent of GDP, respectively. More than half of these financial assets were invested in risky securities. These risky assets include a long position worth 62 percent of Japan's GDP in foreign securities and another one worth 42 percent of GDP invested in domestic equities. To fund these risky investments, Japan's government issued short-term bills and longer-term bonds (104 percent of GDP) as well as drawing on bank reserves (91 percent of GDP). Between 2012 and 2024, the Japanese government reduced its outstanding debt in the bond market from 162 percent of GDP to 104 percent of GDP and instead issued bank reserves, thus mostly borrowing from banks at the policy-determined rate instead of borrowing from bond market investors at market-determined yields.

The risky investments in the public sector are mainly undertaken by the Japanese public pension funds, starting in 2012. Between 2012 and 2024, the domestic equity position of these funds increased from 4.4 percent of GDP to 13.5 percent of GDP and their foreign investment rose from 7 percent of GDP to 27.7 percent of GDP. During the same period, the Bank of Japan also rapidly increased its risky asset position from less than 1 percent of GDP in 2012 to 12.6 percent of GDP. These risky long positions (including domestic equities and foreign securities) are shown in the consolidated government balance sheet in Table 1, which grew from 18 percent GDP to 51 percent GDP from 1997 to 2012 and then rapidly increased to 104 percent GDP in 2024. The government's equity position, equivalent to 42 percent of GDP, is equal to about two-thirds of the total equity holdings of all Japanese households combined (as will be discuss later in the paper and show in Table 3). Since 2012, Japan's government has increased its exposure to equities by 100 percent, and it has increased its exposure to foreign risky assets by more than double.

The composition of liabilities of these funds has changed significantly over the past three decades. In 1997, around 46 percent of GDP in funding came from deposits with the postal savings bank through Japan's Fiscal Investment and Loan Fund. In 2001 Japan abolished the requirement that the postal bank provide funding to FILF, and as this source of FILF funding gradually dried up, the Japanese government issued more government bonds and other fixed income securities instead. From 1997 to 2012, the funding from postal savings deposits through FILF declines from 46 percent of GDP to only 1 percent of GDP, while the outstanding stock of Japanese government bonds rose from 42 percent to 162 percent of GDP.

The unconventional monetary policy conducted by the Bank of Japan plays an important role in the evolution of the public sector balance sheet. As a result of quantitative easing and

yield curve control, the Bank of Japan has purchased a significant portion of the government's longer-maturity debt, primarily funded by the creation of reserves held at the Bank of Japan. After 2012, the government fully replaced the Fiscal Investment and Loan Fund deposits with bank reserves held at the Bank of Japan as a source of cheap domestic funding. In the second quarter of 2024, the Bank of Japan held long-term government bonds equivalent to 93 percent of GDP (recorded as –93.3 percent of GDP in Table 1 on the consolidated public sector liability side). This position offset government debt in the consolidated balance sheet, reducing the debt held by the public to just 103.8 percent of GDP. Without holdings by the Bank of Japan, outstanding government bonds and bills would approach 200 percent of GDP. Meanwhile, the central bank bond purchases were largely matched by an expansion of bank reserves, which stood at about 91 percent of GDP in 2024. In other words, through central bank bond purchases, government securities amounting to 91 percent of GDP were converted into overnight bank reserves on the consolidated public sector balance sheet.

On the public sector balance sheet expressed in market values, total liabilities minus the financial assets equal the net liabilities, which have to be backed by the present discounted value of future primary budget surpluses (provided that a "no-bubble condition" holds). The net liabilities of the public sector are reported in the last row of Table 1. As a result of the growth of its financial assets, the net liabilities have only grown from 24.7 percent in 1997 to 52.9 percent in 2024. In fact, Japan's net liabilities decreased over the past 10 years from 118.4 percent to 77.6 percent. However, these gains have come from taking risks: in particular, the risks of duration mismatch and currency mismatch.

Duration Mismatch

The current composition of the Japanese public sector holds risky long-duration assets, such as equities, equivalent to 102.5 percent of GDP, while a large fraction of its liabilities consisted of short-duration instruments. More than 40 percent of its liabilities have zero duration: that is, 91 percent of GDP was held in reserves at the Bank of Japan, and another 20 percent of GDP in cash. Government short-term bills and longer-term bonds accounted for only 104 percent of GDP. As a result, the Japanese government has engineered a sizable duration mismatch on its consolidated balance sheet. It borrows primarily at floating rates while investing in longer-duration, risky assets to harvest risk premia, resulting in a duration mismatch.

According to the workhorse expectations hypothesis of the term structure of interest rates, borrowing short-term to invest in long bonds when the yield curve is upward-sloping will not yield higher returns, because the slope of the yield curve signals higher short-term rates ahead, making the expected return on long-term bonds equal to the expected cost from rolling over short-term borrowing. But the expectations hypothesis fails in the data, and the "naive strategy" of chasing high yields along the yield curve works, but it is risky (see, e.g., Campbell, 1995). Investors who buy longer-dated bonds when the yield curve slope upwards harvest the term premium, which compensates them for the interest rate risk they are taking on.

To understand the duration risk exposure of financial assets and liabilities for Japan's government, we estimate the duration of each type of financial asset in the government's balance sheet.

Currency, deposits, and bank reserves have zero or near-zero duration. For all loans on the government's balance sheet, we assume a duration of three years. The duration of

equities is perhaps a less familiar idea, but just as the duration of a bond is determined by the time it takes for the present value of the bond to be fully repaid, the duration of an equity is the time it takes for the present value of the equity to be repaid—which in turn will depend on the dividends paid by the stock. A shorter-duration equity will have higher near-term dividends; a longer-duration equity is expected to pay back its value later in the future. The Gordon (1959) growth model is the standard formula for inferring the duration of an equity from its expected flow of dividends. For the price-to-dividend ratio of Japanese stocks, we use the Jorda-Schularick-Taylor Macro-history database (Jordà et al., 2019). Using the Gordon formula, the average duration for Japanese stocks over this period is 75.6 years, a high value reflecting the elevated valuation ratios of Japanese stocks during this time. For government bonds, we use the effective duration as caculated by the ICE-BofA Japan Government index, which averages 7.19 years over our sample period. The duration of FILP deposits is calibrated to one year.[1]

Foreign securities primarily consist of two components: 1) foreign reserves; and 2) securities held by social security funds. For social security foreign securities, we calculate a weighted average duration based on US stocks (59 years) and bonds (7.19 years). Given the 50/50 portfolio allocation of Japan's social security fund, the resulting duration is 33 years. The portfolio composition of Japan's foreign reserves, mostly held in the form of US Treasury debt, is not publicly available. We approximate its duration using the average maturity of foreign official holdings of US long-term debt, which is approximately 8.5 years. The Treasury International Capital (TIC) data indicate that most of Japan's holdings of US Treasury debt are long-term. For instance, in January 2023, Japan held approximately

[1]Our duration calculation excludes other assets and liabilities for two reasons. First, their durations are difficult to estimate without detailed portfolio information. Second, their shares are relatively small compared to the overall balance sheet.

$1.1 trillion in US Treasury securities, but only $72 billion in T-bills (as shown at the US treasury report: Foreign Portfolio Holdings of U.S. Securities)

Putting these estimates together, and using the portfolio reported in Table 1, we can then calculate the duration of the consolidated balance sheet. In the second quarter of 2024, the duration of its risky asset position is around 24.5 years. The high duration is mostly due to its equity position. The duration of its liabilities is quite short, only 3.2 years. The short duration of its liabilities is a direct result of the quantitative easing and yield curve control policies adopted by the Bank of Japan.

The "net duration" is the weighted average of asset and liability duration. The consolidated government has a net financial liability position of 77.6 percent of GDP in 2024, the net result of a debt position of 270 percent of GDP, and an asset position of 192.4 percent of GDP. As a result, in the perspective of net liability position, the smaller asset position contributes more negative duration than the positive duration contributed by its larger debt. This means that the duration of the government's net liability position is large and negative. In 2024, the public sector's asset duration is 49 years longer than its liability duration, leaving the liability duration equal to -49 years. As a result, increase in Japan's interest rates by 100 basis points reduces Japan's asset value more than its liability value, increasing its net debt by 49 percent. Given the 2024 net liabilities position at 77.6 percent of GDP (Table 1), a 49 percent rise in net debt is about 38 percent of GDP. This is mainly due to the long position in high-duration risky assets.

Any primary budget surpluses for Japan are far in the distant future (for more detailed analysis, see Chien, Cole, and Lustig (2023)). Hence, an increase in Japan's interest rates increases the market value of its net debt, because the value of its financial assets declines by more than the value of its debt, but greatly reduces the present discounted value of

surpluses. As a result, Japan would come under heavy pressure to cut spending and/or to increase taxes. In short, interest rate increases destroy fiscal capacity in Japan. To avoid this duration mismatch, Japan would have had to align the duration of its net debt with the duration of its future surpluses by issuing lots of long-term debt, thus locking in low long yields.

Currency Mismatch

In addition to duration risk, Japan's public sector is heavily exposed to currency risk. The Japanese public sector is engaged in a global currency "carry trade," which refers to trades in which an investor borrows in low-interest-rate currencies and invests in high-interest-rate currencies without hedging the currency risk. According to the theory of uncovered interest rate parity, this naive strategy of chasing high interest rates will not yield high returns, because these currencies will depreciate, but, in the data, this naive strategy does work. The empirical evidence shows that low-interest-rate currencies do not appreciate sufficiently against high-interest rate currencies to offset their interest rate differentials, making carry trades consistently profitable on average (Lustig, Roussanov, and Verdelhan, 2011; Hassan and Mano, 2019). Currency carry trade investors harvest the currency risk premium, which compensates them for the currency risk they are taking on. In bad times for global investors, high interest rate currencies depreciate against low interest rate currencies.

Japan's government borrows at low short-term rates in Japanese yen, a typical funding currency for carry trades, and invests 62 percent of GDP in risky foreign assets without hedging currency risk.[2] This currency carry trade has been associated with large gains for

[2]This currency exposure compounds the duration risk, as the Japanese yen tends to depreciate in real terms when Japanese long-term real interest rates decline below foreign rates (Lustig, Stathopoulos, and Verdelhan, 2019).

Japan's public sector balance sheet over the past three decades, as the Japanese yen has depreciated by 47 percent in real terms since 1997 (according to the Bank of International Settlements data).

As shown in Table 1, the public sector's net exposure to foreign securities was equal to 62 percent of Japan's GDP in 2024. Of this, an amount equal to 27.7 percent of GDP was held in foreign securities by public pension funds, primarily through the Government Pension Investment Fund. Notably, the GPIF maintains a near-zero hedge ratio on its dollar-denominated assets, as documented in Du and Huber (2024), leaving public sector finances highly vulnerable to exchange rate fluctuations.

Decades of ultra-low interest rates have cemented the Japanese yen as a canonical funding currency in global carry trade. The funding currency refers to the low-interest-rate currencies you borrow in to implement a currency carry trade. This strategy is highly sensitive to shifts in global risk appetite and monetary policy expectations. The sheer scale of Japan's public sector holdings makes it the world's largest carry trade investor, borrowing in yen-denominated liabilities and investing in higher-yielding foreign securities, predominantly denominated in US dollars. Indeed, the Japanese government's total foreign investments of $2.5 trillion dwarf existing estimates of the total yen-funded global carry trade by private investors. For example, Aquilina et al. (2024) provides a rough estimate (acknowledging that significant data gaps remain) of approximately $250 billion in yen carry trades by private investors.

While carry trades have been profitable on average, and the yen's substantial depreciation over the past decade has benefited Japan's public sector balance sheet, the currency position of the Japanese public sector entails considerable risk. Assuming the public sector's foreign currency exposure is entirely unhedged, a 10 percent appreciation of the yen would result in

a valuation loss equivalent to 6.2 percent of GDP on its foreign currency portfolio.

This is not a free lunch. Rising interest rates in Japan would reduce the attractiveness of borrowing in yen, potentially triggering a major unwinding of global carry trades and a sharp yen appreciation. A reversal in carry trades can trigger a feedback loop of heightened global market volatility and reduced risk appetite, which further accelerates deleveraging and the unwinding of carry positions. The market turbulence in the summer of 2024 underscores this dynamic. Following the Bank of Japan's unexpected interest rate hike on July 31, 2024, the yen appreciated sharply, while the Japanese stock market plummeted by 12 percent in a single trading session. These developments had broader effects on the global financial markets. Global equity markets and digital assets suffered significant declines, and the Chicago Board Options Exchange Volatility Index (VIX), which measures market uncertainty by looking at option prices to infer the range of expectations about 30-day movements in the S&P stock market index, surged from 16 percent to 38 percent. Historical evidence shows a strong negative correlation between carry trade returns and global market volatility (Lustig, Roussanov, and Verdelhan, 2011).

In summary, the consolidated balance sheet of the Japanese government assumes substantial interest rate risk and currency risk. In return, it collects a combination of the term premium, currency carry premium, and equity premium on these investments. The Japanese public sector effectively operates a large sovereign wealth fund financed with domestically borrowed money. Large increases in Japan's interest rates and/or yen appreciation would cause substantial mark-to-market losses for the public sector, including the Bank of Japan, and could potentially induce a run on government-issued yen-denominated debt.

Sustainability of Public Debt?

The reasons behind the sustainability of Japan's high public debt, at least up to the present, include a combination of borrowing at low interest rates and harvesting premia on risky assets. Here, we consider whether these dynamics are sustainable in the longer run. Additionally, we explore some pricing implications for Japanese government bonds and the associated risks for bondholders.

Risk Premium and Debt Sustainability

A nation's debt-to-GDP ratio records the cumulative impact of past macro-economic events and government decisions, much like a glacier records past weather. In the spirit of Hall and Sargent (2011), the key factors are the past record of primary deficits relative to GDP (where "primary" means that interest spending on past debt is not included), the interest payments on past debt, and the nominal growth of GDP.[3]

When the real rate of return that the government needs to pay on its debt is lower than the real growth rate of the economy, the government can sustain steady-state deficits while maintaining a constant debt-to-GDP ratio. The size of the possible steady-state deficit will be determined by the gap between the government's cost of debt and the growth of nominal GDP. However, in the sample period from 1997 to 2004, Japan's real GDP grew at an average rate of -0.03 percent, while the average real return on the Japanese government bond portfolio was 1.30 percent. Thus, Japan's central government was not operating in the magical region where it can just roll over steady-state deficits at an interest rate that is below the growth rate of the economy (Blanchard, 2019; Mehrotra and Sergeyev, 2021).

However, if we start from the consolidated budget constraint for the entire public sector,

[3]For an algebraic treatment of the conditions discussed in this section, see Internet Appendix A.

which takes into account the government's holdings of financial assets and the returns on those assets, the net debt-to-GDP ratio for the public sector has some additional determinants: the accumulation of financial assets over time and the gross return on the portfolio of assets. In this setting, even if the real growth rate of GDP is lower than the real rate of return that the government needs to pay on its debt, the consolidated government can run steady-state deficits with a constant debt-to-GDP ratio, provided that both the real returns on its asset position exceed the government's funding cost, and the asset position itself is sufficiently large.

Over the past decade, Japan's public sector has realized an average annual return net of the funding costs equal to 4.6 percent Chien, Cole, and Lustig (2023). That's equivalent to a gross return of 6 percent of GDP per annum between 2013 and 2023. Because the public sector is harvesting substantial excess return, Japan's net liabilities increased by only about 53 percent of GDP (as shown in Table 1) since 1998, even though the cumulative primary deficits surpassed 133 percent of GDP. To evaluate the impact of the risk-taking strategy, we conduct a simple counterfactual exercise in which Japan does not engage in risky investments. Specifically, instead of maintaining large equity and foreign asset investment positions, Japan is assumed to allocate these holdings exclusively to 6-month Japanese Treasury bills. The results show that, under this counterfactual, the rise in net liabilities would have been similar to the data between 1998 and 2012, but would then have increased rapidly to more than 180 percent of GDP in 2024, compared with the actual level of 81 percent (see Appendix B for details). These results clearly reflect the shift toward a riskier portfolio during Abenomics.

Looking ahead, Chien, Cole, and Lustig (2023) project that the consolidated Japanese government could earn an expected return around 3.9 percent of GDP on its current risky portfolio. This nearly 4 percent of GDP, harvested in the form of risk premia, may help

explain why the expansion of Japan's government balance sheet has not led to a large inflation spike.

Where did the Risk Go?

The Japanese approach resembles a "gamble for resurrection," akin to the strategy employed by certain California municipalities facing underfunded pension liabilities (Myers, 2022), or certain financial institutions that are insolvent but not yet illiquid. The strategy is to take substantial risks, with the belief that if the risks pay off with higher returns, then the financial catastrophe can be averted. While if the risks don't pay off, the financial position was already negative, and it only becomes more so.

Can governments earn large excess returns by simply running a sovereign wealth fund with money borrowed at a low interest rate? No, not if the debt of that government is priced correctly. Governments cannot simply make risk disappear. The additional systematic risk on the asset side in Table 1 cannot be engineered away (Jiang et al., 2020), and will be priced into the cost of funding on the liability side. Ultimately, the risk on the asset either has to be borne by the bondholders of the Japanese government or by its current and future taxpayers and/or recipients of government spending.

The essential long-run condition here is that the present value of all public sector liabilities must equal to the future budget surpluses and the value of the financial assets. According to Table 1, in 2024 the present value of future Japan's total liabilities is 270 percent of GDP while the value of its financial assets 192 percent of GDP in 2024. This condition implies that the present value of future Japanese budget surpluses will be equal to 78 percent of GDP. Since this budget constraint is satisfied period by period, it implies that the gain or loss from its risky investment has to be reflected by the value of its debt or the value of

future surplus claims. In other words, the risk associated with holding risky assets must be borne by either the taxpayer through the path of future surpluses or by the bondholders through changes in the valuation of debt.

Another way to see this point follows directly from the Modigliani and Miller (1958) theorem, which implies that the risk of the government's total assets, including its future surpluses, must equal the risk of its liabilities, irrespective of the "capital structure" of the public sector balance sheet. As the consolidated government loads up on interest rate, currency, or equity risk on the asset side, the riskiness of its liabilities will increase proportionately. The only alternative would be if Japan's government offset the increased riskiness of its financial assets by reducing the riskiness of its non-financial asset, the claim to future surpluses—effectively shifting risk onto taxpayers.

In a "good state" for Japan's fiscal situation, the returns to risky financial assets remain high. But what happens in a bad state? On the one hand, if the risk is fully borne by Japanese taxpayers, then they will face a large future tax bill in bad states of the world. That seems implausible, given that surpluses in advanced economies are strongly pro-cyclical. There is no historical precedent that would rationalize expecting higher fiscal surpluses in the bad state of the world.[4] On the other hand, if the risk of a bad outcome is borne by bondholders and other creditors, a scenario that seems more likely, then they face large real losses in the future. If so, this should be reflected in a large risk premium on bonds, if the bonds are priced correctly. But Japan's government bonds are not in fact reflecting that risk premium, as we discuss in the next section.

[4]In a neoclassical model with complete markets, the allocation of risk may be irrelevant for a country's aggregate welfare, as taxpayers and bondholders perfectly share risks. In the Ricardian class of models, a single representative agent effectively serves as both the bondholder and the taxpayer, with the government investing on their behalf. However, in reality where financial market participation is low (for example, many Japanese households do not hold bonds) and taxation is distortionary, the distribution of risk matters for the overall welfare.

Sustain Low Interest Rates

The ability of Japan's public sector to sustain high levels of debt depends on stable and low funding costs from bondholders. However, governments can employ various strategies to enable borrowing at below-market interest rates. In this scenario, Japan's public sector liabilities are overpriced and do not reflect all of the risks. Reinhart, Kirkegaard, and Sbrancia (2011) refer to these measures as "financial repression." Possibilities include "macroprudential regulations" that require banks and financial institutions to hold government bonds, direct lending to the government by domestic pension funds and banks, and moral suasion to encourage domestic banks to increase their holdings of government bonds.[5]

The Japanese government has implemented a range of financial repression policies to maintain low funding costs. As discussed earlier, Japan's postal bank and public pension funds were mandated to invest heavily in the FILF program at below-market interest rates up to 2011. As financial liberalization eroded this cheap funding source, the consolidated Japanese public sector turned to large-scale asset purchases, replacing bank reserves held at the Bank of Japan with low-cost deposits from the postal savings bank and pension reserves. Because the return on these reserves is set by monetary policymakers, it does not fully reflect the risk exposure on the asset side of the balance sheet.

When looking at the consolidated fiscal position of the central government with the Bank of Japan and pension funds, approximately 90 percent of GDP in consolidated debt takes the form of reserves, compared to only 80 percent of GDP in bonds (excluding short-term bills). The interest rate on bank reserves at the Bank of Japan has averaged just 10 basis points between 1997 and 2024. Without these exceptionally accommodative policies,

[5]For a recent example of financial repression during the Eurozone sovereign debt crisis in 2011-2012, see Acharya and Steffen (2015); De Marco and Macchiavelli (2016); Ongena, Popov, and Van Horen (2019).

it is unclear whether the Japanese government could sustain borrowing above 200 percent of GDP at such low interest rates (Hansen and İmrohoroğlu, 2023; Koeda and Kimura, 2021). The public sector also benefits from a strong domestic investor base for Japanese government bonds. Panel A of Figure 1 shows that foreign ownership of Japanese government bonds remains extremely low, with non-residents holding less than 10 percent of outstanding bonds. Historically, domestic banks were the largest holders of Japanese government bonds. However, over the past decade, the Bank of Japan crowded out private investors as a result of its quantitative easing and yield curve control program. By the end of 2023, the Bank of Japan held 581 trillion yen in Japanese government bonds (excluding short-term bills), accounting for more than half of all outstanding bonds. Since the inception of the Bank of Japan quantitative easing program, banks have shifted away from Japanese government bonds, increasing their reserve holdings at the Bank of Japan instead. The combined holdings of the Bank of Japan and domestic banks have steadily grown, surpassing 66 percent in 2024. Among non-bank domestic investors, insurance companies, private pensions, and investment trusts remain the largest holders, collectively accounting for approximately 27 percent of the market.

Japanese government bonds receive favorable regulatory treatment for regulated financial institutions such as banks, pensions, and insurance companies. Given that the majority of Japanese government bonds are held by the Bank of Japan and regulated domestic financial institutions, price discovery in the Japanese bond market is likely to be significantly impaired. This distortion helps explain why interest rate and currency risks might not be fully reflected in pricing of Japanese government bonds. A growing body of evidence suggests that liquidity and price discovery in Japanese government bond markets have deteriorated over the past decade, particularly as the Bank of Japan transitioned from large-scale asset purchases to

full yield curve control (for example, Financial Markets Department, Bank of Japan, 2024). Over the past ten years, daily transaction volumes in the cash market for on-the-run (recently issued) bonds have declined, bid-ask spreads for inter-dealer transactions have widened, and most liquidity metrics of Japanese government bonds have worsened.

Lastly, despite the absence of strict capital controls and persistently low nominal interest rates in Japan, domestic financial institutions, including banks, insurance companies, and pensions, face significant costs when scaling up their overseas investments. Because these institutions primarily have yen-denominated liabilities, investing abroad requires them to either maintain substantial currency risk exposure or hedge this risk using foreign exchange derivatives. In the post-crisis regulatory environment, constrained financial intermediaries have faced increasing pressure to sell US dollars and buy back yen in forward and swap markets for foreign exchange, leading to persistent deviations (Du, Tepper, and Verdelhan, 2018; Du and Schreger, 2022). This sustained demand for yen from hedging raises the cost of hedging for Japanese investors, effectively acting as a tax on private-sector institutions seeking to mitigate foreign currency risk. As a result, the rising cost of hedging discourages domestic investors from allocating capital abroad, reinforcing a strong domestic clientele for yen-denominated assets.

Implications for the United States

Over the past two decades, the US federal government debt-to-GDP ratio has doubled, rising from approximately 60 percent of GDP in 2004 to about 120 percent in 2024. According to projections from the Congressional Budget Office in 2024, the US government is expected to run persistently large primary deficits exceeding 2 percent of GDP per annum over the next

three decades that can be traced to an aging population and rising healthcare costs, together with ever-rising interest expenses on past debt. Under this trajectory, the US government debt-to-GDP ratio is poised to continue rising.

The fiscal challenges now faced by the United States bear striking similarities to those Japan encountered several decades ago. In the early 2000s, Japan's national debt surpassed 100 percent of GDP, prompting widespread concerns that the mounting social security burden would lead to persistent fiscal deficits and, ultimately, a public debt crisis. While Japan did indeed run consistent fiscal deficits, such a crisis has yet to materialize. Instead, the Japanese public sector has strategically engineered a massive duration and currency mismatch on its balance sheet. By absorbing foreign exchange, aggregate, and interest rate risks, Japan's government has generated substantial excess returns on its risky investments. This additional income has played a crucial role in sustaining Japan's high debt levels and ongoing fiscal deficits. The Japanese experience, therefore, may potentially provide lessons as the United States navigates its own fiscal challenges.

Consolidated Public Sector Balance Sheet for the U.S.

We begin by conducting a consolidated balance sheet analysis for the United States, including the federal government, the Federal Reserve, and state and local governments, with the results reported in Table 2. Compared to Japan, the US government holds significantly fewer financial assets, amounting to just 45.7 percent of GDP in 2024. Most of these assets are concentrated in public employee pension funds or on the Federal Reserve's balance sheet in the form of equities, agency debt, and other debt securities. A substantial portion of the government's equity exposure comes through state and local public pension funds (in the table, S&L PPFs). In response to underfunded pension liabilities, US state and local gov-

ernments have increasingly leveraged their balance sheets, employing an investment strategy that parallels, in a less extreme way, Japan's approach to risk-taking (Myers, 2022; Giesecke and Rauh, 2023). Additionally, a large share of agency debt is held by the Federal Reserve as a result of its quantitative easing policies. The next most significant asset category is domestic loans, primarily student loans, which could potentially be subject to forgiveness.

Meanwhile, the public sector has borrowed extensively through debt securities, with national debt reaching 72.2 percent of GDP and municipal securities accounting for an additional 11.2 percent of GDP in 2024. Furthermore, unfunded pension liabilities across federal, state, and local governments amount to 15.2 percent of GDP. These pension liabilities are likely underestimated Giesecke and Rauh (2023), further complicating the fiscal outlook.

With total US public sector liabilities reaching 129.4 percent of GDP and a significantly smaller asset base, the US government's net liabilities amount to 83.7 percent of GDP—slightly higher than Japan's 77.6 percent of GDP. Moreover, while Japan's population has already reached an advanced stage of aging, the United States is only beginning to enter this demographic shift. These factors challenge the common assumption that Japan's fiscal challenges are necessarily more severe than those facing the United States.

The Japanese government's strategy involves borrowing at extremely low interest rates and investing in risky, high-return assets. In contrast, this is not currently the case for the United States, at least not at the federal level. The US public sector balance sheet—particularly that of the federal government—shows a smaller scale of leverage relative to Japan. In 2024, risky equity accounts for only 12.7 percent of GDP, mostly held by state and local public pension funds. Most of its agency debt, around 6.8 percent of GDP, is held by the Federal Reserve and is declining due to the ongoing quantitative tightening policy. Furthermore, the risky investment strategy employed by Japanese public pension funds is not currently avail-

able to the U.S. federal government. Unlike Japan, the US Social Security fund is restricted by the Social Security Act to holding only US Treasury securities. Because the U.S. public sector does not currently engage in a risky investment strategy similar to Japan, its current asset holdings are highly unlikely to generate a significant excess rate of return above its funding cost.

A Sovereign Wealth Fund based on Borrowed Money for the U.S.?

Could the United States duplicate Japan's strategy and sustain its high debt while running a consistent deficit? This question echoes recent proposals to establish a U.S. sovereign wealth fund (see, for example, the Plan for a U.S. SWF by the White House or the Plan to Save Social Security by Senators Cassidy et al.). Given the large net liabilities position of the US public sector (Table 2), a U.S. sovereign wealth fund would be funded by issuing additional debt, putting the U.S. on a path similar to that of Japan over the past two decades. As a result, the Japanese experience also provides insights into this issue.

As discussed earlier, the extra risks associated with the investments undertaken by sovereign wealth funds must be borne by either bondholders or taxpayers. However, it is unlikely that if bad outcome risks materializes, the government would then offload the additional costs onto taxpayers, because doing so would require raising more tax revenue during economic downturns. A more plausible scenario is that the extra risks are shifted to bondholders, who would, in turn, demand higher returns to compensate for the added risk. As a result, the returns earned by the sovereign wealth fund would be offset by higher funding costs, ultimately eliminating the positive spread. Without deliberate financial repression policies to suppress borrowing costs or significant financial market frictions, the government cannot case bondholders to lend at below-market rates. The United is would probably find

it more difficult than Japan to sustain low interest rates for government bondholders, for several reasons.

First, the investor base for U.S. Treasury bonds differs significantly from that of Japanese government bonds. As shown in Panel B of Figure 1, the Federal Reserve has reduced its holdings of Treasury securities to less than 20 percent of the total outstanding by stepping back from its quantitative tightening policy. Domestic banks now hold less than 10 percent of outstanding Treasury securities, while domestic non-bank financial institutions account for approximately 40 percent. Foreign investors hold about 30 percent of the market. Overall, the central bank and regulated financial institutions play a much smaller role in holding US Treasury securities, leaving a larger share to more price-elastic mutual funds and foreign investors. The overall liquidity of the Treasury market is significantly better than that of Japanese government bonds. These factors make a persistent mispricing of Treasury securities less likely.

Second, US households exhibit greater financial sophistication than their Japanese counterparts. Table 3 contrasts the portfolio held by the Japanese household with the US household. Japanese households hold half of their wealth in low-return demand deposits, providing the government with an abundant and inexpensive funding source. In contrast, the U.S. household allocates a much larger share of its wealth to stocks, bonds, and other long-duration assets rather than deposits. For Japanese households, a much higher share in deposits is mirrored in a much lower financial market participation rate (around 23 percent own stocks, bonds or mutual funds), compared to US households (well over 60 percent). The portfolio of Japanese households holds the key in why that the inflation rate of Japan remains low despite the massive liquidity injection by the quantitative easing and yield curve control policy by the Bank of Japan. Even if the US government is willing to implement

low-rate policies at the expense of depositors, the effect on lowering its funding cost may be smaller than in Japan, because American households seem more willing to substitute away from deposits. Consequently, US policymakers face greater challenges in employing financial repression as a tool to support its fiscal deficits.

Third, a sustained low-rate policy in the United States poses a risk to what is called the "convenience yield" on US Treasury securities—that is, the fact that many investors want to hold the securities themselves and to have immediate access to them. This convenience yield reflects the and the status of the US dollar as the global reserve currency. After Japan's decades of current account surpluses, it has one of the largest positive net external asset positions. In contrast, the US economy has run persistent current account deficits for three decades, accumulating a large negative net foreign asset position. To finance this position, the US economy relies on attracting foreign capital inflows. Given the central role of the US dollar in the international financial system, the U.S. has historically been able to borrow from the rest of the world at relatively low rates, in dollars, to fund its current account and government deficits. In the past, US Treasury bonds have benefited from large convenience yields, particularly during periods of global financial stress. However, there is evidence that these convenience yields have largely disappeared (Du, Im, and Schreger, 2018). As one sign, the the spread between Treasury yields and AAA corporate bond yields has narrowed, pointing to a deterioration of the Treasury convenience relative to other relatively safe dollar debt (for example, Gomez Cram, Kung, and Lustig, 2024). If the United States was to maintain a prolonged low-interest-rate policy that led to sustained depreciation of the dollar against other currencies, its status as a provider of safe assets could be further undermined.

Fourth, a US sovereign wealth fund is unlikely to earn substantial currency risk premia from its investments. By investing in US dollar-denominated assets on net, without hedging

this exposure, the Japanese public sector captures significant currency risk premia. However, for a US dollar-based sovereign wealth fund, the pool of foreign currencies offering higher yields, such as those of Australia, New Zealand, Canada, and emerging markets, is much more limited. Additionally, if the US public sector were to invest considerable foreign assets on net, the US private sector would need to offset these outflows by attracting even greater foreign capital inflows, given the overall large negative net foreign asset position of the US economy.

Conclusion

To keep its promises to bondholders and to Japanese transfer recipients, the Japanese government has combined low-interest-rate policies with risk-taking on the asset side. The Japanese public sector is running a highly leveraged and increasingly risky sovereign wealth fund, exposing its taxpayers, bondholders and depositors to significant interest rate, exchange rate, and equity risks. The risky investments are funded by borrowing from banks and ultimately depositors at below-market rates. This strategy has worked particularly well over the past two decades, amid a generally low-yield global macroeconomic environment. Returns on risky investments have sustained the debt-to-GDP ratio in Japan despite the lack of primary surpluses. Going forward, the sizable duration and currency mismatch on the public sector's balance sheet exposes Japan to significant mark-to-market losses that could trigger a fiscal crisis and even a run on the Japanese currency. The United States faces similar fiscal pressures but is unlikely to replicate Japan's approach. Unlike Japan, the US government has relied more on external funding to support its deficits. A prolonged policy that sought to help the federal government finance borrowing with below-market interest

rates could erode the dollar's reserve currency status and further diminish the convenience yield on U.S. Treasury bonds.

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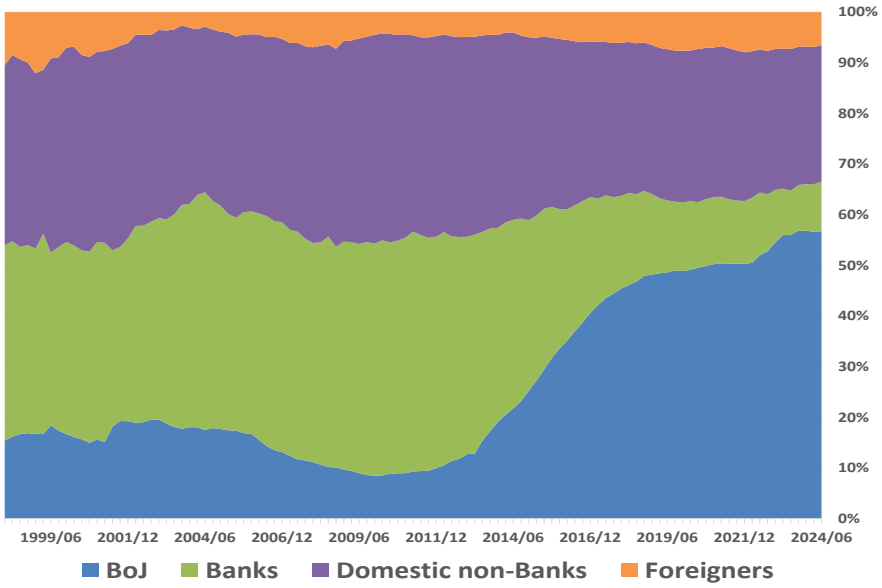
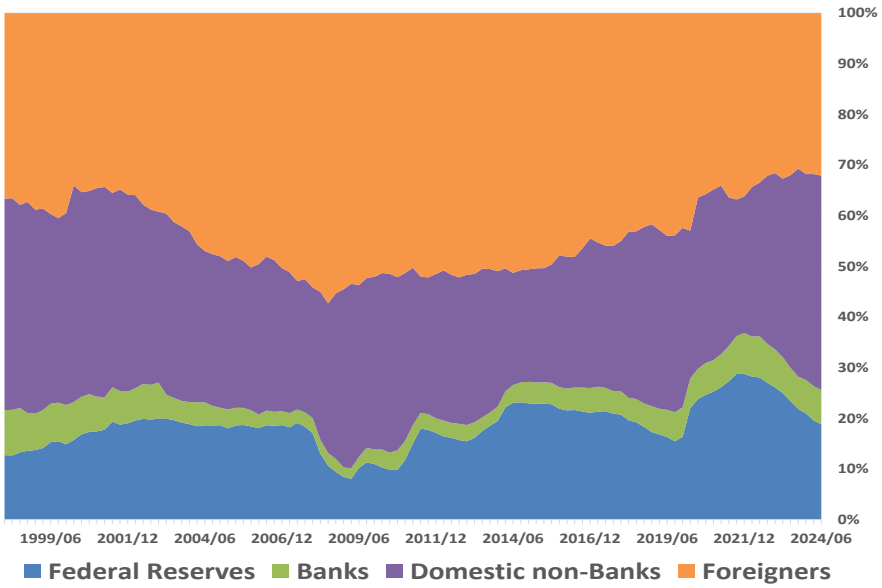
Figure 1: Public Debt Holder Comparison

(a) Japan



(b) United States



Note: The public debt considered here excludes intragovernmental holdings. These intragovernmental holders include state and local governments, public financial institutions, and public pension funds. Japan's public debt figure includes debt issued by public financial institutions, such as FILF, but excludes T-bills. Domestic non-bank holders include all other domestic investors, such as insurance companies, mutual funds, and households.

Source: Japan flow of fund, Federal Reserve Economic Data, and US Treasury Bulletin

Table 1: Consolidated Japanese Government Balance Sheet

% of GDP, Quarter End	1997Q4	2012Q4	2024Q2	Δ 97-24
Assets				
Deposits	5.9%	8.5%	19.1%	13.2%
Loans	102.8%	63.1%	63.4%	-39.4%
Of which by PFIs	92.2%	50.1%	40.0%	-52.2%
Domestic Equities	10.7%	20.9%	41.7%	31.1%
Of which by PPFs	2.4%	4.4%	13.5%	11.1%
Of which by BoJ	0.0%	0.7%	12.6%	12.6%
Foreign Securities	7.5%	29.7%	61.8%	54.3%
Of which by PPFs	1.3%	7.0%	27.7%	26.5%
Other Assets	8.4%	7.9%	6.4%	-1.9%
Sum (Assets)	**135.2%**	**130.1%**	**192.4%**	**57.2%**
Liabilities				
Currency	10.8%	18.3%	20.3%	9.6%
Bank Reserves	0.6%	9.5%	90.8%	90.2%
Bonds & T-Bills	41.8%	162.3%	103.8%	62.0%
Of which by BoJ	-9.6%	-23.2%	-93.6%	-84.0%
Loans	55.1%	48.5%	37.8%	-17.4%
Deposits FILF	46.4%	1.1%	1.5%	-44.9%
BoJ External Debt	0.0%	0.1%	7.1%	7.1%
Other Liabilities	5.2%	8.7%	8.8%	3.6%
Sum (Liabilities)	**159.9%**	**248.5%**	**270.0%**	**110.1%**
Net Liabilities	**24.7%**	**118.4%**	**77.6%**	**52.9%**

Notes: Balance Sheet in Market Values as % of GDP. The consolidated Japanese government includes central and local government, public pension funds (PPFs), Bank of Japan (BoJ), and public financial institutions (PFIs). The net liabilities—defined as the sum of liabilities minus the sum of assets—should equal the present discounted value (PDV) of primary surpluses, which represents the implied market value of claims on future primary surpluses. Source: Japan Flow of Funds and National Accounts of Japan.

Table 2: Consolidated U.S. Government Balance Sheet

% of GDP, Quarter End	1997Q4	2012Q4	2024Q2	Δ 97-24
Assets				
Deposits	5.0%	4.9%	4.3%	-0.7%
Agency Debts	2.3%	10.5%	8.8%	6.5%
Of which held by Federal Reserves	0.0%	6.6%	6.8%	6.8%
Other Debt Securities	4.3%	4.9%	3.7%	-0.6%
Loans	5.4%	8.1%	8.8%	3.4%
Equities	14.7%	14.0%	12.7%	-2.0%
Of which held by S&L PPFs	12.0%	12.0%	11.4%	-0.6%
Other Assets	3.8%	3.1%	7.3%	3.5%
Sum (Assets)	**35.6%**	**45.5%**	**45.7%**	**10.1%**
Liabilities				
Currency	5.6%	7.4%	8.6%	2.9%
Bank Reserve & Repo	0.4%	9.6%	14.2%	13.8%
Marketable Treasury Securities	29.7%	50.9%	72.2%	42.5%
Municipal Securities	12.1%	19.2%	11.2%	-1.0%
Non-Marketable Treasury Securities	4.7%	3.4%	2.1%	-2.6%
Other Liabilities	3.1%	6.5%	6.0%	2.9%
Unfunded Pension	19.9%	29.0%	15.2%	-4.6%
Sum (Liabilities)	**75.6%**	**126.1%**	**129.4%**	**53.8%**
Net Liabilities	**40.0%**	**80.6%**	**83.7%**	**43.7%**

Notes: Balance Sheet in Market Values as % of GDP. The consolidated U.S. government includes Federal government, State and local government, social security funds, public employees defined-benefit pension funds, and, Federal Reserves. S&L PPFs: state and local government defined benefit pension funds. Source: U.S. Flow of Funds and U.S. National Income and Product Accounts. The net liabilities—defined as the sum of liabilities minus the sum of assets—should equal the present discounted value (PDV) of primary surpluses, which represents the implied market value of claims on future primary surpluses.

Table 3: Japan and United States Household Balance Sheet

	Japan		U.S.	
% of GDP, Year End	1997	2023	1997	2023
Assets				
Currency and Deposits	127.6%	188.9%	43.4%	61.8%
Debt Securities	11.7%	4.8%	20.0%	20.3%
Equities	20.4%	63.4%	128.2%	196.9%
Insurance & Pension	63.1%	90.2%	112.0%	117.3%
Other Assets	12.8%	11.9%	10.6%	9.7%
Sum (Assets)	**253.7%**	**352.9%**	**314.1%**	**406.0%**
Liabilities				
Loans	64.8%	61.9%	63.2%	69.0%
Other Liabilities	10.5%	2.4%	0.2%	0.1%
Sum (Liabilities)	**75.3%**	**64.4%**	**63.5%**	**69.1%**
Net Wealth	**160.4%**	**294.8%**	**250.6%**	**336.9%**

Notes: Unit: % of GDP.
Source: Japan's Flow of Funds. Federal Reserve Board of Governors, Z.1 Financial Accounts of the United States, Table B.101.h.

Internet Appendix

A Debt Sustainability Accounting

Following Hall and Sargent (2011), we can impute variation in the debt-to-output ratio of a country to its history of output growth, inflation, and interest rates. Let G_t denote nominal government spending before interest expenses on the debt, T_t denote nominal government tax revenue. We start from the flow government budget constraint in a deterministic environment:

$$G_t - T_t + D_{t-1} R_t^D = D_t, \tag{A1}$$

where R_t^D denotes the gross return on the entire portfolio of marketable debt D_{t-1}. By iterating backwards, we obtain the following expression for the debt-to-output ratio. The debt-to-output ratio can be stated today as a function of cumulative past returns $R_{t-j,t}^D$, cumulative past nominal growth $X_{t-j,t}$, as well as past primary deficit/output ratios $\frac{G_{t-j}-T_{t-j}}{Y_{t-j}}$:

$$\frac{D_t}{Y_t} = \sum_{j=0}^{t} \left(\frac{G_{t-j} - T_{t-j}}{Y_{t-j}} \right) \frac{R_{t-j,t}^D}{X_{t-j,t}} + \frac{R_{0,t}}{X_{0,t}} \frac{D_{-1}}{Y_{-1}},$$

where $R_{t-j,t}^D = \prod_{k=1}^{j} R_{t-j+k}^D$ and $X_{t-j,t} = \prod_{k=1}^{j} X_{t-j+k}$.

When r^D, the real rate of return on debt, is lower than x, the real growth rate of the economy, the government can sustain steady-state deficits ($G > T$) while maintaining a constant debt-to-GDP ratio. This can be seen clearly in the steady state version of government budget constraint: $\frac{x-r^D}{1+x} \frac{D}{Y} = \frac{G-T}{Y}$. In our sample period, the average rate of real GDP growth is -0.03%, while the average real return on the Japanese government bond portfolio is 1.30%. The Japanese central government is not in the $r^D < x$ region where it can just roll over steady-state deficits at an interest rate that is below the growth rate of the economy (Blanchard, 2019; Mehrotra and Sergeyev, 2021).

However, if we start from the consolidated budget constraint that takes into account the returns on financial assets,

$$G_t - T_t + D_{t-1} R_t^D - A_{t-1} R_t^A = D_t - A_t \equiv ND_t$$

where R_t^A denotes the gross return on the portfolio of assets, the net debt-to-output ratio ND_t/Y_t can be stated as a function of cumulative past debt returns, cumulative past nominal growth X_{t-j}, primary deficit/output ratios $\frac{G_{t-j}-T_{t-j}}{Y_{t-j}}$, past asset position/output ratios $\frac{A_{t-j}}{Y_{t-j}}$,

as well as past cumulative excess returns between R_t^A and R_t^D:

$$\frac{ND_t}{Y_t} = \sum_{j=0}^{t} \left(\frac{G_{t-j} - T_{t-j}}{Y_{t-j}} \right) \frac{R^D_{t-j,t}}{X_{t-j,t}} - \sum_{j=0}^{t} \frac{A_{t-j}}{Y_{t-j}} \frac{R^A_{t-j,t} - R^D_{t-j,t}}{X_{t-j,t}} + \frac{R^D_{0,t}}{X_{0,t}} \frac{ND_{-1}}{Y_{-1}},$$

where $R^A_{t-j,t} = \prod_{k=1}^{j} R^A_{t-j+k}$.

The steady state version of budget constraint is modified as:

$$\frac{r^D - x}{1+x} \frac{D}{Y} = \frac{T-G}{Y} + \frac{r^A - r^D}{1+x} \frac{A}{Y},$$

where r^A denotes the real rate of return on its assets. Even if the real growth rate is lower than the real rate of return on debt, $r^D > x$, the consolidated government can run steady-state deficits ($G > T$) with a constant debt-to-GDP ratio, provided that both the real returns on its asset position, r^A exceed the government's funding costs, and the asset position itself, A, are sufficiently large.

B No-Carry-Trade Counterfactual

We conduct a counterfactual exercise to evaluate the impact of the carry trade strategy on Japan's balance sheet. Specifically, we assume that instead of investing in equities and foreign assets, the Japanese government allocates these holdings exclusively to 6-month Japanese Treasury bills. We proceed in two steps. First, using balance sheet data and the estimated return on each balance sheet item, we back out the net flow of funds into or out of asset type i using the following formula:

$$F^i_{t,t+1} = A^i_{t+1} - R^i_{t,t+1} A^i_t, \tag{A2}$$

where A^i and F^i denote the stock and flow of asset i, respectively.

Second, we assume that equities, foreign equities, and foreign bonds earn only the return on Japanese 6-month Treasury bills. The hypothetical asset position is then calculated as:

$$A^i_{t+1} = F^i_{t+1} + R^{TB}_{t,t+1} A^i_t, \tag{A3}$$

where R^{TB} denotes the return on 6-month Japanese Treasury bills. The calculation begins with the initial data point at the end of 1997, and from there uses the estimated fund flows and T-bill returns to compute the hypothetical asset position for each asset. This step is iterated forward until the hypothetical asset positions are obtained for all periods. Since the return on the liability side remains unchanged, the liability position is unaffected.

The Figure A1 presents the net liability position under both the actual data and the

counterfactual scenario. It is evident that the gap widens substantially after 2012, reflecting the large carry trade position implemented by the Japanese public sector.

Figure A1: No-Carry-Trade Net Liability Counterfactual