Sustainability of Public Debt in the United States and Japan[1]

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Introduction

This paper applies the European Debt Simulation Model (EDSM) developed in Cline (2014) to the cases of the United States and Japan. The objective of the EDSM (which for present purposes may be generalized to Sovereign rather than European, or SDSM) is to investigate whether public debt is on a path that reflects solvency or insolvency. If debt begins at a moderate level and remains stable or declines relative to GDP in the future, the diagnosis is one of solvency. If instead debt begins already extremely high and spirals ever upward relative to GDP, the diagnosis is one of potential insolvency, even if the government currently has comfortable financial market access.

I begin with a review of how the US debt burden reached its current level and a summary of the Congressional Budget Office's baseline projections through 2024. Next I provide a briefer review of long-term trends in Japanese public debt. I then present an initial summary view of whether the United States and Japan meet a well-known criterion for debt sustainability, involving the size of the non-interest (primary) surplus in comparison with the difference between the interest rate and the growth rate. The paper then describes the SDSM, and then applies it first to the United States and next to Japan. The conclusion draws policy implications.

United States Background

The stylized facts about US public debt run broadly as follows. Federal debt held by the public, the central concept in US fiscal discussions, was only about 25-30 percent of GDP in the 1970s. Then in the 1980s and early 1990s, revenue losses from tax cuts, rising cold-war defense spending, and high interest rates pushed the debt up to about 50 percent of GDP. In contrast, in the second half of the 1990s the tech boom spurred tax receipts even as post-cold-war defense cuts delivered a peace dividend. By the early 2000s policy-makers had begun to worry that the federal debt would be eliminated by surpluses as far as the eye could see, and wondered what would replace it as the risk-free asset. Debt eased to about 30-40 percent of GDP. But then the Great Recession inflicted prolonged and massive fiscal deficits that have left the debt held by the public at a new and relatively high plateau of about 70 percent of GDP. The pending Fiscal Cliff embodied in the prospective expiration of the Bush era tax cuts provoked a standoff in mid-2011 in which there was a brief risk of at least technical default because of disagreement over the debt ceiling (a tactic that had not been risked since early in the Clinton presidency).

[1] Background paper prepared for the first meeting of the PIIE-Sasakawa Foundation Working Group of Japanese and American Economists, Washington, June 2-3, 2014. I thank Jared Nolan for research assistance.

A temporary "sequestration" deal (Budget Control Act of 2011) set caps on discretionary spending for 2012-21, imposing equal dollar-amount cuts on defense and non-defense discretionary spending. The more permanent budget agreement at the end of 2012 (American Taxpayer Relief Act of 2012) retained most of the tax cuts but restored the top bracket to its earlier level of about 40 percent. That agreement still left a legacy of spending caps, set at a total of $1.01 trillion for discretionary spending in 2014, rising 2.4 percent annually thereafter through 2021 (CBO, 2014a, 20). Considering that medium-term inflation is typically placed at about 2 percent, the implication is a near long-term freeze in real discretionary spending and a persistent decline for its share in GDP. That prospect in turn is driven by the seemingly inexorable rise of mandatory spending, mainly for health.

The general sense of the fiscal problem after the end-2012 legislation seems to have been that it is taken care of for the next decade or so, but could return in severe form over subsequent decades if rising health-care expenditures are not somehow curbed. Moreover, the dominant view has been that whatever the remaining long-term problems, care should be taken to avoid excessive fiscal tightening in the immediate future because the economy still remains in substantial underemployment. This view in turn requires some view of whether the unemployment rate (6.3 percent in April 2014) is seriously understating the true level of unemployment considering that the labor force participation rate (for the population of 16 years and older, including post-65) has fallen from 66 percent in late 2007 to 63 percent in 2013. For its part the CBO (2014a, 38) considers that this trend is mainly driven by the aging population, and it projects a further decline to 61 percent by 2024. That view implicitly leans against major additional short-term fiscal stimulus by gauging the output gap is not much larger than reflected in reported unemployment.

The simulations presented below suggest that there is some downside risk to the benign view that fiscal matters are under control even for the next decade or so. The basic problem is that plausible alternative scenarios tend to suggest that the CBO baseline is on the optimistic side.[2] Even the CBO baseline shows some increase in the debt burden, by about 5 percentage points of GDP from a plateau in 2014-20 to the level by 2024 (CBO, 2014b, 3).

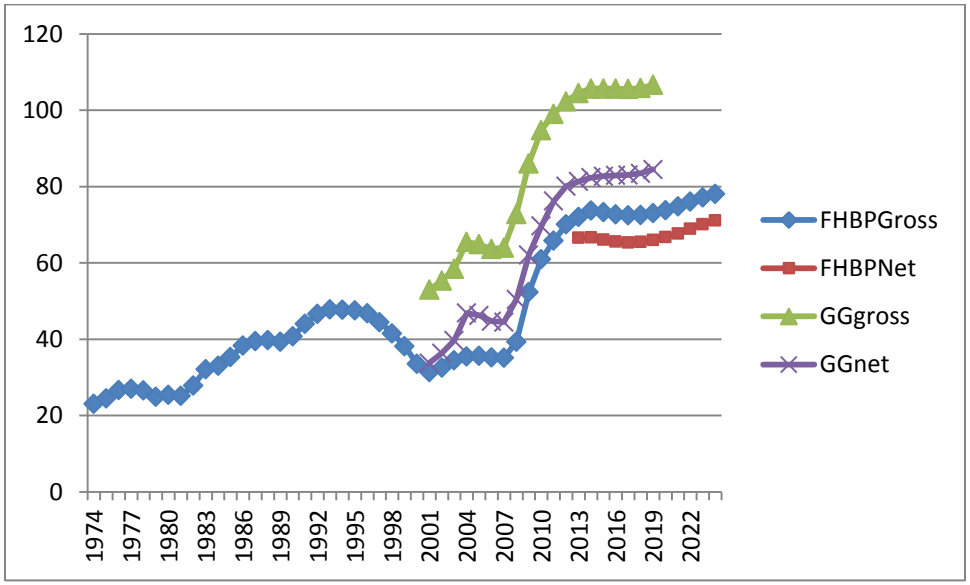
Figure 1 reports the ratio of government debt held by the public to GDP for the past 40 years and the coming decade (CBO baseline). The most closely watched metric is gross federal debt held by the public, amounting to 72.1 percent of GDP in 2013 and reaching 78.1 percent in 2024 in the baseline. Sizable assets (primarily student loans amounting to about $1 trillion) mean that the net debt held by the public is significantly lower, 67 percent of GDP in 2013 rising to 71 percent by 2024.[3] The figure also shows gross and net debt of the general government (including state and local) as estimated by the IMF

[2] Although not nearly as much so as before the end-2012 legislation when the "current law" CBO projections had to incorporate a large boost to taxes from expiration of the tax cuts, such that the agency emphasized its "alternative" scenarios.

[3] Rohit Chopra, "Student Debt Swells, Federal Loans Now Top a Trillion." Consumer Financial Protection Bureau, July 17, 2013.

(2014). This measure shows an increase in gross debt from 53 percent of GDP in 2001 to 104.5 percent in 2013 and 106.7 percent by 2019. The general government has larger financial assets than the federal government, so the difference between net debt is smaller than the difference in gross debt.[4] In principle the best measure for policy purposes is net federal debt held by the public.[5]

Figure 1
US Public Debt as Percent of GDP, 1974-2024:
Federal Debt Held by the Public and General Government, gross and net



Source: CBO (2014b,c); IMF (2014)

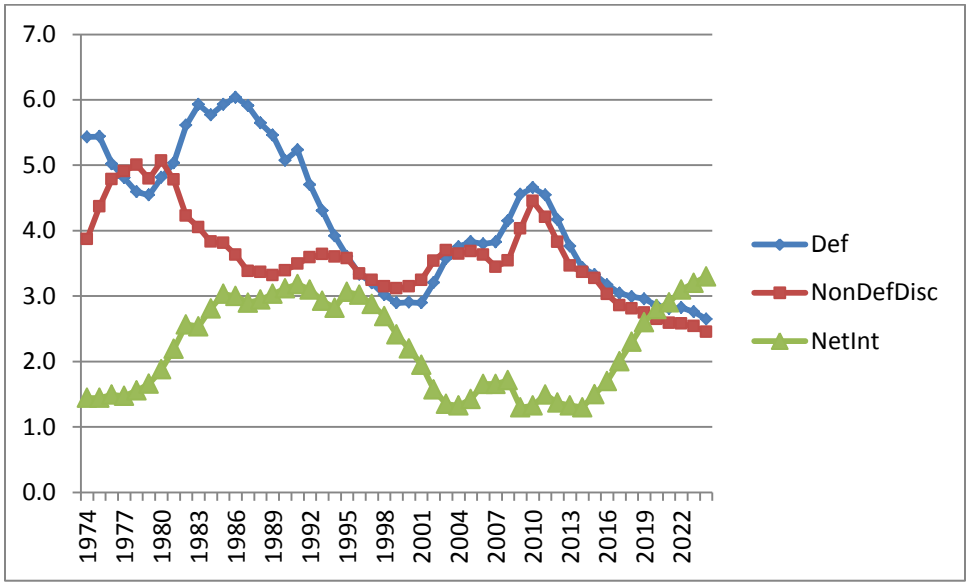
Figures 2 through 4 show the corresponding influences that lie behind the debt path and the stylized facts reviewed above. Figure 2 shows the large downswing in defense spending from 6 percent of GDP in 1986 to 3 percent by 1998 (the peace dividend). It also shows that discretionary non-defense spending had been squeezed when defense spending was high, but rose after 2000 (and soared to 4.5 percent of GDP in 2010 with unemployment insurance benefits in the Great Recession. The figure also shows the rigid dietary regime for both defense and non-defense discretionary spending from 2013 to 2024, during which period each one will have fallen by about 1 percent of GDP.

[4] Thus, in 2013 general government net debt at 81 percent of GDP was about 15 percentage points of GDP higher than net federal debt held by the public, whereas the corresponding difference in the gross concepts was 32 percentage points of GDP.

[5] The plight of Detroit shows that in the United States "discovered debt" for the federal government from provincial debt is not the problem often found abroad. Moreover, the main holders of federal debt other than the public are the social security trust fund and the government employees retirement fund. Neither is about to declare bankruptcy and shift a major burden to the federal government. Nonetheless, the annual net cash flow of the Social Security trust funds and Postal Service are projected to swing from +0.2 percent of GDP in 2014 to -0.8 percent of GDP by 2014 (CBO, 2014b, 3), posing a small source of discovered federal debt over the period.

Figure 2

US Federal Expenditure as percent of GDP: Discretionary (defense and non-defense) and Net Interest



Source: CBO (2014b,c)

The figure also shows the sharp decline of interest payments from about 3 percent of GDP in the mid-80s to mid-90s to about 1½ percent of GDP in the most recent decade. The decline reflected lower interest rates combined with still modest debt in the initial part of this period, but a combination of historically low interest rates with higher debt in the later part. The interest path also reveals a major challenge going forward: paying for about an additional 2 percentage points of GDP (by 2024) in interest as interest rates return to more normal levels in the face of relatively high debt stocks.

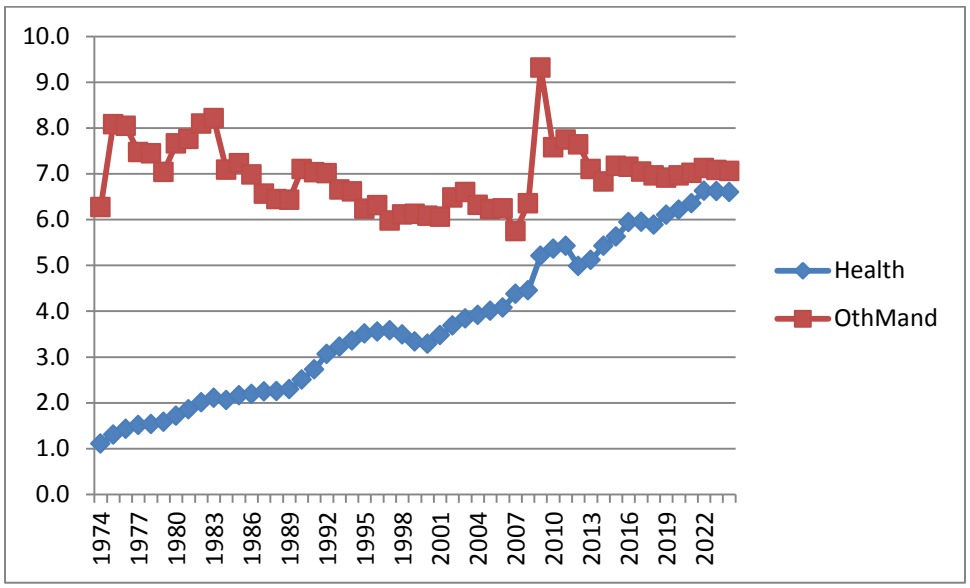
Figure 3 reports the corresponding path of mandatory spending. The striking feature it shows is the persistent, steady rise in mandatory health-related spending from only 1 percent of GDP in 1974 to 5 percent in 2013 and 6.6 percent by 2024.[6] (The CBO's long-term projections anticipate a continuation of this straight-line increase to 8 percent of GDP by 2038; CBO, 2013, 42). By contrast, other mandatory spending (mainly social security, federal retirement, and income security) will still be about 7 percent of GDP in 2024, the same level as the average in the 1970s and 1980s.[7]

[6] These costs include medicare, medicaid, health insurance subsidies in the exchanges, and (much smaller) the Children's Health Insurance Program.

[7] The $500 billion spike to over 9 percent of GDP in 2009 was driven mainly by outlays for the Troubled Assets Relief Program (about $150 billion), Fannie Mae and Freddie Mac (about $90 billion), and mandatory increases from the fiscal stimulus legislation ($80 billion, largely for Medicaid, unemployment benefits, Social Security benefits). CBO (2010, 3-4).

Figure 3

US: Mandatory Expenditure as percent of GDP (Health and Other)

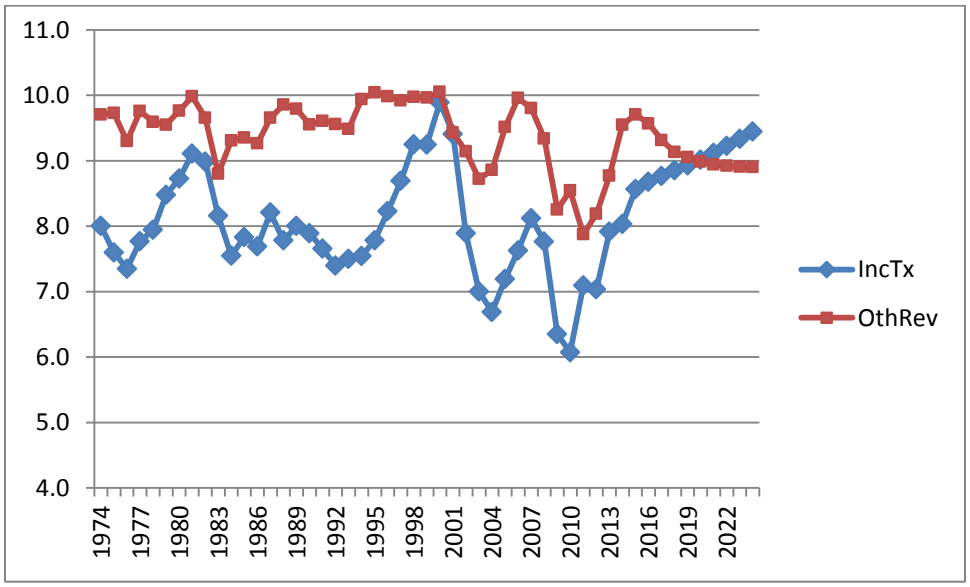


Source: CBO (2014b,c)

On the revenue side, Figure 4 shows the path of income taxes and other revenue as a percent of GDP. The principal components of other revenue are social security taxes and corporate taxes. Both income and other tax revenue shows cyclical response to the recession in 2001 and again, especially, in the Great Recession.

Figure 4

US: Revenue as percent of GDP (personal income taxes and other)



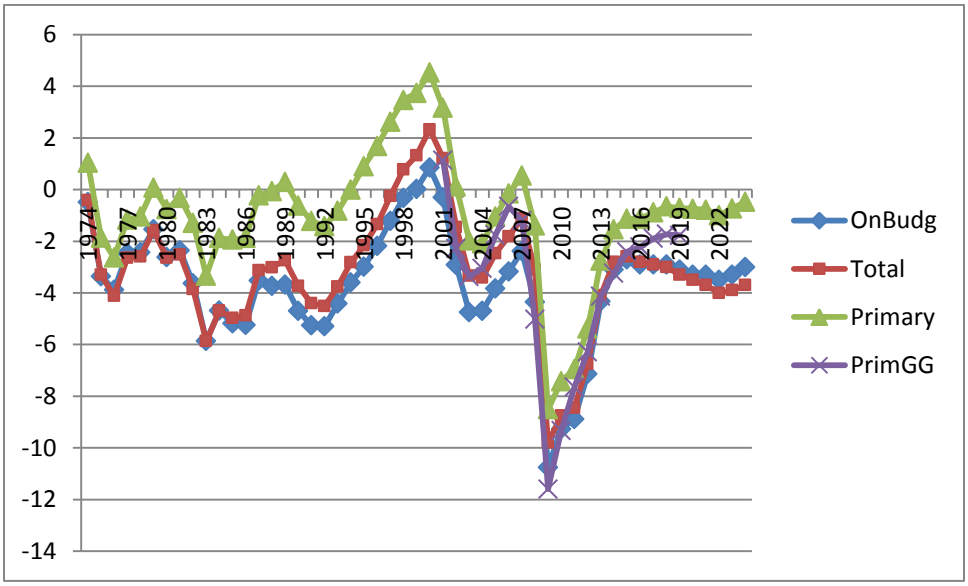
Source: CBO (2014b,c)

Perhaps the most intriguing pattern in the figure, however, is the pronounced increase in personal income taxes in the CBO baseline projections, rising from 8 percent of GDP in 2013 to 9.4 percent of GDP in 2020. This expected increase is a relatively well kept secret. The CBO attributes it mainly to the facts that "growth in people's real (inflation-adjusted) income will push more of their income into higher tax brackets and … withdrawals from tax-deferred retirement accounts will increase faster than GDP as baby boomers retire." (CBO, 2014b, 10).

Finally, figure 5 reports the overall fiscal balance as a percent of GDP, as well as the primary deficit. The total balance (including net flows from social security and postal service) reached a peak surplus of about 2 percent of GDP in 2000. The on-budget surplus peaked at about 1 percent of GDP in that year. Both measures showed a collapse to a deficit of about 10 percent of GDP in 2009. For its part, the (total) primary balance was systematically about 3 percent of GDP higher than the (total) fiscal balance in the mid-1980s to mid-1990s (the amount of interest payments, figure 2), but the two concepts have been much closer in recent years with low interest payments. By 2024 the primary balance returns to about zero, whereas the total deficit is projected at almost 4 percent of GDP, mainly reflecting interest at over 3 percent of GDP but also an off-budget deficit (social security, postal service) of 0.8 percent of GDP. For comparison, the figure also reports the IMF's estimate of the primary balance for the general government as a percent of GDP for 2001-19.

Figure 5

US: Fiscal Balances as percent of GDP



Source: CBO (2014b,c).

OnBudg: On budget. PrimGG: primary, general government

As shown in figure 5, the total fiscal deficit is at a plateau close to 3 percent of GDP in 2014 through 2018, and then widens to about 4 percent of GDP by 2022. The relative stability of the overall

deficit masks major changes in the components. Essentially higher income taxes and lower discretionary spending are being used to cover higher health spending and higher interest costs over the coming decade. The changes from 2014 to 2024 as a percent of GDP are: income tax revenue, +1.4; discretionary spending, -1.7; health spending, +1.2; interest costs, +2.0.

Japan Background

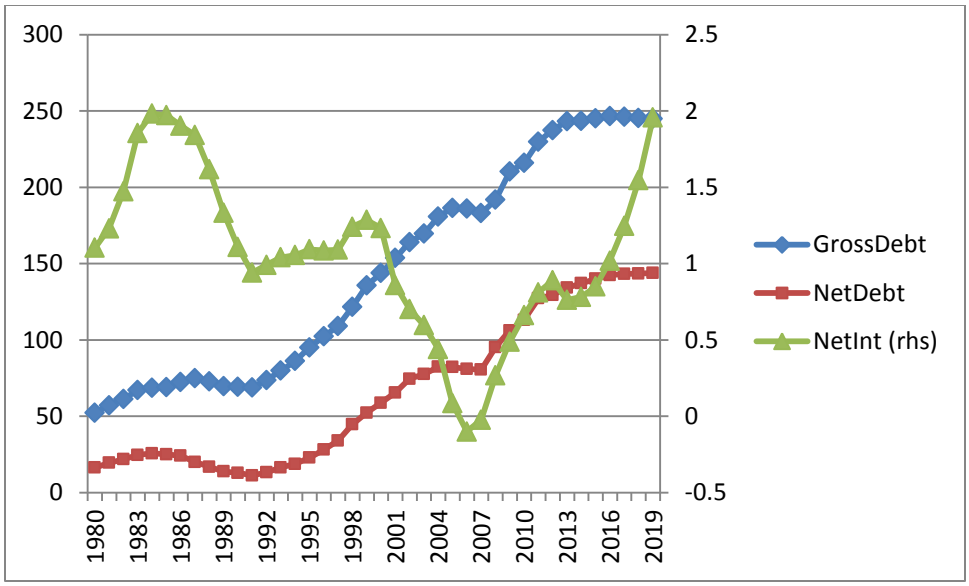
For many years now the central stylized fact about Japanese public debt seems to have been that the seemingly stratospheric debt ratios are meaningless, because of four factors. First, interest rates are low. The economic burden of the debt depends not only on its magnitude but also its price. If the interest rate is zero, an even an extremely high debt ratio poses no economic burden. Second, there is a strong home bias, such that Japanese households will ensure that the interest rate stays low. Third, the Japanese government has large assets as well as debt, and the net debt figure is much less foreboding than the gross figure. Fourth, unlike Greece, Japan has its own currency and its own central bank that if necessary can print currency to service the debt, which is denominated in its own currency. The central question about Japanese public debt is whether a time will come when investors shift the paradigm of their perception away from these considerations toward greater weight on more normal international comparisons (such as the benchmark Maastricht 60 percent of GDP debt target, less than half the level of *net* debt in Japan) and conclude that Japanese government debt does at least potentially have sovereign default risk.

Figure 6 shows long-term debt trends as reported in the IMF's World Economic Outlook (IMF, 2014). Gross and net general government debt as a percent of GDP are shown on the left-hand axis, and net interest payments as a percent of GDP on the right axis.[8] The figure shows that the debt levels have not always been high, nor has the interest always been low. The net interest burden was much higher in the 1980s than so far in the 2000s (although by 2019 the Fund projects the interest burden returning to its 1983-84 peak of 2 percent of GDP). The figure does confirm the vast difference between the gross and net debt levels. Although the figure shows the debt ratios stabilizing rather than continuing to rise, that change lies wholly in the future. In the most recent three years of actual history (2010 to 2013) the average escalation of the gross debt ratio was 9 percentage points of GDP annually.

Figure 6

Japan: Gross and Net Public Debt (left) and Net Interest (right) as percent of GDP

[8] Net interest is calculated as the difference between the primary fiscal balance and the total fiscal balance.



Source: IMF (2014)

The Summary Sustainability Test

Before proceeding to the SDSM analysis, it is useful to consider a classic summary measure of debt sustainability. This measure asks whether the primary surplus being run by the government is sufficient to keep the debt from rising as a percent of GDP. The debt rises both from inheritance of interest on past debt and from borrowing to cover new deficits. GDP rises at the real growth rate plus the inflation rate. So the summary test is:[9]

$$\pi \geq \lambda\,(r - g)$$

where π is the primary surplus as a percent of GDP, r is the interest rate (nominal), and g is the growth rate (nominal), and λ is the initial ratio of public debt to GDP. If the left-hand side exceeds the right-hand side, then the ratio of debt to GDP will be falling. If instead the left-hand side is smaller than the right-hand side, the debt to GDP ratio will be rising. A larger initial debt ratio (λ) means that the primary surplus needs to be larger to keep up with the inherited interest burden.

Table 1 reports the performance of the United States and Japan on this test. For the United States, the main test is using the federal debt held by the public. An alternative test is included, however, based on the IMF's projections for the general government. For Japan, only the IMF projections are applied. In all cases the test is applied to net debt, the proper concept if the interest rate applicable to assets is identical to the interest rate on borrowing.

Table 1

[9] See Cline (2014; 2003).

Debt Sustainability Equation Test for the United States and Japan

	United States:			Japan:
	Federal NDHBP	Gen. Govt. ND		Gen. Govt. ND
	(2014-24)	(2014-19)		(2014-19)
Primary surplus (% GDP)	-0.89	-2.21		-4.57
Midpoint net debt/ GDP	0.65	0.82		1.42
Interest rate (%)	3.54	4.20		0.87
Nominal growth rate (%)	4.47	4.67		2.30
Stabilizing fiscal gap (% GDP)	0.28	0.50		2.54

NDHBP: net debt held by the public ND: net debt
Source: Calculated from CBO (2014b) and IMF (2014)

Both Japan and the United States enjoy an advantage unavailable to most sovereigns: their average nominal growth rates for the periods in question exceed the average nominal interest rates on their debt, so the sustainability equation will permit some primary deficit rather than requiring a primary surplus. Nonetheless, it turns out that the average primary deficit is somewhat too large to avoid a rising debt ratio, for the United States, and more substantially too large in the case of Japan. The final row of the table shows how much the average primary balance over the period would have to rise to meet the debt sustainability equation test. This increase would amount to a primary balance higher than the baseline by 0.28 percent of GDP for the US (federal) or, alternatively, 0.5 percent of GDP (based on general government debt). For Japan, because the prospective average primary balance is in such large deficit (about 4.5 percent of GDP), an increase in the primary balance by 2.5 percent of GDP on average over the period is needed to keep the net debt to GDP ratio from rising, even though the average interest rate is low (less than 1 percent).[10] This summary test tends to confirm what one suspects: the US fiscal path is not quite on track for stability over the next decade, and the Japanese fiscal path is substantially below such an outcome.

The Sovereign Debt Simulation Model

The European Debt Simulation Model developed in Cline (2012, 2014) is a probabilistic accounting framework focused on projecting the likely path of the ratio of public debt to GDP. The debt at the end of the year equals the previous year's debt plus the total fiscal deficit plus borrowing needed to acquire financial assets, plus any newly "discovered debt" (e.g. from socialization of bank losses), minus amounts received from privatization. Gross borrowing needs in a given year further include the amount needed cover amortization of existing debt, and the model distinguishes between interest rates on the new debt and those on the old debt tranches being amortized..

In the context of the euro area debt crisis, there are five key variables with alternative scenarios: real GDP growth, primary surplus, interest rate (reflecting sovereign risk spread), bank recapitalization,

[10] Note further that for the interest rate, the implied rates are from net interest relative to net debt at the end of the prior period.

and privatization. For each key variable there is a baseline scenario, an unfavorable scenario, and a favorable scenario, so there are $3^5 = 243$ possible outcomes. As discussed below, application to the United States and Japan involves replacement of the bank recapitalization and privatization variables with alternative variables more germane to each economy respectively.

The model considers the likely correlation between the scenario states (good, bad, central). After taking account of these correlations, the probability of any specific combination of scenarios can be obtained. The resulting projections, arrayed by most favorable to least favorable, can then be reviewed to find the 25^{th} percentile cumulative probability favorable case, baseline case, and 75^{th} percentile unfavorable case (with ascending debt ratios by the end of the period). The probability-weighted path (which is not necessarily the median case) is identified, and serves as an important benchmark for inferring the implied relative pessimism or optimism of the baseline.

For application as a generalized SDSM for the United States and Japan, over the 10-year horizon considered in this paper there is little basis for anticipating either banking cleanups costly to the government (or other major sources of discovered debt) or privatization receipts in either economy. The key variables for scenarios thereby freed up are assigned here in the following way. For the United States, instead of a single fiscal variable (primary surplus) there are three: income tax revenue, discretionary spending, and mandatory health spending. For Japan, the GDP deflator is considered as a scenario variable.

Table 2 shows the state correlation coefficients assumed for the key scenario variables for the United States; Table 3 shows the correlations for Japan. Complete good-good or bad-bad correlation is indicated by a coefficient of +1; complete good-bad correlation is indicated by -1.

Table 2
Scenario State Correlation Coefficients for the United States

Variable:	Growth (g)	Interest rate (r)	Income tax revenue (t)	Health spending (h)	Discretionary spending (d)
g		-1	1	0	0
r	-1		0	0	0
t	1	0		0	-0.3
h	0	0	0		-0.2
d	0	0	-0.3	-0.2	

For the United States, the good scenario for growth (high) is fully correlated with the bad scenario for interest rates (high) because of the likely response of monetary policy and the absence in this horizon of serious sovereign default credit risk (which, as in the euro area periphery, would make the scenario states positive for growth and the interest rate rather than negative). The good state for income tax revenue is fully correlated with the good state for growth, given the positive response of revenue to higher GDP. Health spending is treated as exogenous to the state of growth (zero

correlation). Discretionary spending from past data tends to show a positive state correlation with growth (high growth good case correlated with lower discretionary spending good case) but this relationship derives from cyclical components (e.g. unemployment compensation) and the analysis here omits any business cycles. There might be a case for a mild negative state correlation (high growth good case induces greater spending bad case), but with little past basis for this relationship the correlation is simply set at zero. The state correlations for the interest rate are all zero for tax revenue, health spending, and discretionary spending. The correlation for tax revenue is set at zero for health spending but placed a moderately negative for discretionary spending. The idea is that if tax revenues are high (good state) there may be some tendency to spend more on discretionary uses (bad state for the debt profile, though not necessarily for welfare). Finally, health spending also has a moderate negative state correlation with discretionary spending, because if such factors as slower escalation of pharmaceutical costs facilitate less rapid increases in health spending, there may be a tendency to spend some of the savings on discretionary categories.

Table 3
Scenario State Correlation Coefficients for Japan

Variable:	Growth (g)	Interest rate (r)	Primary surplus (π)	GDP deflator inflation (i)
g		-1	1	1
r	-1		0	-1
π	1	0		0
i	0	0	0	

For Japan only four key macroeconomic variables are used to specify the scenarios. The interest rate has the same state correlation with growth as in the United States (-1). The primary surplus has a complete positive state correlation with the growth rate (because of higher revenue, as in the United States). The GDP deflator has a positive state correlation with growth, because higher growth will tend to be associated with higher inflation which will boost the nominal value of GDP (and thus the denominator in the debt/GDP ratio). The interest rate has a negative state correlation with the GDP deflator because the good interest rate state (low rates) will be correlated with the bad GDP deflator state (low inflation). The primary surplus is assumed exogenous to the GDP deflator.

It is important to clarify that the two sets of correlation coefficients are essentially business-as-usual conditions for the two countries. They do not capture the reversals that could be associated if the countries were to reach a zone of serious perceived default risk (as noted above regarding the growth-interest rate correlation). Nor do the essentially fixed alternative scenario paths allow for feedback from the resulting debt path to the variables. In a richer version of the model, it would be desirable to add feedback from higher debt ratios to slower growth because of higher cost of capital formation, and from higher debt ratios to higher interest rates as a consequence of rising default risk.

Projections for the United States

Table 4 presents the scenario assumptions for the United States. The baseline for real growth is from CBO (2014a). Baseline interest rates are the average of the projections in CBO (2014a) and OMB (2014). Income taxes, health spending, and discretionary spending are from CBO (2014b), as are the fixed paths for other revenue and for other (non-health) discretionary spending (not shown).

The CBO growth baseline is premised on average labor force growth of 0.7 percent per year. The average total growth of 2.52 percent in the CBO baseline implies average labor productivity growth of 1.82 percent. In the 15 moving 7-year periods from 1991 to 2012, labor productivity growth in the sixth-highest (63rd percentile) was 2.16 percent; productivity growth in the 10th highest (37th percentile) was 1.64 percent.[11] On this basis, the favorable growth scenario adds 0.34 (=2.16-1.82) percentage point to baseline annual growth, and the unfavorable growth scenario subtracts 0.18 percent (=1.82-1.64) from the baseline.

Table 4
Scenario Assumptions for the United States

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Real GDP growth (%)											
1	2.5	3.1	3.2	2.8	2.2	2.1	2.0	2.0	1.9	1.9	1.8
2	2.7	3.3	3.4	3.0	2.4	2.3	2.2	2.2	2.1	2.1	2.0
3	3.2	3.5	3.4	3.3	2.9	2.6	2.5	2.4	2.4	2.4	2.4
Interest rate: MLT new											
1	3.1	4.1	4.7	5.1	5.3	5.4	5.5	5.5	5.6	5.6	5.6
2	3.1	3.6	4.2	4.6	4.8	4.9	5.0	5.0	5.1	5.1	5.1
3	3.1	2.9	3.4	3.8	4.1	4.1	4.2	4.3	4.3	4.3	4.3
Income tax revenue (%GDP)											
1	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
2	8.0	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4
3	8.5	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9
Health spending (%GDP)											
1	5.5	5.7	6.1	6.2	6.2	6.4	6.6	6.8	7.2	7.3	7.3
2	5.4	5.6	5.9	5.9	5.9	6.1	6.2	6.4	6.6	6.6	6.6
3	5.4	5.6	5.9	5.9	5.9	6.0	6.0	6.0	6.0	6.0	6.0
Discretionary spending (%GDP)											
1	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
2	6.8	6.6	6.2	5.9	5.8	5.7	5.5	5.4	5.4	5.3	5.1
3	6.8	6.5	6.1	5.8	5.7	5.6	5.4	5.3	5.3	5.2	5.0

1: adverse 2: baseline 3: favorable

Source: CBO (2014a, b); OMB (2014); author's calculations

[11] See Cline (2013TIE).

For the long-term (10-year) interest rate, the favorable scenario subtracts 75 basis points from the baseline beginning in 2015; the unfavorable scenario adds 50 basis points. For income taxes, the unfavorable scenario freezes the share in GDP at the 8.0 percent of GDP average actually collected in 1990-2007. The favorable scenario adds 0.5 percent of GDP to the baseline. For health spending, the unfavorable scenario postulates faster growth in health spending by 1 percent per year than in the baseline. In the favorable scenario health spending is capped at 6 percent of GDP, about one-tenth below the baseline by 2024. For discretionary spending, in the unfavorable scenario it is assumed that there is no decline from the 6.8 percent share in GDP at the beginning of the period. (The CBO's "alternative" projections similarly include a less stringent discretionary spending paths than in the current law, with spending allowed to grow at the rate of inflation; CBO, 2014a, 23.) Because of the already sharp cutbacks in discretionary spending as a share of GDP in the baseline, the favorable scenario allows only a token further reduction by 0.1 percent of GDP from the baseline.

The combination of baseline assumptions for the tax and spending variables generates a path for the primary balance that begins with a deficit of 1.5 percent of GDP in 2014, narrows to 0.7 percent by 2019, and is still in small deficit at 0.5 percent by 2024. The failure to reach a primary surplus even by the end of the horizon is an indication that the fiscal effort is not particularly ambitious for an economy with debt already relatively high.

The implementation of the model distinguishes between interest due on the legacy debt stock already in place at the end of 2013 and interest on new debt incurred subsequently. For subsequent years there is a long-term interest rate applicable to each year's vintage of new borrowing that persists through the maturity of that vintage.

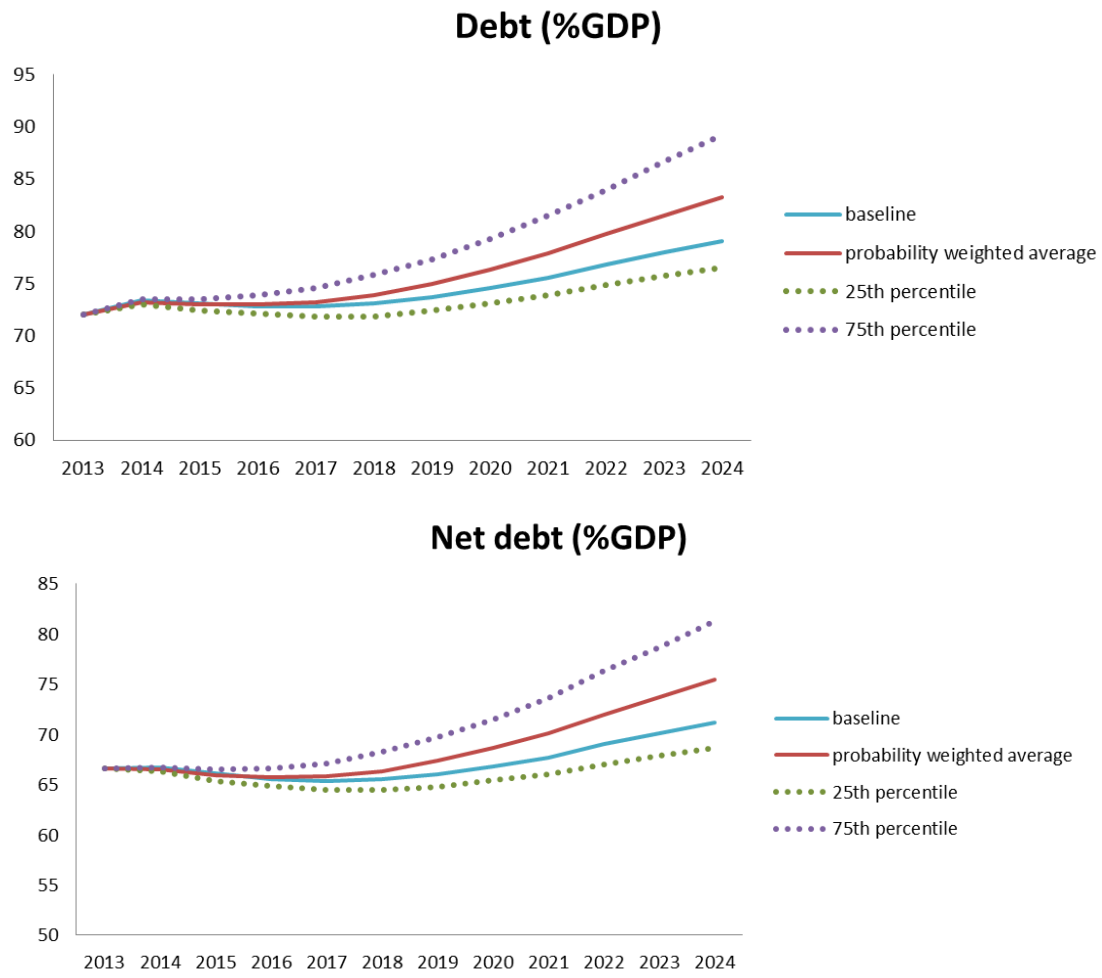
Figure 7 shows the results of the projections for the United States for gross debt held by the public as a percent of GDP, in the upper panel, the corresponding projections for net debt held by the public, in the middle panel, and net interest payments as a percent of GDP, in the lower panel. In the baseline, gross debt held by the public rises from 72 percent of GDP in 2013 to 79 percent in 2024.[12] Net debt also rises, from 67 percent of GDP to 75 percent. Net interest payments rise from 1.3 percent of GDP in 2014 to 3.3 percent in 2024. (Appendix table A1 provides additional details on the baseline projections.) The figure also shows the corresponding probabilistic range of projections, from the favorable 25th percentile of cumulative probability to the unfavorable 75th cumulative percentile. For gross debt relative to GDP, the ratio rises from 72 percent in 2014 to 77 percent of GPD in 2024 even in the favorable 25th percentile; it rises to 89 percent in the unfavorable 75th percentile.

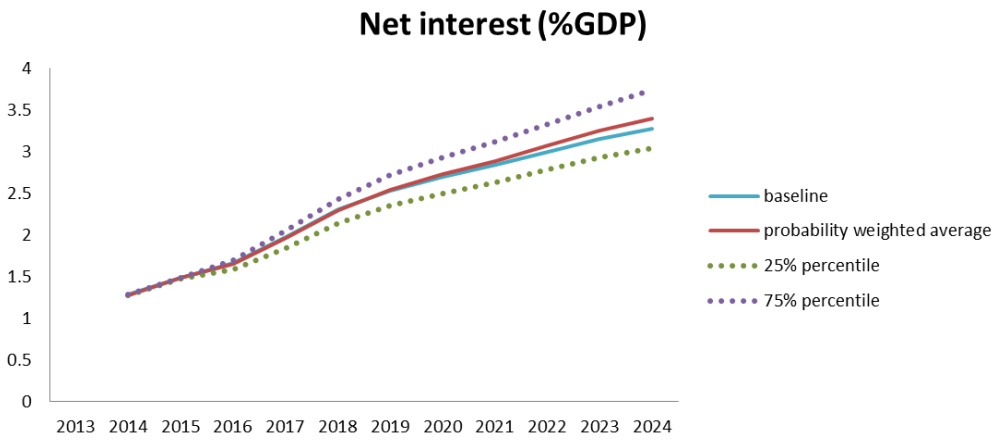
The probability-weighted gross debt ratio rises to 83 percent of GDP by 2024, significantly higher than the baseline. The strong implication is that there is more downside risk to the prospect of stabilizing the US debt ratio than upside risk in this period. In other words, the baseline assumptions (largely the CBO current-law version) tend to be on the optimistic rather than pessimistic side. The same divergence holds for net debt, which rises from 67 percent in 2013 to 75 percent of GDP in 2024 in

[12] This baseline closely tracks that of the CBO (2014b), which places the debt ratio at 78 percent of GDP in 2024.

the probability-weighted path. Overall, the picture that emerges from these calculations is that the US debt problem is not quite as fully "fixed" for the next decade as many might have thought, despite the important legislation of December 2012.

Figure 7
Debt Projections for the United States (Federal debt held by the public)





Source: author's calculations

Projections for Japan

Table 5 shows the scenario assumptions for Japan. The baseline assumptions for all four macroeconomic variables are from the "reference" scenario in the January 2014 projections of the Cabinet Office (2014). Growth is at an average of 1.2 percent annually over the decade. Considering that Japan's labor force is expected to shrink by 0.5 percent per year in this period (Kitahara, 2014), this baseline implies labor productivity growth at 1.7 percent per year, almost the same as the 1.82 percent for the United States in the CBO baseline. Measured on a comparable basis, then, Japan would be growing just as fast as the United States. For the interest rate, the baseline 10-year rate rises from 1 percent in 2013 to 3.1 percent by 2024. In the latter part of the decade, the difference between the 10-year rate and inflation as measured by the GDP deflator (set at 0.5 percent in this period) implies a real rate of about 2-1/2 percent, comparable to the corresponding 3 percent real rate in the US baseline (where the GDP deflator runs at 2 percent inflation per year). The baseline primary balance is disappointing, for an economy with such high public debt. Although the primary deficit falls from 5.7 percent of GDP in 2013 to 3 percent by 2015 and after, by international standards a deficit this size would be considered still relatively large.

The "revitalization" variant in the same source provides the basis for several of the alternative scenarios in table 5. In the revitalization case the Cabinet Office projects that growth would average 2.1 percent annually over the decade. This variant is applied here as the favorable scenario for growth. It would seem to imply considerable success in staving off the declining labor force through higher female labor force participation and perhaps greater immigration. For the unfavorable growth scenario, in contrast, a reduction of 0.2 percent per year is applied against the baseline. This reduction from baseline is approximately the same as for the US, implying that downside deviation from expected labor productivity growth is comparable for the two simulations.

For the primary fiscal balance, the favorable scenario is also taken from the Cabinet Office revitalization variant. In this scenario the 10-year average for the primary deficit is 2.3 percent of GDP,

instead of 3.3 percent in the baseline. Faster growth presumably spurs higher revenue and lower primary deficits. Table 5 places the unfavorable primary balance at a uniform 1 percent of GDP below the baseline primary balance path. For the interest rate, the Cabinet Office revitalization scenario provides the benchmark for high interest rates (thus, ironically, the unfavorable scenario). The rate reaches the range of 4-1/2 percent by 2020-24. The favorable scenario for the interest rate subtracts 40 basis points from the baseline. Finally, the Cabinet Office revitalization scenario is also the basis for the favorable GDP deflator scenario, in which the deflator rises at an annual average of 1.5 percent over the decade instead of 0.7 percent in the baseline. Higher GDP inflation boosts the denominator of nominal GDP and hence tends to reduce the ratio of debt to GDP. In the unfavorable scenario the deflator is set arbitrarily at only 0.1 percent lower than in the baseline, considering that the baseline GDP inflation rate is already very low.

Table 5
Scenario Assumptions for Japan

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Real GDP growth (%)											
1	1.4	0.7	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1
2	1.4	0.9	1.1	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.3
3	1.4	1.7	1.8	2.0	2.1	2.2	2.3	2.3	2.4	2.4	2.4
Primary surplus (%GDP)											
1	-5.7	-4.8	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0
2	-5.7	-3.8	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
3	-5.7	-3.5	-2.4	-2.3	-2.2	-2.0	-1.9	-1.7	-1.4	-1.2	-1.2
Interest rate: MLT new											
1	1.00	2.10	2.40	2.80	3.20	3.60	4.00	4.30	4.60	4.80	4.80
2	1.00	1.50	1.90	2.10	2.30	2.50	2.70	2.85	3.00	3.10	3.10
3	0.60	1.10	1.50	1.70	1.90	2.10	2.30	2.45	2.60	2.70	2.70
GDP deflator (%)											
1	1.9	0.9	1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
2	1.9	1	1.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3	1.9	1.7	1.9	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3

Source: Cabinet Office (2014) and author's calculations.

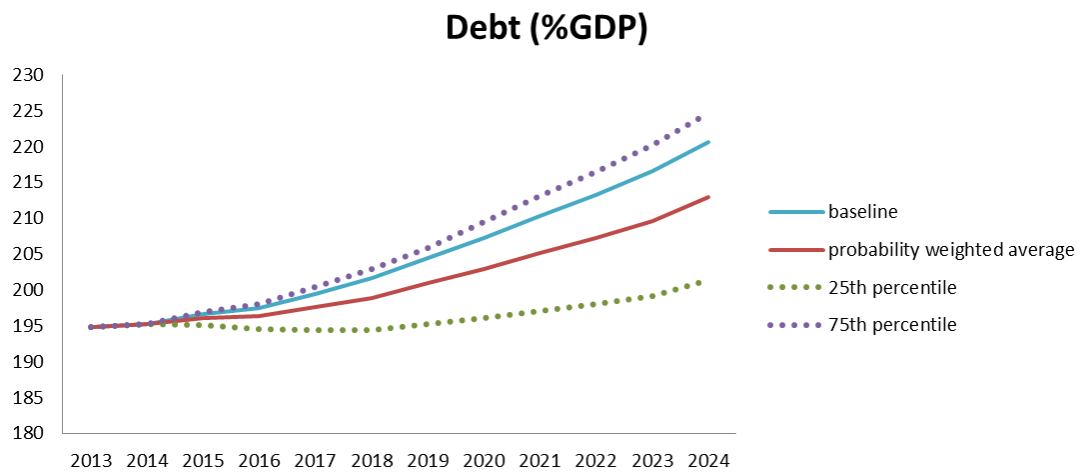
There is a key feature of Japan's public debt that warrants further discussion. There is a large difference between gross public debt and net public debt. The OECD (2014) places the 2013 gross public debt at 225 percent of GDP and net debt at 138 percent; the IMF (2014) places the gross figure at 243 percent and the net figure at 134 percent. The Cabinet Office (2014, 8)reports a debt figure that is intermediate, at 195 percent of GDP in 2013. It does not specify whether the figure is gross or net, but its order of magnitude suggests that the concept is gross. The SDSM requires an estimate of financial assets to arrive at net debt, so the procedure adopted here is to use the IMF's 2013 figure for net government debt (134 percent of GDP) and impute the 2013 general government financial assets as the difference between this figure and the Cabinet Office figure for total debt (with the result of an initial level of financial assets at 61 percent of GDP). In the simulations it is assumed that the interest rate

earned on government assets is relatively low.[13] As in the case of the United States, the amortization profiles of existing debt and average interest on legacy debt stocks, as well as the vintages of new long-term debt and their relevant future interest rates, are specifically estimated for Japan.[14]

Figure 8 shows the resulting model projections for Japan. In the baseline, the ratio of gross public debt to GDP rises from 195 percent in 2013 to 221 percent in 2024. For the year 2023, the final year in the Cabinet Office horizon, the baseline here approximately replicates the Cabinet Office estimate (at 217 percent of GDP versus 216 percent, respectively). (Appendix table A2 provides additional details on the baseline projections.)

For Japan, international policy discussions seem to have focused more on net debt. Thus, in its most recent Article IV consultation for Japan, the IMF (2013, 3) forecast that Japan's net public debt would rise from 144 percent of GDP in 2013 to 177 percent in 2024 in the "baseline scenario," and 200 percent of GDP in a "no adjustment scenario," but that the ratio could be brought down to 137 percent of GDP by 2024 in a "fiscal adjustment scenario." In the baseline SDSM projections here, Japan's net public debt rises from 134 percent of GDP in 2013 to 171 percent by 2024. Net interest payments rise from 1 percent of GDP in 2013 to 4.9 percent of GDP in 2024, a dramatic end to the era of low interest burdens despite high debt levels.

Figure 8
Debt Projections for Japan



[13] A rate of only 25 basis points. Higher rates begin to cause the path of debt to be significantly lower than in the Cabinet Office baseline.
[14] Based on Bloomberg data for debt stocks, interest rates, and maturities.

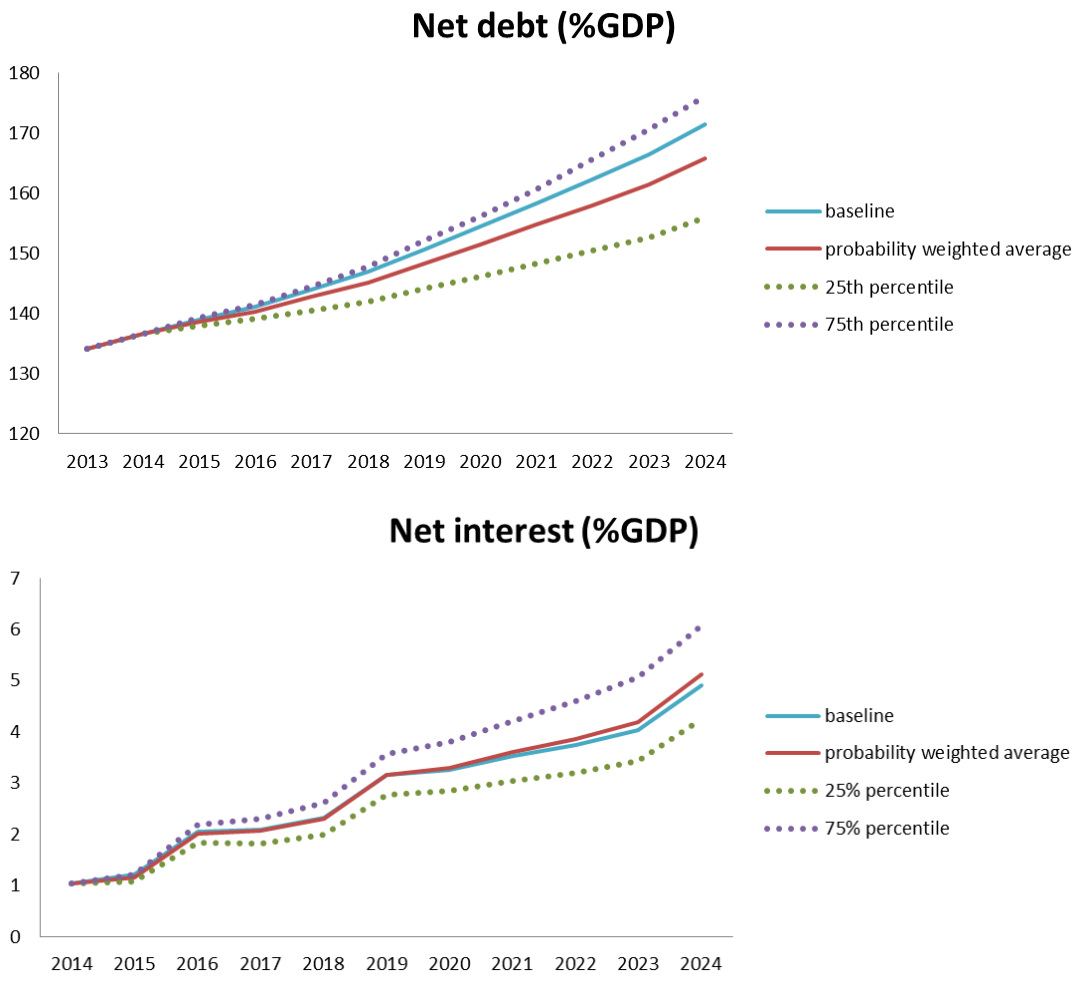


Figure 8 shows that the probability-weighted outcome for the debt ratio is considerably more favorable than the baseline outcome. The baseline may thus be on the pessimistic side (versus the opposite for the United States). Unfortunately, even in the probability-weighted case the debt ratio rises quite substantially over the decade, by about 20 percentage points of GDP.

Conclusion

The implication of these projections is that even for just a 10-year horizon, somewhat more effort will be required to keep the debt to GDP ratio from escalating in the United States, and much more will need to be done in Japan. Using the probability-weighted ratio of net debt to GDP (federal held by public for the United States), holding the ratio flat at its 2013 level would require cutting the 2024 debt ratio 8 percentage points of GDP for the United States and by 32 percentage points of GDP for Japan.[15] In broad terms achieving this outcome would involve reducing the average primary deficit by about 0.75 percent of GDP from baseline in the United States and by about 3 percent of GDP in

[15] The probability-weighted net debt ratios rise from 67 percent of GDP in 2013 to 75 percent in 2024, for the United States, and from 134 percent of GDP in 2013 to 166 percent in 2024, for Japan.

Japan. These orders of magnitude are approximately the same as in the back-of-the-envelope sustainability tests of table 1 above.

Ideally both countries would do even more, to begin reducing the debt ratio. This conclusion would only be reinforced by an extension of the analysis incorporating adverse feedback from a rising debt ratio to a higher sovereign risk premium in the interest rate and slower capital formation from crowding out.

For Japan further adjustment is especially needed because the previous deus-ex-machina for extremely high debt – low interest rates – is scheduled to disappear over the decade, as Japan's real interest rates rise to nearly the same levels as those in the United States. Both private and official sources have called for aggressive action in Japan. Thus, the Japan Center for Economic Research has recommended that the consumption tax continue to be increased by one percentage point annually from its present 10 percent level to reach 19 percent at the end of the decade. The consequence, it calculates, would be to eliminate the primary deficit by 2023. Indeed, the Center asserts that "Without further consumption tax hikes, sovereign default cannot be avoided." (JCER, 2014, 4.) For its part, the IMF (2013, 3) concluded that an additional 5.5 percent of GDP fiscal consolidation needs to be identified, approximately equal in size to the consolidation represented by the increase of the consumption tax to 10 percent and the expiration of stimulus and reconstruction spending. By implication, the Fund sees a need to boost the primary balance from a deficit of about 3 percent of GDP in the second half of the decade to a surplus of about 2 percent of GDP, a fiscal posture that would be much more in keeping with gradually bringing down debt from high levels.

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Appendix A Baseline Projections through 2024

Table A.1 United States

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Percent GDP:												
Debt	72.1	73.4	73.1	72.8	72.8	73.1	73.7	74.5	75.5	76.8	78.0	79.1
Net debt	66.6	66.7	66.1	65.6	65.3	65.5	66.0	66.8	67.7	69.0	70.1	71.2
Net interest		1.3	1.5	1.7	2.0	2.3	2.5	2.7	2.8	3.0	3.2	3.3
Amortization		17.5	18.1	17.6	16.0	16.3	14.8	15.0	13.8	13.6	13.6	12.3
Billion Dollars:												
Nominal GDP	16627	17332	18208	19166	20116	21011	21924	22855	23825	24811	25839	26883
Health spending		940	1024	1139	1196	1236	1338	1420	1513	1645	1709	1773
Discretionary spending		1184	1193	1195	1196	1211	1240	1267	1295	1330	1357	1383
Other spending		1180	1300	1365	1412	1459	1511	1587	1668	1762	1825	1895
(-) Income tax revenue		1387	1552	1657	1758	1855	1952	2055	2166	2283	2406	2535
(-) Other tax revenue		1649	1760	1826	1868	1914	1980	2049	2124	2209	2296	2388
Primary deficit		267	206	216	178	137	157	170	185	245	189	128
Total deficit		489	477	535	575	622	712	787	862	989	1005	1008
Net borrowing requirement		489	477	535	575	622	712	787	862	989	1005	1008
(+) Financial asset purchase		251	119	106	104	92.8	92.3	91.4	89.3	89.0	86.7	90.1
Amortization		3038	3303	3365	3225	3435	3238	3423	3276	3382	3515	3306
ST		1591	1591	1591	1591	1591	1591	1591	1591	1591	1591	1591
Inflation-Protected Securities		1381	1427	1263	927	964	644	657	331	293	281	9.6
MLT (pre-2014)		66.9	66.5	83.7	81.4	85.0	32.6	55.2	76.3	84.2	82.6	0
MLT (new)		0	219	428	626	795	972	1120	1279	1415	1560	1706
Gross borrowing requirement		3778	3898	4007	3904	4149	4043	4301	4228	4461	4606	4404
Debt	11983	12722	13317	13959	14638	15352	16157	17036	17987	19066	20157	21255
ST	1591	1591	1591	1591	1591	1591	1591	1591	1591	1591	1591	1591
MLT (pre-2013)	9419	8039	6612	5348	4421	3457	2814	2157	1826	1533	1252	1242
Inflation-Protected Securities	973	906	839	755	674	589	556	501	425	341	258	258
MLT (new)		2188	4276	6265	7952	9716	11196	12788	14146	15601	17057	18164
Net Interest payments		222	271	320	397	484	555	617	677	744	816	880
ST		1.6	3.2	6.4	28.6	52.5	58.9	58.9	58.9	58.9	58.9	58.9
MLT (pre-2013)		226	213	185	157	141	117	102	78.1	72.0	64.8	52.6
Inflation-Protected Securities		12.5	11.6	10.8	9.8	9.4	8.0	7.6	7.2	7.5	7.7	5.8
MLT (new)		0	66.7	143	229	311	403	482	568	643	723	803
(-) Financial assets		18.3	23.3	25.7	27.8	29.9	31.8	33.6	35.4	37.2	39.0	40.7
Financial assets	916	1167	1285	1391	1495	1588	1680	1772	1861	1950	2037	2127
Net debt	11067	11556	12032	12568	13143	13765	14477	15264	16126	17116	18120	19128

Source: Author's calculations.

Table A.2 Japan

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Percent GDP:												
Debt	194.8	195.3	196.6	197.4	199.4	201.6	204.4	207.2	210.3	213.3	216.5	220.6
Net debt	134.1	136.6	139.0	141.1	143.9	147.0	150.7	154.4	158.4	162.3	166.4	171.4
Net interest		1.0	1.2	2.1	2.1	2.3	3.2	3.3	3.5	3.7	4.0	4.9
Amortization		41.9	40.2	35.4	36.0	37.5	32.5	33.9	34.9	35.6	36.3	31.7
Trillion Yen:												
Nominal GDP	484	500	510	521	530	538	547	557	566	576	587	597
Primary deficit		28.5	19.4	15.6	15.9	16.1	16.4	16.7	17.0	17.3	17.6	17.9
Total deficit		33.7	25.6	26.3	27.0	28.6	33.7	34.9	37.0	38.8	41.3	47.3
Net borrowing requirement		33.7	25.6	26.3	27.0	28.6	33.7	34.9	37.0	38.8	41.3	47.3
(+) financial asset purchase		0	0	0	0	0	0	0	0	0	0	0
Amortization		210	205	185	191	202	178	189	197	205	213	190
ST		83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2
MLT (pre-2014)		127	106	72.3	68.5	69.8	36.3	40.2	41.3	41.1	40.9	9.4
MLT (new)		0	16.0	29.2	39.0	48.6	58.4	65.4	72.9	80.8	88.8	97.0
Gross borrowing requirement		243	231	211	218	230	212	224	234	244	254	237
Debt	943	977	1003	1029	1056	1085	1118	1153	1190	1229	1270	1318
ST	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2
MLT (pre-2014)	860	734	628	555	487	417	381	341	299	258	217	208
MLT (new)		160	292	390	486	584	654	729	808	888	970	1026
Net Interest payments		5.2	6.2	10.7	11.1	12.5	17.3	18.2	20.0	21.6	23.7	29.4
ST		0.1	0.3	0.5	0.8	1.0	1.2	1.2	1.2	1.2	1.2	1.2
MLT (pre-2014)		5.9	5.0	7.2	5.4	4.2	6.2	5.0	4.3	3.0	2.1	4.6
MLT (new)		0	1.6	3.7	5.7	8.0	10.6	12.7	15.2	18.0	21.0	24.2
(-) Financial assets		0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Financial assets	294	294	294	294	294	294	294	294	294	294	294	294
Net debt	650	683	709	735	762	791	824	859	896	935	976	1024

Source: Author's calculations.