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The Crisis that Wasn't: How Japan Has Avoided a Bond Market Panic

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How Japan Has Avoided a Bond Market Panic

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Abstract

This paper explores the history of Japanese fiscal policy over the past two decades with the aim of better understanding where previous forecasts have erred. As such, Japan provides an important case study of how a country facing intense fiscal pressures can avoid a hyperinflation or financial panic. We find that there were three key forces that likely improved Japan's fiscal situation relative to more pessimistic predictions. First, the Japanese government has shown remarkable ability to hold down per capita expenditures on social pensions and healthcare. Second, the Japanese government has been able to raise taxes substantially. Third, the remarkable monetary policy pursued by the Bank of Japan has resulted in a dramatic decline in the amount of government bonds held by the private sector.

Introduction

In the almost two decades since Takayama et al (1999) published their work indicating substantial generational imbalances in Japan arising from Japan's aging population, a large number of papers have been published arguing that that the Japanese government's fiscal situation is not sustainable.[1] Many have interpreted these results as implying that a Japanese default or a hyperinflation was imminent.[2] The fact that yields Japanese government bonds (JGBs) have remained low for almost twenty years, suggests markets never feared a JGB crisis. Some have suggested that this may reflect a bubble in the JGB market, but if so, it is probably the longest lasting bubble in the history of the world. This paper explores the history of Japanese fiscal policy over the past two decades with the aim of better understanding where previous forecasts have erred. As such, Japan provides an important case study of how a country facing intense fiscal pressures can avoid a hyperinflation or financial panic. We find that there were three key forces that likely improved Japan's fiscal situation relative to more pessimistic predictions. First, the Japanese government has shown remarkable ability to hold down per capita expenditures on social pensions and healthcare. Second, the Japanese government has been able to raise taxes substantially. Third, the remarkable monetary policy pursued by the

[1] See, for example, Asher and Dugger (2000), Ihori, Doi, and Kondo (2001), Dekle (2002), Kotlikoff (2004), Doi, Hoshi, and Okimoto (2011), Imrohoroglu and Sudo (2011), Hoshi and Ito (2014), and Braun and Joines (2015).

[2] For example, Asher and Dugger (2000) conclude "Japan's government debt and deficit are on an explosive and unsustainable trajectory." Similarly, Kotlikoff (2004) writes, "There seems to be ample potential for inflation to take off at any moment in Japan and with it, interest rates." Similarly, Fukao (2003) writes, "In my view, the current deflation in Japan can be regarded as a negative bubble; people are shifting assets from stock and real estates to cash, deposits, and government bonds. They are blindly buying government-backed financial assets even though the credit worthiness of the government is rapidly deteriorating. This negative bubble is clearly unsustainable."

Bank of Japan has resulted in a dramatic decline in the amount of government bonds held by the private sector.

In order to understand the disconnect between studies predicting unsustainable policies and market reaction, it is worth bearing in mind a few points. The first is that one must always be wary of any such prediction because of the impossibility theorem that governs forecasts of asset prices. If markets knew with certainty that the Japanese government would default next year, interest rates would skyrocket today, forcing a default today. But if the default is today, then the original "certain" forecast of a default must have been wrong—the default occurred today rather than next year. Given the self-fulfilling nature of defaults and the resulting difficulty in predicting them, we should avoid definitive claims or counterclaims about whether a crisis is inevitable. Nothing is certain; at best, we can talk about default probabilities.

The second point to realize is that discussions on fiscal sustainability can be a bit confusing because showing that a government's fiscal situation is not sustainable does not necessarily mean that a crisis is imminent. Typically, fiscal situations are deemed unsustainable if there is some difference between expected future expenditures by the government and expected future government receipts. For example, both economists and Japanese young people know that the amount of social pension payments relative to social pension contributions is likely to decline. While this means that the current Japanese system is unsustainable because future generations won't get the same benefits as past generations, it does not mean that a crisis will be forthcoming. Default can be averted by revisions in pension indexing formulas, raising the retirement age, raising copays on medical insurance, increasing taxes, more inflation, etc. In other words, fiscal forecasts reveal *a* future but not necessarily *the* future. As Dickens's Scrooge avers, we "may change these shadows…by an altered life." Put in the more prosaic language

familiar to economists, economic forecasts are built on assumptions about future events and the behavior of government and private agents that may or may not come to pass. But, the fact that we've had two decades of these forecasts provides us with an interesting opportunity to compare what actually happened in Japan with what economists predicted would happen.

In order to do this, we are going to update Broda and Weinstein (2005), which used data up to the year 2000 to forecast what would happen to Japan's fiscal situation over the next 100 years. This paper, optimistically titled, "Happy News from the Dismal Science," was a big outlier in the literature as it, along with Morgan (2004), were among a small set of papers arguing that only modest changes were required to avert a crisis. Broda and Weinstein (2005) implemented Blanchard's (1990) fiscal accounting system. In the Blanchard framework, fiscal sustainability depends on three factors: the current level of Japanese government liabilities and the forecast of future government expenditures and revenues. Broda and Weinstein extended this framework by including the assets and liabilities of the Bank of Japan.

The simplicity of the Blanchard framework has advantages and disadvantages. On the positive side, fiscal sustainability comes down to just a few variables: the level of net debt, the difference between interest and growth rates, monetary policy, and the path of expenditures and taxes. The principle disadvantage is that the calculation does not involve an economic model. The Blanchard approach is essentially an intertemporal budget accounting exercise, but as such it does lay bear the basic factors that need to come into play in order to make a sustainability calculation.

A Simple Framework for Fiscal Sustainability

To help fix ideas, we first summarize the Blanchard (1990) framework as used in the Broda and Weinstein (2005) paper. In this setup, government expenditures can be divided into three categories: public pension payments and medical benefits for the elderly, H_t; all other expenditures, except interest, G_t; and interest on the debt, where B_t is the level of government net debt and i_t is the interest rate on that debt. The government's intertemporal budget constraint can then be written as:

$$(1) \qquad (G_t + H_t + i_t B_{t-1}) - T_t = (B_t - B_{t-1}) + (M_t - M_{t-1}),$$

where T_t stands for government revenues, H_t is transfers to the old, and G_t is other government non-interest expenditures. B_t and i_t are the level of government *net* debt and the interest rate on debt in period t, respectively, and M_t is the money supply in period t. In this setup, any fiscal deficit (given on the left-hand side) must be matched by either increasing net debt or increasing the money supply.

If we divide both sides of equation (1) by nominal GDP and rearrange terms, we obtain

$$(2) \qquad b_t = g_t + h_t - \tau_t + \frac{1+i_t}{1+\eta_t} b_{t-1} - \frac{\lambda_t}{1+\lambda_t} m_t,$$

where τ_t is T_t/GDP$_t$, η_t is the growth rate of nominal GDP, and λ_t is the growth rate of the nominal money supply. Starting with an initial level of debt-to-GDP is given by b_0, we can express the level of debt-to-GDP in period n as:

$$(3) \qquad b_n = \sum_{t=1}^{n} \left(\frac{1+i_t}{1+\eta_t} \right)^{n-t} \left(g_t + h_t - \tau_t - \frac{\lambda_t}{1+\lambda_t} m_t \right) + \left(\frac{1+i_t}{1+\eta_t} \right)^{n} b_0 .$$

Equation (4) is simply the result of accounting and involves no theories of economic behavior. In this setup the "sustainable" tax rate is defined as the value of τ_t that sets level of debt in the year 2100 equal to that in 2000.

Broda and Weinstein (2005) did not formally model the evolution of each term in equation (4); they just used rules of thumb to produce "plausible" paths under various assumptions about fiscal and monetary policy. More sophisticated papers model the evolution of each of the variables with time subscripts. However our interest is not in testing or calibrating models, but rather to see what actually happened to each of these series empirically with an eye to assessing whether or not taxes in Japan will have to rise if the future behavior of the Japanese government looks like the past behavior.

Assessing Assumptions

The first key assumption in Broda and Weinstein (2005) was the interest rate gap or the difference between the nominal interest rate and the nominal growth rate. An increase in interest rates relative to growth rates tends to raise the sustainable tax rate because existing debt becomes more costly to repay. Since forecasting this variable is difficult, Broda and Weinstein (2005) used a number of interest rate gaps ranging from 1% to 4%, with a preferred level of 2%.

Figure 1

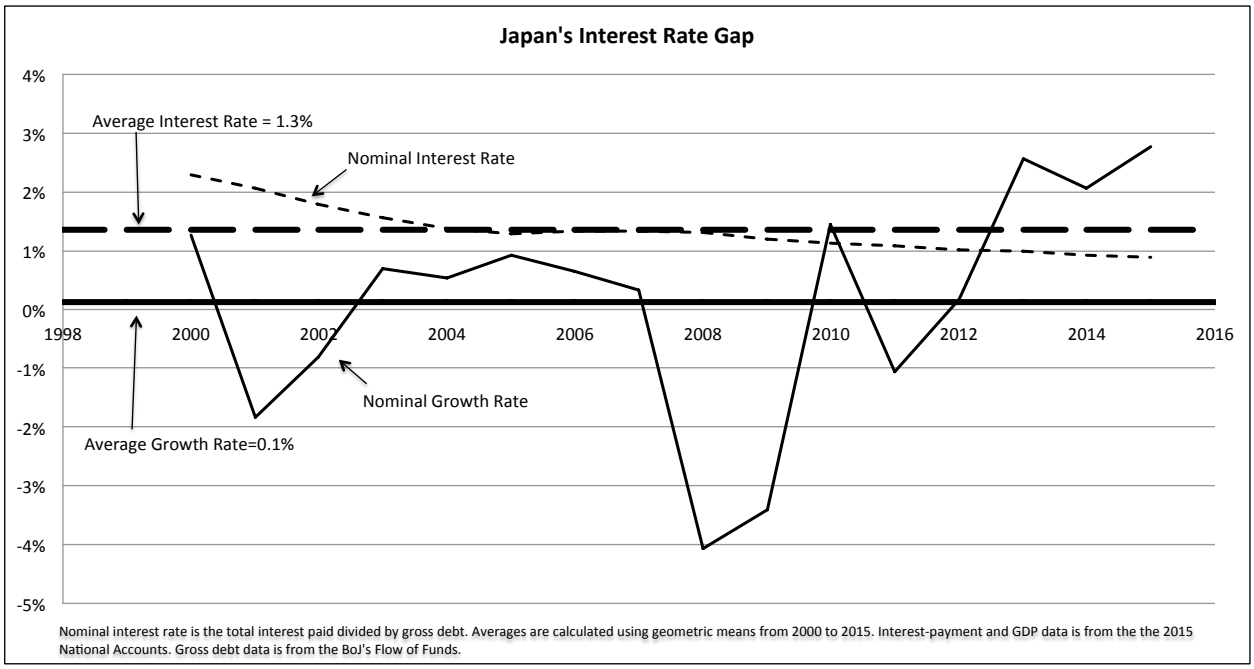


Figure 1 shows the evolution of this rate gap from 2000 to 2015. There are several notable features of the plot. First, while there have been some large swings in Japanese nominal GDP over the past fifteen years, the long-run growth rate of Japanese nominal GDP has been almost constant: only rising by an average of 0.1 percent per year. By contrast, real GDP grew by 0.7 percent per year, with the difference due to the fact that the GDP deflator fell by about 0.6 percent per annum. Second, interest paid on Japanese debt fell consistently over this time period to levels below one percent. These two facts meant that the average interest rate gap was only 1.2 percent. This low interest rate gap—which fell below zero during Kuroda's term—meant that it was easier for the Japanese government to finance the debt.

Two other important variables are the expenditures on the "elderly" (h_t) and the "young" (g_t). In Broda and Weinstein (2005), elderly expenditures were composed of government

expenditures on social pensions and elderly medical care, which they assumed to be paid to all people over the age of 65. Expenditures on the young constituted all other expenses. Given Japan's rapid aging population, a crucial feature of any sustainability calculation is getting the path of these variables right. Indeed, the principle reason why Broda and Weinstein (2005) was, in Hubbard and Ito's opinion, an "optimistic" assessment of Japan's future can be traced back to forecasts of the development of these variables.

Broda and Weinstein (2005) showed (in their "Case 3") that if one assumed that per capita pension benefits rose with GDP per worker, their proxy for wages, Japan needed to raise taxes dramatically in order to stabilize the debt level. However, a major reason for the optimism of Broda and Weinstein arose because in their baseline cases, they assumed that Japan would be able to hold down the path of per capita expenses on the elderly to rise only as fast as GDP. Given that GDP was essentially flat over the past fifteen years, this implied we should have seen no growth in per capita payments to the elders.

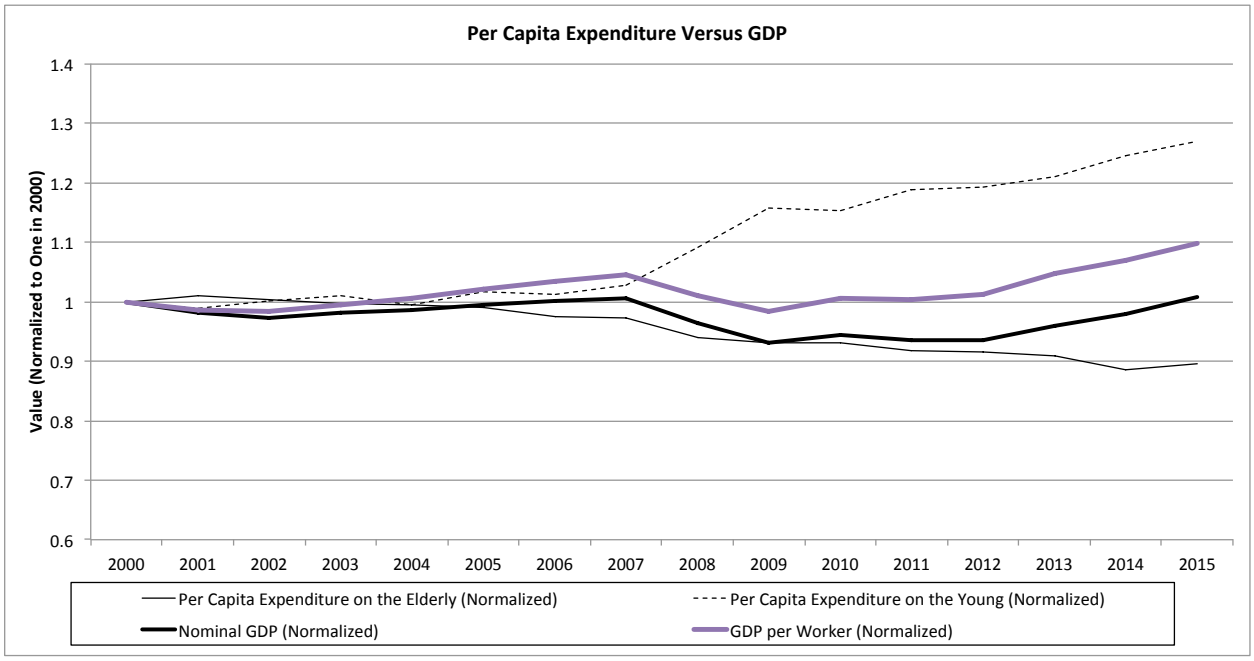
It is important to remember that in terms of the generational accounting approach of Takayama et al (1999), this sort of fiscal discipline produces large generational imbalances because it implies that current and future Japanese workers will pay taxes that will rise with their earnings but will receive pensions that are indexed to a lower rate. In other words, the current generation of Japanese workers is making a large net transfer to retirees without a prospect of getting a similar transfer in the future from their children. In this sense, Japan's policy is not sustainable because future generations will get much less in benefits per dollar of taxes paid than past generations. However, it is important to also realize that this does not mean that crisis is imminent.

Whether one assumes that pensions rise with wages (or GDP per worker as in Broda and Weinstein 2005), is a crucial assumption. On one level this assumption seems non-controversial because current pension formulas tie the pensions to wages. However, governments are free to change the rules governing what they will pay retirees, and the Japanese have been particularly apt at (quietly) doing it in a variety of ways. One important step in this direction was implemented in 2004 as the Japanese government reformed the social security law. In this reform, the government changed the social pension indexing formula in such a way that benefits would be reduced if the number of contributors to the system declined or life expectancy rose. Takayama (2005) estimated that this would slow the growth rate of benefits to be 0.9 percent per year less than wages. Moreover, the Japanese government has been aggressive at holding down healthcare fee and price increases while at the same time increasing copayments (thereby shifting healthcare costs from the government to private citizens).

We can see the impact of these policy changes in Figure 2, which displays nominal GDP, nominal GDP per worker, per capita expenditures on the elderly, and per capita expenditures on the young all normalized to equal one in the year 2000. As we noted earlier, nominal GDP rose by a paltry 0.7%, and GDP per worker rose by 10%. What is most striking is that per capita expenditures on the elderly (i.e. government expenditures on social pensions and elderly medical care) declined by 10 percent between 2000 and 2015. This decline was not matched by a decline in wages, as Japanese hourly earnings in manufacturing rose slightly over this period. Thus, while the number of elderly rose by over 50 percent between 2000 and 2015, total expenditures on them grew by less because of a reduction in per capita benefits. Interestingly, per capita expenditures on the young did not exhibit this trend, rising faster than even per worker GDP.

Here, however, the opposite logic applies. While the per capita expenditures rose, total expenditures rose much slower because the number of young people fell over this time period.

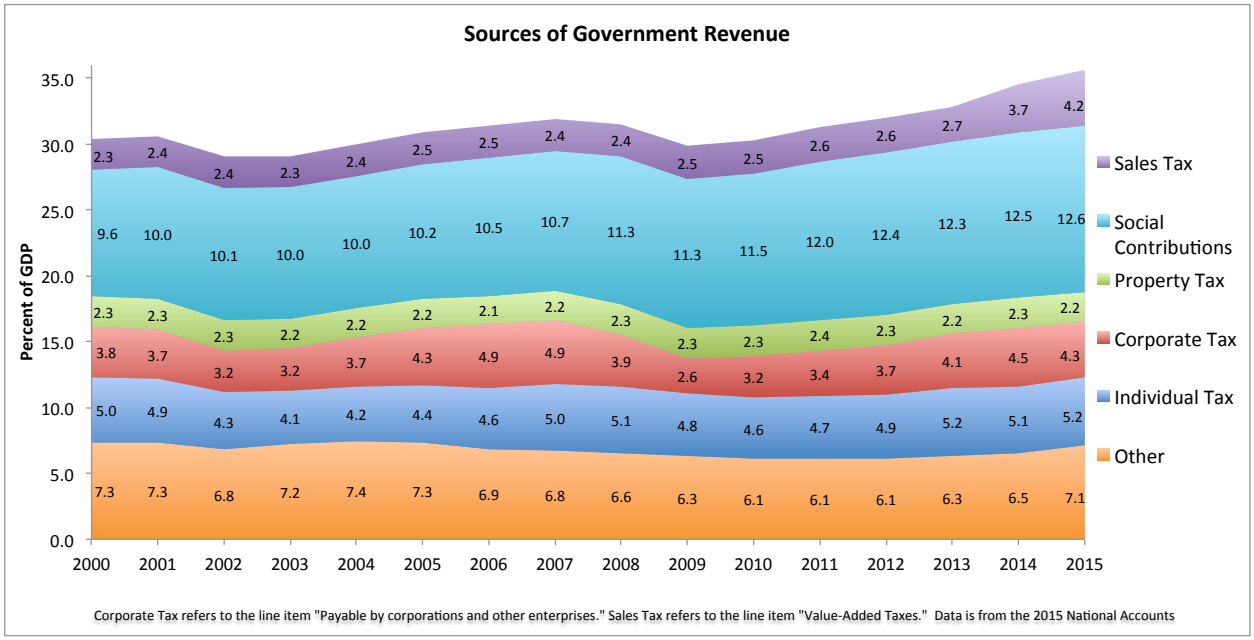
Figure 2



Bringing this discussion back to what Japan's experience tells us about fiscal sustainability, we see that while expenditures on the elderly have been rising, they have been rising at a much lower rate than was forecast even in the most fiscally restrained version of Broda and Weinstein (2005) and substantially slower than forecasts of pension benefits that predicted them to rise with wages (which increased by about 3 percent between 2000 and 2015). In other words, the Japanese government has a good track record of using fiscal austerity to hold down growth rates of social pensions, and this restraint has worked towards preventing a crisis from emerging.

A second important factor in terms of understanding Japan's response to it's aging society is the impact of the 2004 pension reforms on government revenues. As Takayama (2005) discusses, the reforms phased in a 4.72 percentage point increase in the social pension tax between 2004 and 2017. Moreover, the government implemented a three-percentage-point increase in the consumption tax in 2014.

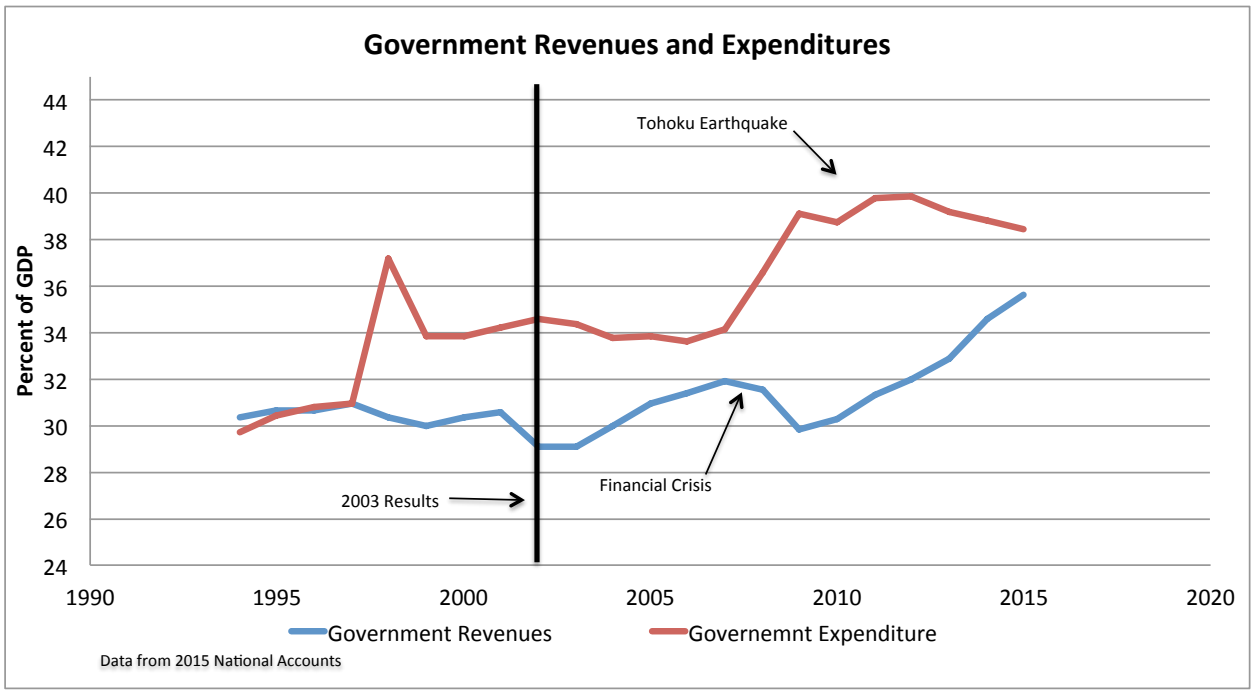
Figure 3



We can see the impact of these policies in Figure 3, which shows Japanese government revenue as a share of GDP and its sources. Between 2000 and 2015, government revenues rose from being just over 30 percent of GDP to 36 percent of GDP. Much of this increase came from social contributions (which rose by 3 percentage points) and sales taxes (which rose by 2 percentage points). To give some sense of how important these tax increases are, we can return to the Broda and Weinstein (2005) forecasts, which suggested that if Japan could hold down the per capita rate of pension rate increases to the GDP growth rate, a six-percentage point of GDP

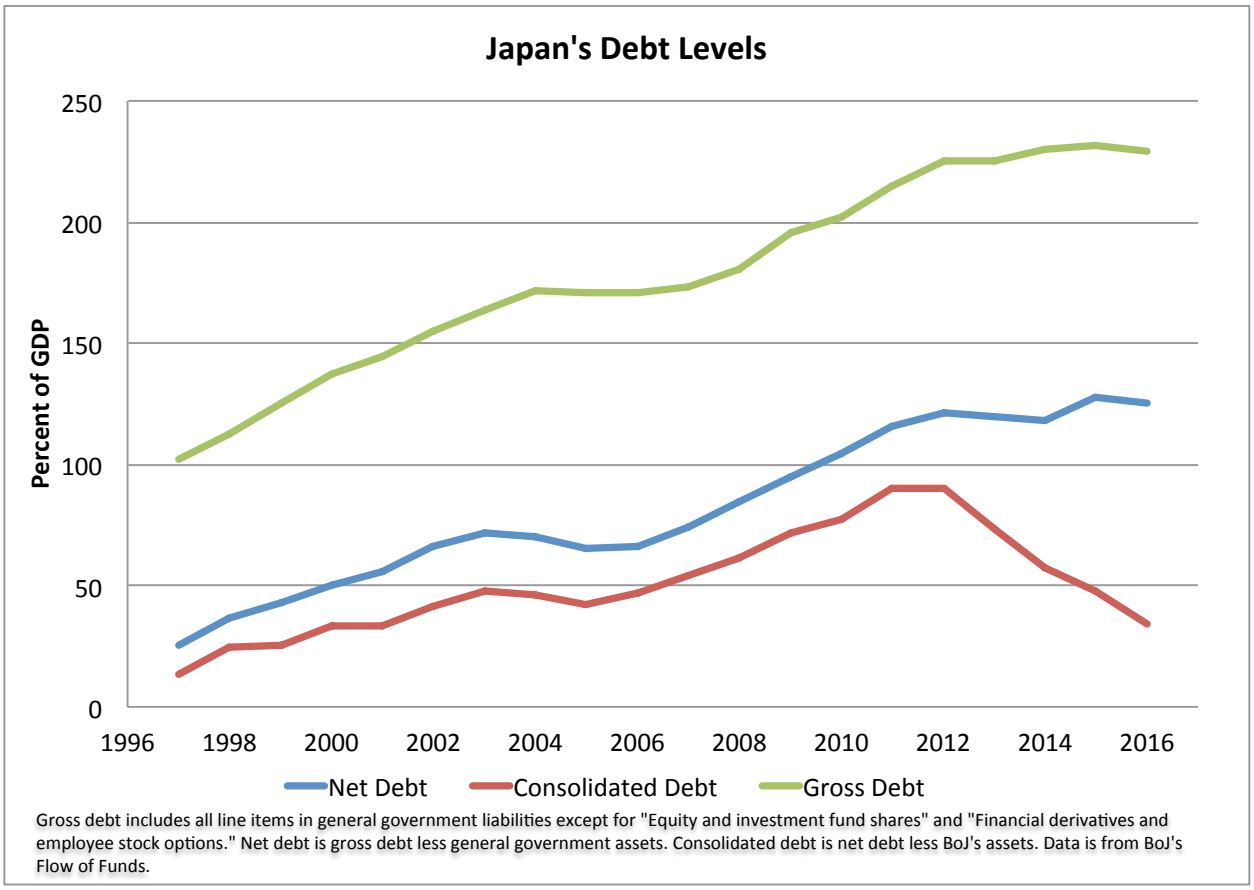
tax increase would render the debt-to-GDP ratio stable over a 100-year horizon in all but the most generous public expenditure scenarios.

Figure 4



Another way of seeing the impact of these reforms is by looking at the evolution of government revenues and expenditures, expressed as a share of GDP, which is shown in Figure 4. Japanese government expenditures show a clear upward trend driven by the aging society. Most of the big increases followed the economic stimulus packages after the 1997 and 2007 financial crises and the reconstruction package following the Tohoku earthquake. With the exception of these extraordinary events, expenditures have been relatively stable as a share of GDP. More striking is the time path of government revenues, which since 2000 have been rising faster than expenditures. The figure demonstrates that the Japanese government has held down expenditures in the past and raised taxes substantially over long horizons.

Figure 5



A final component of the sustainability calculation concerns the evolution of Japan's government debt position. The green and blue lines in Figure 5 show the inexorable rise of Japan's gross debt that has been the source of so much consternation. However, what is less well publicized is the financial assets held by the government of Japan. The government owns a large amount of financial assets (principally foreign and domestic government bonds, currency, and equities), and these assets reduce the net liabilities of the Japanese government and therefore reduce the fiscal pressure.

One can see this formally by modifying equation (1) so that we introduce gross assets and liabilities. Since the definition of net debt is government financial assets less liabilities (i.e., $B_t = L_t - A_t$), we can rewrite equation (1) in terms of gross debt as

$$(4) \qquad [G_t + H_t + i_t(L_{t-1} - A_{t-1})] - T_t = \left(L_t - L_{t-1}\right) - (A_t - A_{t-1}) + (M_t - M_{t-1}) .$$

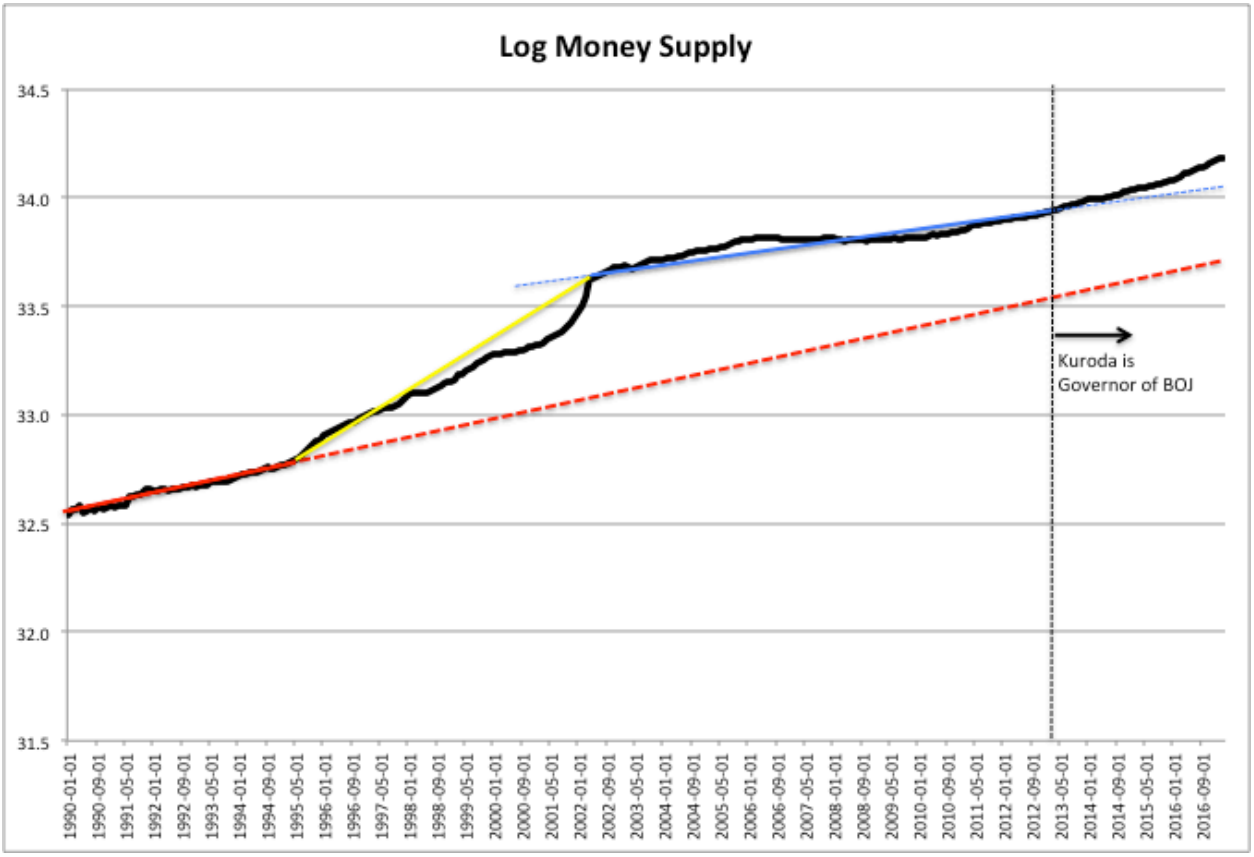
It is immediately apparent that any combination of gross assets and liabilities that satisfies equation (4) will also satisfy equation (1). In other words, given a particular path of government expenses and taxes, all that matters for the government budget constraint is the *net* asset position of the government. Thus, if one does the accounting correctly, it doesn't matter how one wants to do fiscal accounting using net or gross debt.

One final important element of the calculation is the path of monetary policy. Auerbach and Obstfeld (2003) and Eggertsson and Woodford (2003) made strong cases for large-scale open market operations in order to help stimulate the Japanese economy. The idea that Japan should be following some price-level target along with a positive inflation target has been widely accepted (see, for example Ito and Mishkin (2005)), but the idea seems to invoke deep ambivalence on the part of economists and policymakers. On the one hand, the theory of a price-level target dictates that the central bank should allow future inflation to be substantial in order to restore the price level to the level that would have obtained if there had been no deflation. On the other hand, the reality of the implied inflation rates required to achieve a price-level target makes many economists uneasy even as they advocate it.

For example, if one believes that Japan should have targeted the price level in 1997 (as in Ito and Mishkin 2005) and that consumer price inflation should have averaged 2 percent per year since then (due to biases and other factors), then one should also believe that that the price level today should be about 50 percent higher than it is. This creates a bit of a conundrum for

policymakers: is the large increase in the money supply and its implications for future inflation a fundamental part of the solution or a fundamental part of the problem?

Figure 6



This issue also raises the question of what monetary policy is "normal" for Japan. As one can see from Figure 6, the growth rate of money supply has been remarkably constant over long horizons in Japan. We see a substantial increase between 1995 and 2002, but aside from that increase (and until the policies of Governor Kuroda), we see little change in the long-run growth rate of the money supply. It is not obvious from this picture how far back in Japanese history we should go to see normal money-supply growth. If we go back to the 1990s, it looks like the level of money in the economy is about 50 percent higher than what we might have expected by extrapolating the trend. Of course, one might argue that the five years following the collapse of

the Japanese bubble was an exceptional period, but this begs the question—was monetary policy normal during the bubble years? Following the first oil shock and the collapse of Bretton Woods? During the high growth period? In other words, without a theoretical model, e.g. a price-level target, it is difficult to look at long-run trends for guidance about what monetary policy makes sense for Japan.

One fact that is indisputable is that the recent open market policy of the Bank of Japan has had a dramatic impact on the amount of government bonds held by the private sector. As one can see in the red line in Figure 4, the consolidated debt of Japanese government, which equals the net amount of bonds held by agents other than the Japanese government and the Bank of Japan has fallen precipitously as a percentage of GDP.

This figure provides another important reason why a JGB crisis hasn't materialized—there simply are not that many private entities holding Japanese government debt. Obviously, if inflation started to rise, the Bank of Japan might feel conflicted about its desire to reduce money growth and not precipitate a crisis in the bond market, but it seems like the BOJ could easily prevent any spike in JGB interest rates by buying up the small amount of remaining JGBs in the market. This might involve some higher inflation, but it is hard to see how this would turn into a default or even hyperinflation. For example, if Japan ended up with an inflation rate of five percent per year for ten years, Japan's price level would approximately hit the 1997 price level (adjusted by a 2 percent per year inflation rate), more or less what economists had advocated when writing the initial price-level target papers. Avoiding a future like this seems hardly a reason for a central bank to create a crisis in the bond market.

A New Sustainability Calculation

With this data preview as a background, we are now able to update the results from Broda and Weinstein (2005). These forecasts used data up through 2000 to forecast expenditure and debt levels for the next one hundred years. We are now 17 years into that forecast, so it is reasonable to wonder how well they did. In order to do the update, we now replace forecast values for the years 2000-2015 with actual data and then compare both how the various forecasts performed over this time period and what the revised forecast looks like over the next 85.

Broda and Weinstein (2005) considered three scenarios in their forecasts that allowed for different paths of government benefits. In Case 1, per capita expenditures on the elderly (which we define as those over 65 years of age) were assumed to rise at the same rate as GDP growth while total expenditures on the remaining population were assumed to be a constant share of GDP. In Case 2, per capita expenditures (both on the young and on the elderly) were assumed to always be proportional to GDP. Finally, in Case 3, per capita expenditures (both on the young and the elderly) were assumed to rise with GDP per worker. These three cases differ dramatically in the implied growth rates of Japanese government expenditures for the elderly and young. In other words, Case 3 is the most generous in that all per capita expenditures rise with GDP per worker, Case 1 maintains a generous policy for the young but implies more fiscal discipline for the elderly, and Case 2 imposes fiscal discipline on both the young and the elderly.

Our sustainability numbers differ slightly from those of Broda and Weinstein (2005) because there have been a number of data revisions in the intervening years principally to population forecasts and GDP. In particular, we use the current National Institute of Population and Social Security Research (NIPSSR) forecasts for population, which differ both from the Faruqee and Muhleisen (2001) forecasts as well as the original NIPSSR forecasts used by Broda

and Weinstein (2005). In addition, we update our historical average values of expenditures using data from the 15 years since 2000, when Broda and Weinstein (2005) took their data.

Table 1

	Sustainable Tax Rates					
	Case 1		Case 2		Case 3	
Forecasts	2016	2003	2016	2003	2016	2003
Rate Gap						
0	33.5	33.6	25.8	27.0	45.1	42.5
1	34.5	34.5	27.8	28.9	44.6	42.1
2	35.4	35.3	29.6	30.7	44.1	41.5
3	36.2	36.0	31.3	32.1	43.7	41.1
4	36.9	36.6	32.7	33.4	43.4	40.7
2003 Tax Rate 29.1						
Current Tax Rate 35.6						

Entries are percentages of GDP.

In Case 1, *per capita* expenditures on the elderly are proportional to GDP while expenditures on the young are proportional to GDP.

In Case 2, per capita expenditures (both on the young and on the elderly) are proportional to GDP.

In Case 3, per capita expenditures (both on the young and the elderly) are proportional to GDP per worker.

Both 2003 and 2016 results use population forecasts from NIPSSR.

"Updated 2003" is the sustainable tax rate in 2003 calculated using the realized expenditures through 2015 and the updated forecasts thereafter.

Table 1 shows the results of this exercise. In each case, the first column reports the sustainable tax rate computed using current data, and the second column replicates the Broda and Weinstein calculation using the data they had available (but adjusted for data and accounting revisions that occurred since then to make the numbers comparable with column 1).[3]

There are two interesting features of this table. The first is that there's been remarkably little change in the sustainable tax rate over this time period. In Case 1 the rate stayed approximately the same, in Case 2 the rate fell slightly, and in Case 3 (the most generous case) they went up slightly. The drop in the sustainable tax rate in Case 1 occurred largely because of

[3] In addition to these revisions, the most recent SNA time-series also spans a shorter time period. While the 2003 results used data from 1980 through 2000, the most recent SNA does not have data before 1994. The time period over which we take averages of expenditures have therefore been modified, so that for expenditures on the young, we take the average from 1994 to 2000 (the maximum length, given the data that we have) while for expenditures on the elderly, we take the average from 1998 to 2000 (we use a three-year time span for elderly expenditures so that we stay consistent with our updated results, which will be discussed later).

the cost controls on per capita benefits for the elderly and NIPSSR's new population forecasts that expect a faster population decline. The new population forecasts are also responsible for the rise in the rate for Case 3, as we now expect a faster working-population decline (relative to the whole population) than was predicted in 2003. But it is important to note that the higher tax rate in Case 3 depends wholly on the assumption that the future path of *per-capita* benefits for the elderly will rise at a much faster rate than we have observed over the past twenty years.

The second notable feature is that the rise in Japanese taxes has pushed Japan closer to the sustainable level. For example, in the preferred specification of the Broda and Weinstein (2005) paper (a 2 percentage point rate gap), government revenues needed to rise by 1.6 percentage points of GDP in Case 2 (our baseline case), 6.2 percentage points in Case 1 and 12.4 percentage points in Case 3. Thanks in large part to the increases in government revenue (from 29.1 percent to 35.6 percent), the government revenues as a percent of GDP are now 6 percentage points *above* sustainability for Case 2 (versus 1.6 percent below previously), 0.2 percentage points *above* sustainability for Case 1 (versus 6.2 percent below previously), and 8.5 percentage points below sustainability for Case 3 (versus 12.4 percent below previously). The rise in government revenues is driven primarily by the big tax increases that Japan has already enacted (in social contributions and sales tax).

Our updated numbers therefore indicate that at this level, fiscal policy is sustainable in most scenarios (Cases 1 and 2) and is much closer to sustainability than it was previously for Case 3. Again, if one believes that fiscal discipline will deteriorate in the future (i.e. in Case 3), then Japan will have to raise taxes, but maintaining the current level of aggressiveness at holding down cost increases may be sufficient to avoid tax increases.

Figures 8-10 further explore the reasons for the different forecasts. Each figure portrays historical and forecast expenditure levels for each of our three cases. The orange, purple, and blue curves show the forecasts for the expenditure levels in total and for the young and old based on where Japan was in the year 2000. The black lines to the left of the vertical red line show what actually happened to the series between 2000 and 2015. The black lines to the right of these series show updated forecasts of the series.

Figure 8

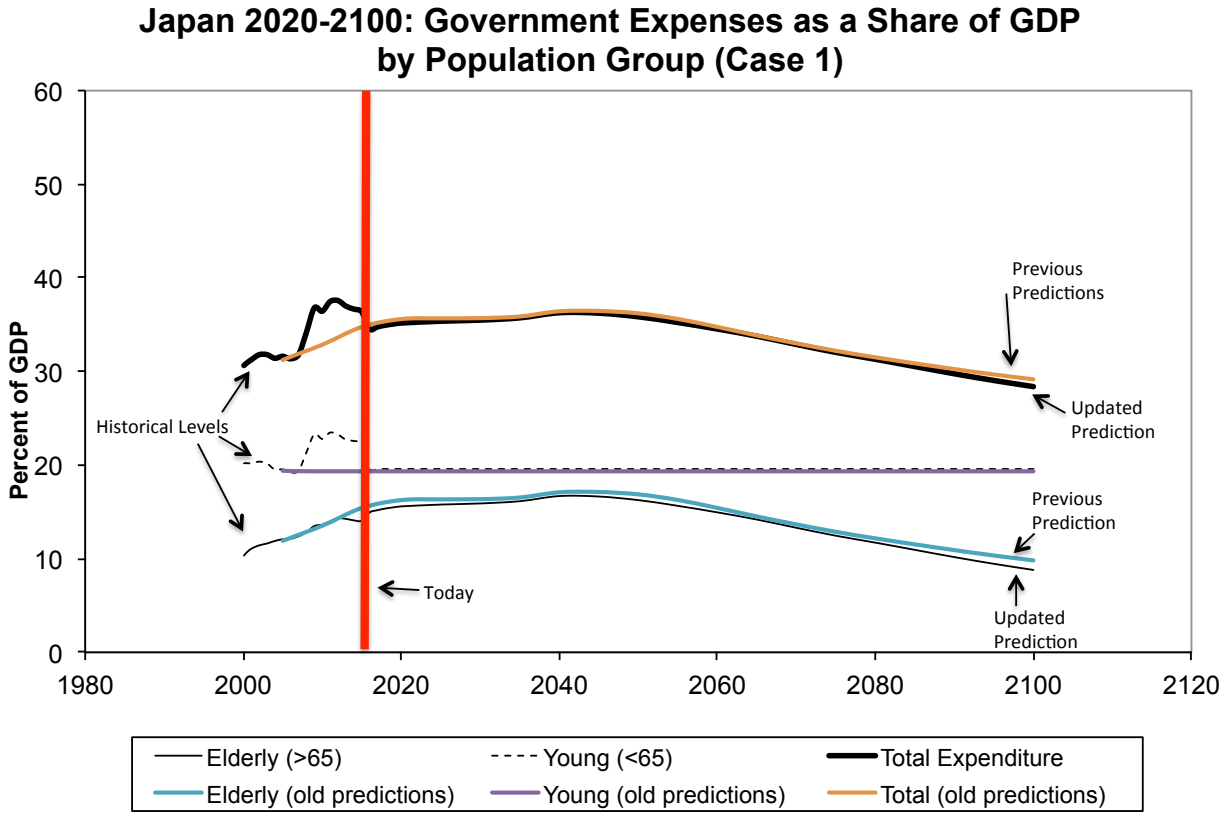


Figure 9

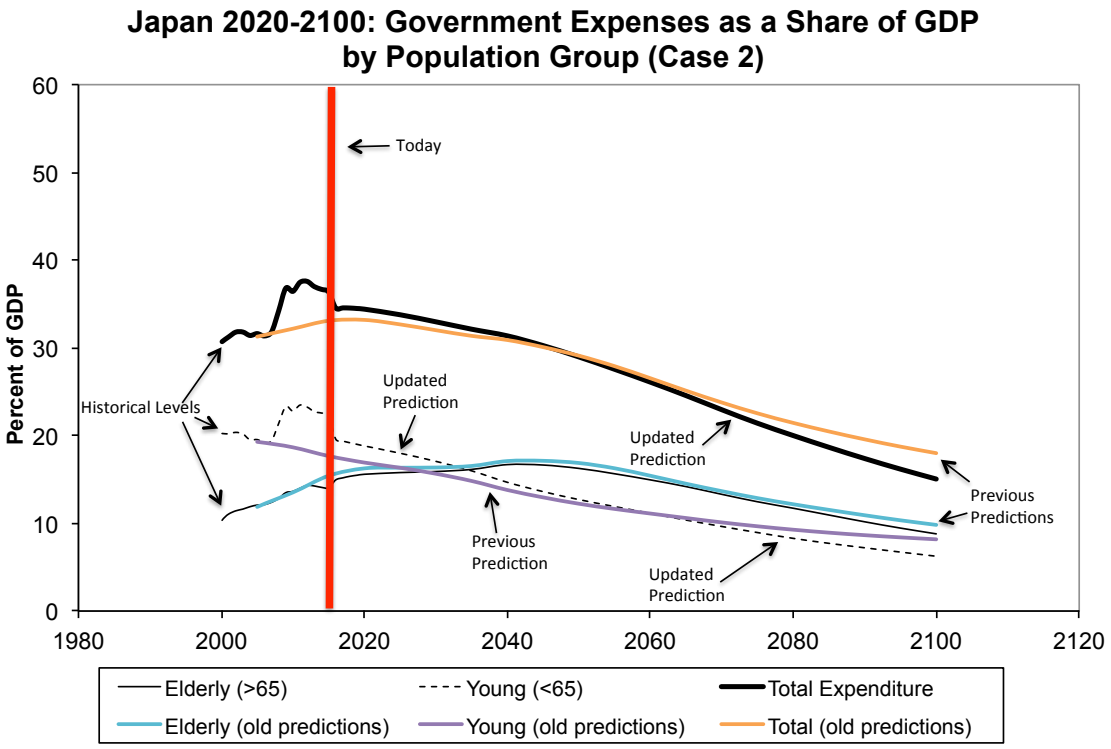
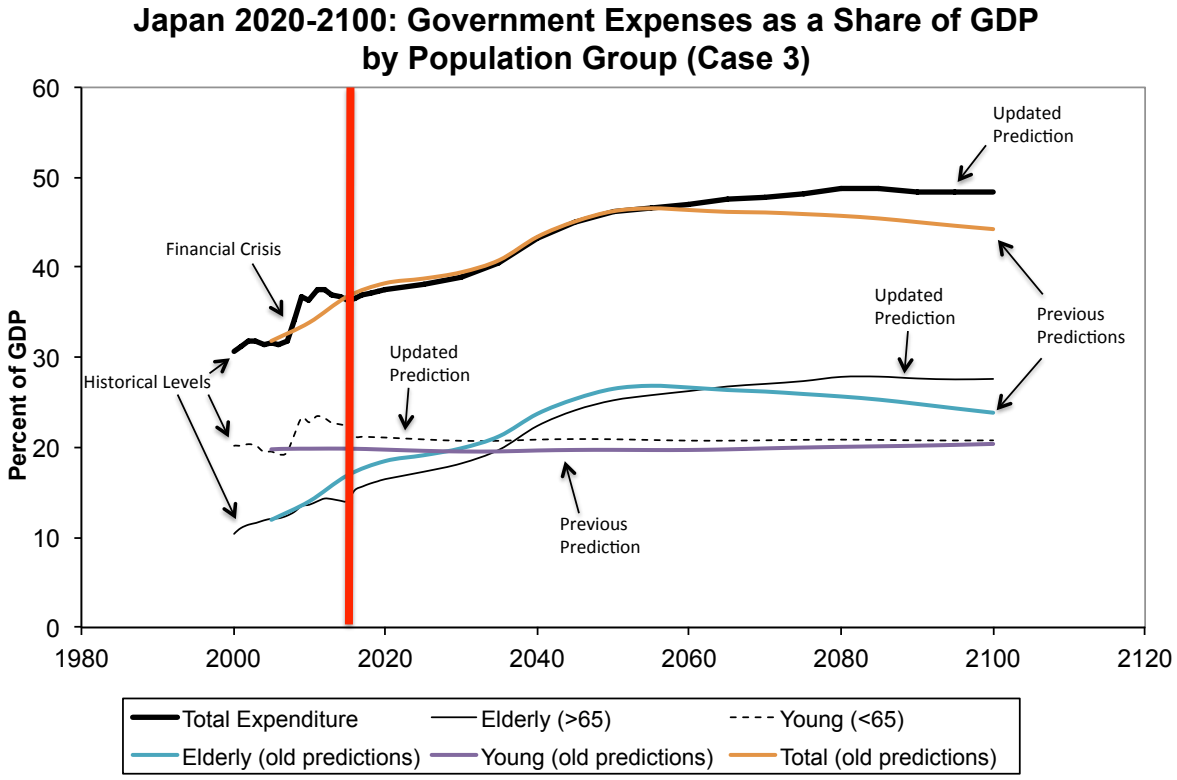


Figure 10



Comparing the historical expenditure levels with what was predicted in 2003 (the section of the plots to the left of the red bar), we can make a few observations. The first is that most of the discrepancies between the actual numbers and the 2003 predictions were a result of the increases in government spending stemming from the financial crisis and the Tohoku earthquake. We can see in all three plots that the actual expenditures on the young (which includes all expenditures that are not for the elderly and would therefore include expenditures from a fiscal stimulus) overshot the predicted expenditure levels by several percentage points starting in 2008 and has lingered at historically high levels since then. While these expenditure levels might not fall back to the levels seen before the crisis, we can expect them to fall to some extent as the remaining effects from the recession tapers off and Abe's government aims to balance its budget by FY 2020. The second observation is that expenditures on the elderly—the part of government expenditures that is much less sensitive to economic fluctuations—has *undershot* the 2003 predictions in all three cases. This is particularly prominent in Case 3 where the actual expenditure numbers were almost three percentage points of GDP lower than what was predicted (a difference of 20% from the actual numbers), offsetting the recession-induced higher expenditures on the young. This slower-than-predicted rise in elderly expenditures can in part be attributed to the cost controls on elderly expenditures that were discussed earlier. However, the pronounced discrepancy for Case 3 also highlights the point made earlier—that the assumption of per capita expenditures on the elderly rising with per worker GDP also contributed to the significant overestimate in elderly expenditures.

Our updated expenditure forecasts (to the right of the red bar) reflect these two observations. First, we predict a higher per capita expenditure on the young (as a share of GDP)

than we did in our 2003 results, but below what we have seen following the financial crises.[4] This assumption is why for all three plots, the dotted line (the updated predictions on young expenditures) immediately after the red bar is above the purple line (the 2003 predictions on young expenditures) but still below the historical expenditure levels immediately before the red bar. In other words, we predict that all else equal (i.e. if the population stayed the same), non-elderly government expenditures should fall to a level between what we have today and what we saw before the recession. Second, we lower our predictions for per-capita expenditures on the elderly (as a share of GDP) to reflect the lower-than-expected expenditure levels we have seen over the past few years.[5] This is the primary reason our updated forecasts for elderly expenditure lie slightly below the 2003 predictions for the whole forecasting duration in Cases 1 and 2 and until 2065 in Case 3. It is worth noting that while these modifications shift the expenditure curves upwards or downwards (by altering their respective proportionality constants), this does not change the fundamental assumptions. In Cases 1 and 2, we still consider per capita expenditure on the elderly to rise proportionally with GDP, an assumption that has matched the actual data reasonably well in the past, and in Case 3, we expect per capita expenditures to rise proportionally to GDP per worker, an assumption that has significantly overestimated elderly expenditures.

This would suggest there is reason to be optimistic about Japan's sustainability. In both Cases 1 and 2, we find that Japan's tax rate is already at a sustainable level. And for the one scenario that indicates Japan's current tax rate is not sustainable (Case 3), we find that the

[4] We make this prediction based on the historical average of government expenditures on the young between 2000 and 2015. We use a 16 year time range (including both the pre- and post-crisis years) so that we can average out the volatility in spending as a result of economic fluctuations.

[5] More specifically, we estimate this value by taking the average per capita expenditure on the elderly over the previous three years (i.e. 2013 to 2015).

underlying assumption led to significant overestimates of elderly expenditures, suggesting that it may not accurately reflect the ability of the Japanese government to rein in expenses.

Conclusion

This paper re-examines Japan's fiscal and monetary policy over the past two decades and finds that the Japanese government has been remarkably adept at restraining benefit growth, raising taxes, and monetizing debt without generating inflation. Japan still needs to continue to balance the generosity of its social pension program with future tax increases, but the simplest interpretation of why markets have not responded to studies showing Japanese finances are troubled is that they have confidence in Japanese policymakers' ability to work out good compromises. If this approach continues, Japan may very well avoid either a financial crisis or a major inflationary episode.

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Technical Appendix

In this section, we detail our data sources and methodology.
Data:
1. The Cabinet Office's Annual Report on National Accounts for 2015 is the source of our data for historical expenditures, government revenues, interest paid on debt, transfers made to the elderly, and GDP. This is available (at the time of this writing) here:
http://www.esri.cao.go.jp/en/sna/data/kakuhou/files/2015/29annual_report_e.html
The Excel file with GDP can be obtained under the specification of "Fiscal Year" at "Current Prices" in section "IV. Main Time Series," under "1. Gross Domestic Product (Expenditure Approach)." In the spreadsheet, row 48 (called "5. Gross domestic product (expenditure approach) (1+2+3+4)") is used.
The Excel file containing expenditure, revenue, and interest data can be obtained under the "V. Supporting Tables" section under a link called "(6-2) Account classified by the Sub-sectors of General Government(GFS)". In the spreadsheet, we use row 9 (called "1 Revenue") for government revenues, row 85 (called "2 Expense") for expenditures, and row 95 (called "24 Interest") for the government's interest expenses (the interest expense is used to create Figure 1 and also to calculate the non-elderly expenditures, which is defined as total expenditures minus elderly expenditures and interest expenses. This spreadsheet is also used to create Figure 3 using row 12 ("1111 Payable by individuals"), row 13 ("1112 Payable by corporations and other enterprises"), row 16 ("113 Taxes on property"), row 24 ("11411 Value-added taxes"), and row 45 ("12 Social contributions").
The Excel file containing data on elderly expenditures can be obtained from the link "(9) Transfers from General Government to Households (Social Security Transfers)" from the Supporting Tables. From the spreadsheet, we use row 11 ("a. Public pension (excluding children allowances)(*2)"), row 23 ("(3) New medical care system for the Elderly"), row 38 ("(9) Long-term care insurance"), row 20 ("(b) Pensions" –these are pensions under Seamen's insurance) and rows 27, 30, 33 (all are called "b(b) Long-term"), which correspond to each of the long-term expenditures from the three mutual benefit association line items ("a. Federation of national public personnel mutual aid associations", "b. Pension fund association for local government officials", and "c. Others").
2. Future population estimates, and fertility rates are taken from Japan's NIPSSR.
Future population predictions are available (at the time of this writing) here:
http://www.stat.go.jp/english/data/nenkan/66nenkan/1431-02.htm
using the link "Future Population." We use the "65 and older" columns for the elderly population, the "15-64" column for the working-age population, and the sum of the "15-64" column and the "0-14" column for the young population.
Fertility data is available using the link called "Standardised Vital Rates and Reproduction Rates." In the spreadsheet, we use the column called "Total fertility rate."
3. Historical population numbers are taken from Japan's Statistics bureau using their E-Stat portal: http://www.e-stat.go.jp/SG1/estat/ListE.do?bid=000001039703&cycode=0
(in case this link becomes unavailable, the site is also accessible through the link called "Time Series 2000 – 2015" from the Statistics Bureau website:
http://www.stat.go.jp/english/data/jinsui/2.htm)
The population time-series called "Population by Age (Five-Year Groups and 3 Groups) and Sex (as of October 1 of Each Year) - Total population,Japanese population (from 2000 to 2015)" is

used. Historical population numbers for the young (below 65 years old), elderly (65 and older), and working (15-64) are available in this workbook.
4. Historical debt level data comes from BoJ's Flow of Funds. The data for this year is available here: http://www.boj.or.jp/en/statistics/sj/index.htm/
Historical levels for each fiscal year can be found on the BoJ's time-series data search tool found here: https://www.stat-search.boj.or.jp/index_en.html
Although the website is difficult to navigate, historical balance sheet data is available on this website using the "Flow of Funds" link. For gross debt, we sum together all categories in the General Government's liabilities except for "Equity and investment fund shares" and "Financial derivatives and employee stock options." For the government's assets (for calculating net debt), we sum all categories in the General Government's assets. For the BoJ's net assets (for calculating the consolidated net debt), we sum all of the central bank's asset categories except for "Currency and deposits" and "Others" and subtract the liability the BoJ has in the "Loans" category.
Method:
As discussed briefly in the main text, an important step in projecting future expenditures is the determination of the proportionality constants for each of the assumptions. For expenditures on the young, we take three approaches. For Case 3, we compute the young expenditure (as a share of GDP) multiplied by the working population divided by the population of the young for each year, and take the average of this value over the period from 2000 to 2015.[6] To project the future expenditure on the young, we would multiply this average by the projected young population and divide by the projected working population. For Cases 1 and 2, we first compute the average young expenditure (as a share of GDP) divided by the young population, and take the average of this value for the period from 2000 to 2015 (this would be the average per capita expenditure on the young as a share of GDP).[7] For Case 2, we then multiply this average by the projected population of the young. For Case 1 (where young expenditure is a constant share of GDP) we simply take the first projection of the young expenditure level as a share of GDP (i.e. for the year 2016) for Case 2 and then assume that this expenditure level (as a share of GDP) remains constant. For expenditures on the elderly, we compute similar averages. For Case 3, we compute the elderly expenditure (as a share of GDP) multiplied by the working population divided by the elderly population for each year, and take the average of this value over the three-year period from 2013 to 2015.[8] To project the future expenditure on the elderly, we multiply this average by the projected elderly population and divide by the projected working population. For Cases 1 and 2, we compute the average elderly expenditure (as a share of GDP) divided by the elderly population, and take the average of this value for the years 2013 through 2015.[9] For both Cases 1 and 2, we then multiply this average by the projected elderly population for a particular year.

[6] For the 2003 replications, we take the average from 1994 to 2000
[7] Again, the average is taken for 1994-2000 for the 2003 replications.
[8] For the 2003 replications, we take the average over the years 1998-2000
[9] Again, the average is taken for 1998-2000 for the 2003 replications.