Preparing for the next crisis in JGB market*

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Abstract

This paper provides an overview of the sustainability of Japan's government debt, emphasizing the viewpoint of market participants in the Japanese government bonds (JGB) market. The Japanese government will be able to finance its debt as long as current surpluses continue, meaning there is sufficient domestic demand for JGB. Looking at domestic investors' portfolio choices, both life insurance companies and pension funds are increasing their holdings of long-term government bonds to match the maturities of their assets and their payments to households. Japanese banks, on the other hand, are increasing their holdings of short-term government debt, almost proportionally to the increase in their deposits. However, there is substantial heterogeneity in portfolio choice. Three megabank groups (Mitsubishi–Tokyo–UFJ, Mizuho, Sumitomo–Mitsui) and large regional banks have decreased their portfolio weights of JGB recently. Smaller banks specializing in small-firm lending and agricultural lending as well as Japan Post Bank (Yu-cho) have increased the proportion of government debt in their portfolios. Hence, potential losses in their portfolios, once the JGB yield starts to increase, are much higher with the latter group of financial institutions.

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1. Introduction

Since the late 1990s, the sustainability of Japan's fiscal situation has been a major concern for economists and policy makers, both domestic and foreign. Japan's fiscal position has been considered the worst among developed economies, with government debt outstanding being around 200% of GDP in recent years. Foreign commentators often express difficulties in comprehending this situation because European countries with much lower debt/GDP ratios have experienced serious fiscal crises since the Lehman shock. Some hedge fund managers even publicly claim that they are taking short position in Japanese government bonds and Yen, since a fiscal crisis in Japan in the near future is inevitable.

On the other hand, it is also known that Japan has run a current account surplus for several decades, accumulating a large net external asset position. For this reason, optimistic commentators, mostly Japanese, have argued that accumulating government debt will not be a serious problem because the majority of Japanese government bonds (JGB) are held and new issues are purchased by domestic investors. Figure 1 illustrates this contradictory situation. While the government debt/GDP ratio has increased from 80% in 1995 to 200% in 2010, the 10-year JGB yield has fallen from 3% to around 1.2% over the same period. Even though the most recent debt/GDP ratio is undoubtedly alarming, the current JGB yields signal that market participants dominated by domestic institutional investors are not concerned about a JGB default.

[Figure 1]

However, this optimistic view emphasizing Japan's large net foreign asset position does not rule out the possibility of a fiscal crisis, because it does not explain why domestic investors keep holding and purchasing JGB. More precisely, domestic investors have not started selling their JGB holdings because they do not believe a fiscal crisis will occur in

the foreseeable future. If, for example, investors expected government bond prices to decline one year from now, they would attempt to sell their JGB today, which would trigger an immediate fiscal crisis. Therefore, we must consider what would happen if a fiscal crisis occurred and why the majority of domestic investors believe such a scenario is unlikely in the immediate future.

We discuss these issues in this paper, emphasizing the viewpoints of the participants in the JGB market. The remainder of this paper is organized as follows. In Section 2, I summarize Japan's fiscal and external balance positions and compare these with other developed economies. Then, I argue that Japan's aging process is extremely rapid, but is not qualitatively different from that in other developed countries. In the long-run, Japanese demographic structure will start to converge to Western European countries. Since the dominant factor causing Japanese fiscal problem is its aging process, the increasing trend in its debt/GDP ratio will not remain forever, but will stabilize at some point in the future. This result has important implications for sustainability calculations.

In Section 3, the most likely future course of events if a fiscal crisis indeed occurs will be discussed. The argument depends on (or at least the majority of domestic investors believe it depends on) whether Japan's current account surplus continues, so that the annual government deficit can be financed by domestic investors alone. In Section 4, assuming that the current account surplus will continue, we examine whether domestic investors are likely to reduce the weight of JGB in their portfolios drastically. We argue that Japanese institutional investors will continue to invest in JGB. In fact, they might even accelerate their JGB purchases in the next several years.

Among the major players, Japanese banks will shift their JGB holdings to shorter maturity securities in the future, while life insurance and pension funds will shift their holdings to longer maturity securities. Finally, we argue that the interest rate risk of an increase in the JGB yield has become concentrated in a small proportion of financial

institutions, namely small regional banks and postal savings banks. Hence, if a sharp increase in interest rates occurs, it would cause disproportionally large amounts of damage to these domestic financial institutions. The damage to the financial system as a whole would be different qualitatively from, and could be much larger than, the case in which JGB holdings and the burden of interest rate risk were spread more widely. As a result, the precautions and ex post policy responses of a potential fiscal crisis will be different too. Section 5 concludes the paper.

2. Overview of Japan's fiscal situation by international comparison

2.1. Debt/GDP ratios and External Balances

Let us start from the discussion on conventional measures of fiscal sustainability. In Table 1, gross debt/GDP ratios and external position as a fraction of GDP are reported for the major developed economies. In 2010, Japan's debt /GDP ratio was almost 200% of GDP as calculated by the OECD, and 220% as calculated by the IMF.

For an international comparison, I adopt to the IMF data. Japan's debt/GDP ratio is much higher than that of Greece at 143% and Ireland at 95%. If we examine net government debt, the Japanese government debt/GDP ratio is still the highest among the developed economies. However, the difference between Japan and European countries decreases. Italy has the second highest net debt/GDP ratio in 2010 at 99.4% among the countries listed in Table 1. The difference of gross debt/GDP ratios between Japan and Italy is about 100 percentage points in 2010, while the difference in net ratio is about 18 percentage points. However, calculating net government asset/debt can be tricky. In Japan's case, previous studies such as Doi and Hoshi (2003) made considerable efforts in assessing exact amount of government asset and debt items embedded in the second budget system, the Fiscal Investment and Loan Program (FILP). Hence, if net debt/GDP number really means that Japanese fiscal situation is not as bad as it has been presumed in popular

discussions is not so obvious.

On the other hand, Japan has run current account surpluses and accumulated foreign assets for several decades. Japan's net external asset position as a percentage of GDP is 56%, which is even larger than that of Germany. European countries facing a fiscal crisis have large negative external positions: minus 130% for Greece and minus 90% for Ireland. It is no wonder that these countries' fiscal situations are heavily influenced by foreign investors and they are more vulnerable to speculative attacks from abroad than is Japan.

[Table 1]

In considering vulnerability to speculative attacks, the size of the government bond market is potentially very important. If the absolute market size is larger, it is difficult for private sector financial entities such as hedge funds to make a profit by taking a short position or making a "speculative attack". The last column of Table 1 presents GDP figures using Japan as a benchmark (= 100). The Japanese economy is approximately 13.5 times larger than that of Greece and is almost equal to those of Germany and Spain combined.

Suppose that the size of the government bond market is roughly equal to the amount of government debt outstanding, and take Japan's JGB market size as the benchmark. Then, from Table 1, the size of the US government bond market is about 150% of the size of the JGB market. Among the European countries, Germany's and Italy's markets are largest and around 25–30% the size of the Japanese market. France and UK are next at around 20%. The size of Greece's government bond market is only about 5% the size of Japan's, and the Portuguese and Irish markets are even smaller. Overall, seeking profit opportunities by taking short positions if betting for an overvaluation of JGB would be much more difficult than doing so for European countries given that Japan's domestic investors hold a large fraction of the total amount of JGB outstanding. Hence, a speculative attack from abroad is unlikely to cause a fiscal and/or currency crisis in the immediate

future.

2.2. Is the debt-GDP ratio a useful measure of fiscal sustainability?

Existing empirical and simulation studies on fiscal sustainability typically start with some predetermined threshold level of debt/GDP ratio and define that the government "defaults" if actual debt/GDP ratio exceeds that threshold. Blanchard et.al. (1990) is one of the early pioneering contributions in this area. See Broda and Weinstein (2005) for rather optimistic account on Japanese fiscal situation. Hoshi and Ito (2012) is more recent and detailed examination of Japan's fiscal situation. Their conclusion is naturally more pessimistic and alarming than Broda and Weinstein seven years earlier.

However, as Broda and Weinstein rightly point out, there is no profound theoretical argument which justifies some particular threshold number for the debt/GDP ratio. Empirical studies such as Reinhart and Rogoff (2009) argue that the likelihood of the sovereign default sharply increases beyond the certain level of the debt/GDP ratio based on historical episodes. Such a practical approach or "conventional wisdom" does make sense as long as the economies similar to each other except for their fiscal situations are compared. On the other hand, Japan is substantially different from other advanced economies in Europe and North-America regarding the speed of aging process.

In fact, the social and economic mechanisms behind Japan's aging process are not qualitatively different from those in other developed countries. Just, the speed has much faster in Japan. This leads two important implications for fiscal sustainability calculations. First, in the long-run, Japanese demographic structure will converge to that in Western European countries. Since the dominant factor causing Japanese fiscal problem is its aging process, the increasing trend in its debt/GDP ratio will not remain forever, but will stabilize at some point in the future. Second, however, the rapid aging process will make Japan's debt/GDP in 21st century a hump shape. The debt/GDP ratio at the top of the hump can be

very high. Considering the first point, Broda and Weinstein (2005) refer to the nonparametric regression result in Faruquee and Mühleisen (2001) in which the fertility rate is regressed on income level. Their nonparametric regression result shows that the fertility rate is mildly increasing in the countries with highest per capita GDP. Based on this fact, Broda and Weinstein argue that "… Japanese fertility rate will not remain low forever, but will rise at some point in the future. This prediction suggests that Japan's long-run population will be lower than the current level, but not zero, a result has important implications for sustainability calculations." In the following, I basically make the same point they make based on recent discussions in population studies and labour economics such as The National Institute of Population and Social Security Research (2012), Steinberg and Nakane (2012), and Global Agenda Council on Ageing Society (2012).

I provide the description of the aging process in developed countries based on Japanese experience in below. Such a description is applicable to most of Western European and East Asian countries, but the speed of aging process are generally much faster in Asian economies: In late 1940s, as Japan rose from the ashes of WWII, the infants and pre-school children mortality rates declined sharply. Such declines were more pronounced in countries which lost the war such as Germany and Japan as shown in Figure 2. Then, in Japanese case, during 1950s and 60s, the economy experienced the sustained rapid growth period. Economic success leads significant improvements in living and medical environments which enabled people to live much longer as shown in Figure 3. Then, in 1970s, the fertility rate starts to decline as the society matures and economic growth slows down as shown in Figure 4. There are two primary reasons behind the fertility rate decline. The first reason is obviously the increasing social participation by women. For the second reason, the social security system had established in 1961 in Japan which allows retired elderly to be less dependent to their children. One of the important motives for the parents to having children used to be the means of saving and insurance when they get old. However, children became more like consumption goods or having issued consol bonds as the pension system established and the society became responsible for the well-being of retired people.

[Figure 2, Figure 3, and Figure 4]

The factors discussed above all contributed to make Japan's aging process much faster, so that Japan's old age dependency ratio --- the ratio of retired population to working age population --- has risen sharply as shown in Panel (1) of Figure 5. However, in the long-run, by year 2100 according to UN's projection in Panel (2), the demographic structure of Japanese society will converge to that of many western European countries at that time. Until then, Japanese society is going to experience much faster and extreme aging process. However, this does not mean that Japan's population growth will be indefinitely lower than the Western Europe counter parts. In that sense, the difference between Western Europe and Japan is about the transition path rather than in the long-run steady state. In addition, there are some, not many, countries might experience the aging process even faster and more extreme than Japan such as South Korea, Singapore, Hong-Kong, Cuba, and Vietnam. Some African countries will also do depending on their future growth path in the second half of 21st century.

[Figure 5]

Japanese economy is and will be haunted by its enormous success in the past. Admittedly, Japanese policy makers could have dealt with the aging problem much more cleverly. However, it is the miraculous recovery from the WWII and the sustained rapid grow until 1980s which set the basis for Japan's rapid aging process today and in the future. In that sense, its aging process should be considered as an extreme example of rapid aging process, but not as an outlier.

It also should be noted that the share of Japan's public retirement and health expenditures in its GDP, so that the debt/GDP ratio as well, will take highly non-linear process, but they are not on monotonic explosive paths. These ratios will increase very

sharply in the mid-21st century, but then they will come down and stabilize toward the end of the millennium. This does not automatically imply that Japan will be able to either finance its aging process or not. Greg Mankiw and Larry Summers, making remarks on "coding errors" in Reinhart-Rogoff papers, suggest the similar point.[1]

I have little doubt that the high-debt GDP ratio makes the economy more vulnerable to the self-fulfilling fiscal crisis and the speculative attacks from the outside. I also believe that large debt is a negative for the economic growth in the long-run. However, I am also convinced that, in order to obtain better and accurate prospect of fiscal crisis, we have to examine how the actual fiscal crisis will happen. That will be the focus of my discussion the next section

3. A possible fiscal crisis in Japan

It is difficult to be too optimistic about Japan's fiscal situation when we consider the long run. Although its net external investment position will continue to be positive for some time, Japan might experience a current account deficit in the near future. In recent years, Japan has run small trade deficits—it is factor income on Japan's large foreign asset holdings that has maintained the surplus in Japan's current account. If Japan indeed runs a current account deficit at some point, even if it is only a small deficit, domestic demand might not be adequate to absorb the supply of JGB, i.e., the sum of new issues and maturing debt the government rolls over. In this case, the increase in JGB yields will depend on the interest elasticity of foreign demand for JGB. In this section, we discuss this issue in detail.

[1] Mankiw's blog: "I never thought there was a magic threshold for the debt-to-GDP ratio above which all hell breaks loose. The world is more continuous than that." http://gregmankiw.blogspot.jp/2013/04/mistakes.html. See also Larry Summers' entry in Huffington Post: http://www.huffingtonpost.com/2013/05/05/larry-summers-reinhart-rogoff_n_3220124.html?utm_hp_ref=business

3.1 The most likely scenario for a fiscal crisis

Assume that there are only two groups of potential investors, domestic and foreign. For domestic investors, JGB are a risk-free asset so they require only a minimum rate of return, so that their demand for JGB is price inelastic as long as JGB yields are above a minimum rate. In other words, the domestic demand curve for JGB should be flat. Foreign investors' demand will be different from that of domestic investors in two ways. First, they will demand a much higher rate of return on JGB, which will include a risk premium for exchange rate volatility. Second, their demand for JGB will be sensitive to the interest rate so that foreign investors' demand curve should be upward sloping. Panel A of Figure 6 illustrates such a situation assuming that domestic investors can absorb the entire supply of JGB.

[Figure 6]

Assume that the domestic demand for JGB decreases for some reason. Then, the yield of JGB must increase so that foreign investors have enough incentive to absorb the remaining supply of JGB, as in panel B of Figure 6. In the extreme case in which foreign investors' required rate of return is substantially higher than that of domestic investors, the JGB yield must increase as shown in panel C of Figure 6. Note that the JGB yield could increase sharply, even if domestic investors hold most of, but not all of, the outstanding JGB issued. This is because the JGB yield will be determined by the required rate of return of marginal investors, not the average of all JGB holders' required rates.

In reality, a small proportion of JGB, around 5 to 10 % of the total, is held by foreign investors. Perhaps this is motivated by pure diversification purposes, not the pursuit of higher returns. At the same time, foreign financial institutions' share of transactions in the JGB market is large so that their turnover rate is much higher even though their net

holdings are relatively small (Nagano, Ooka, and Baba 2007).[2] Hence, foreign investors' influence on interest rate determination in the secondary market is much more important than their holding shares of outstanding JGB.

Once a sharp increase in interest rates occurs, it will damage the balance sheets of domestic JGB holders. In particular, if the rating of JGB is downgraded so that JGB become worthless as liquid assets, at least in international transactions, the demand for JGB would decrease further and the JGB yield would increase further. Expectations of further declines in the JGB price would cause immediate JGB selling, resulting in a self-fulfilling sovereign crisis. This is the most likely scenario for a Japanese fiscal crisis according to domestic market participants[3] if it actually occurs in the near future.

However, this scenario is rather simplistic in dealing with the JGB market alone. The situation is more complicated if we consider other aspects of the economy. For example, European countries in peril of fiscal meltdown right now cannot depreciate their currencies because they have adopted the euro and most of their external borrowings are from other European countries in the same currency union. On the other hand, the yen exchange rate is a free float. If a fiscal crisis hits Japan, a sharp decline in the yen will occur at the same time. Furthermore, Japanese financial and fiscal authorities will try to prevent a sharp increase in the JGB yield, but will be accommodative of or even welcome the depreciation of the yen's value without admitting it officially. While a crisis in the JGB market would create major instability in Japan's financial system, depreciation in the yen would have a positive impact on the real side of the economy by boosting exports. As a result, the negative effects of the fiscal crisis would be offset partially.

[2] Note, however, that this evidence is from the period prior to the Lehman shock.
[3] "Domestic market participants" in this case include major international companies with offices in Japan.

3.2 Prospects of the domestic saving–investment balance in the near future

National income identities imply that a current account surplus of a particular country must be equal to the sum of its fiscal surplus and the saving–investment surplus in the private sector. As long as the private sector's supply of funds exceeds the public sector's demand for funds, Japan's current account will continue to be in surplus. Hence, whether the Japanese government is able to rely on domestic funding for its JGB issues or not depends inevitably on the prospect of a saving–investment balance in the private sector.

Figure 7 shows the net savings of households, corporates, and the public sector as a percentage of GDP since 1980. Until the mid-1990s, large amounts of household savings had financed government deficits. However, since the late 1990s, household savings have decreased sharply because of prolonged stagnation in income growth, in addition to the aging population. Instead, corporate savings have increased significantly in the new millennium, almost completely offsetting the shortfall in household savings. As a result, total net savings of the private sector have not decreased significantly in last 20 years.

[Figure 7]

In the long run, household savings will continue to decrease because of population aging so that more and more retired households start to dissave. However, the timing and the magnitude of the decline are hard to predict. For example, Iwaisako and Okada (2009; 2012) argue that the sharp decline in the household saving rate in Japan from the late 1990s to the mid-2000s was amplified largely by the low income growth caused by an acceleration of corporate restructuring and increasing unemployment in this period. As a matter of fact, household savings as a percentage of GDP stopped declining in the second half of 2000 and increased significantly in 2008/09, to as high as 5% in 2009. Thus, the situation is not a case of monotonic decline.

In contrast with household savings, economic theory tells us little about corporate

savings; therefore, any prediction is rather arbitrary. Iwaisako (2010) argues that the peak in the corporate saving rate and associated rapid reduction in corporate debt in Japan occurred around 2005. Equipment investment started to increase in 2006/07 as the economy finally started to grow strongly. However, this growth was halted by the global recession triggered by the world financial crisis starting in the fall of 2008, and corporate savings declined significantly in fiscal year 2008. Once the economy began to recover, corporate savings rebounded in 2009/10 following a significant decline, after the Lehman shock, in Japanese firms' appetite for investment. Given the adverse business conditions faced by Japanese firms, it is difficult to expect them to reduce their corporate savings in the near future unless there is a large (export) demand shock.

4. Recent trends and prospects of domestic investors' portfolio choices

In the previous section, we argued that Japan's current account surplus is likely to continue as household savings will decrease gradually, and the level of corporate savings will remain high. If so, the JGB market does not require a significant increase in foreign investment. Therefore, the most important issue regarding Japan's fiscal sustainability is the portfolio choices of domestic JGB investors—whether they continue to purchase JGB and whether they have incentives to shift toward other assets, especially foreign assets, in their portfolios.

Domestic investors are primarily domestic institutional investors. In Table 2, we report sectoral holding shares of public sector debt including municipal bonds (chihou-sai) and government agency bonds (zaiyu-sai) at the end of fiscal year 2010. The Japanese government has been making vain attempts to sell JGB to domestic households, but the share of direct holdings is less than 5%. Household shares are even smaller for municipal bonds and agency bonds. Given the small share of households in the JGB market, we

concentrate on a discussion of recent trends and future prospects of domestic institutional investors' portfolio choices below.

We consider four major groups of domestic institutional investors. The first one is the group we call ***large banks*** including "megabanks" such as Mitsubishi–UFJ, Sumitomo–Mitsui, Mizuho, and large regional banks. The second one is ***smaller banks***. This group includes financial institutions specialized in small-firm/agricultural lending. Though it is the biggest financial institution in terms of total deposits, Japan Post Bank "Yu-cho", a semi privatized former postal savings bank, is categorized as financial institutions specialized in small-firm lending, so they belong to this group.[4] These two constitute 97–100% of government debt holdings by the banking sector. However, their portfolio choices are quite different. The remaining two groups of nonbank financial institutions are ***life insurance companies*** and ***pension funds***.

As shown in panel I of Table 2, the share of domestic financial institutions including life insurance companies in total holdings of JGB and FILP bonds[5] is about 77%. The share of the general government sector is 10.4%. Note that this category is almost identical to the category of social security funds (syakaihosyo-kikin).[6] The sum of these two shares is more than 85% of the total of all JGB and FILP bonds issued.

In panel II of Table 2, the breakdowns of JGB holdings among domestic financial institutions are reported. The share of ***large banks*** that corresponds to "domestic banks" in the table is 11.8%. For ***smaller banks*** including postal savings banks, the sum of A2 and A3 is about 27%. ***Life insurance companies***' share is 16.3% and ***Pension Funds***' share is 3.8%. These four groups of domestic investors hold nearly 60% of the total JGB issued.

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[4] Postal saving appears as an individual category until 3rd quarter of 2007, but is merged into the category called "the financial institutions specialized in lending to small and medium size enterprises." The latter is the category we call ***smaller banks***.

[5] FILP stands for "Fiscal Investment and Loan Program (FILP). FILP bond is "Zaiyu-Sai" in Japanese. For details of the Fiscal Investment and Loan Program, see Doi and Hoshi (2003).

[6] For all four categories of government debt listed, the differences between the *general government sector* and *social security fund* numbers are less than one percentage point.

On the other hand, foreign investors hold 17% of short-term maturity JGBs, as shown in panel I of Table 2. However, their holdings of longer maturity JGB are only 5%. Therefore, using recent data, we confirm the claim that has been made among economists and business media that "*95% of JGB are held domestically*".

[Table 2]

Given the distribution of current JGB holdings, the next question is whether there is a possibility that domestic investors will start to sell their JGB holdings in the near future. In the remainder of this section, we examine this question for the four groups of institutional investors. Before getting into a detailed discussion of each group, we first emphasize the major points from a broad perspective.

Among various types of financial institutions, life insurance companies and pension/social security funds have obvious incentives to sell their JGB holdings in the immediate future. As population aging in Japan continues, total insurance and pension payments will begin to exceed the inflows of new insurance contract payments and contributions to pension funds. Although no reliable data are available, it has been argued in the business media widely that such a reversal of the direction of payments has already taken place in recent years.

However, the small decline in the amount of funds they manage does not necessarily result in an immediate decline in their demand for JGB. On the contrary, for the near term, there are a number of reasons to believe that domestic demand for JGB will remain strong. First, life insurance companies and pension/social security funds will not have the cash to make payments to households by selling their risky assets in the markets at the exact time of payment. There is an important intermediate step for the purpose of asset liability management (ALM) — these financial institutions only gradually decrease their

risky asset holdings such as equities and foreign assets and increase their holdings of liquid assets such as JGB in preparation to make payments. Furthermore, this process will be implemented in a staggered/overlapping manner because the timing of payments is spread over a long period of time. Hence, their holdings of JGB might increase in the short term, even if the total amount of funds that these financial institutions manage begins to decrease.

Second, when older households received pensions and insurance payments, they are likely to deposit some proportion of such payments with the banks. In particular, wealthier households will tend to do this. The banks will use some fraction of deposits they have received to purchase JGBs. This will further contribute to sustained demand for JGB. As we will see immediately below, the amount of JGB held by Japanese banks and the amount of liquid deposits they accept are roughly proportional.

4.1 Banking sector

As discussed above, deposit-taking financial institutions, including postal savings banks and Japanese branches of foreign banks, own more than one-third of the JGB on issue. Their JGB holdings and liquid deposits are shown in panel A of Figure 8. Their holdings of government sector debt increase roughly proportionally to the increase of their deposits accepted from households.

Examining the graph more closely, from 1998 to 2003 the increase in deposits was slow, perhaps reflecting the banking crisis in 1997/98. Government debt holdings increased quickly because of the budget deficits so that the amount of JGB issues under the Obuchi and Mori administrations was relatively large. As a result, the ratio of deposits to government debt decreased to a local minimum of 1.13 in 2001. From 2002 to immediately before the Lehman shock, deposits increased more than did the holdings of government debt by deposit-taking financial institutions. The ratio of deposits to government debt

increased to around 1.3 in 2007. In 2010, 2011, and 2012, because of the fiscal expansion required in response to the adverse effects of the worldwide recession, the issue of JGB increased. Thus, the holdings of deposit-taking financial institutions also increased rapidly, resulting in a decline in the ratio of deposits to government debt to 1.12, almost identical to the level in 2001.

[Figure 8]

Next, we consider the subgroup of deposit-taking financial institutions excluding ***large banks*** according to the definition at the beginning of this section, the subgroup namely consists of consists of *Financial Institutions for Small Businesses* and *Financial Institutions for Agriculture, Forestry and Fisheries*. Their JGB holdings and liquid deposits are shown in panel B of Figure 8. The deposit taking of this subgroup stops increasing after 2004. On the other hand, this group's holdings of JGB rapidly increased from 2001 to 2007, and then stabilized. Also note that the increase of JGB by the subgroup except *large banks* in early 2000s was largely JGB, Japanese government bond with one year maturity or longer. On the other hand, the increase of government debt holding in the post Lehman shock in Panel A is T-bills. So the deposit-taking financial institutions other than ***large banks*** are more vulnerable to the increase of long-term interest rate.

Next, let us concentrate on the largest "megabanks" among the ***large banks***. For domestic financial institutions, JGB are the safest and most liquid assets. However, because the amount of JGB holdings is so large and there is extremely limited room for the JGB price to increase further or for the yield to decrease, the interest rate risk is a major concern for Japanese financial institutions too. A possible method of assessing their vulnerability to interest rate risk is to calculate how large their losses would be when the JGB yield increases. In the case of megabanks, such data are readily available. In responding to Basel II, all major Japanese banks must calculate and report "the outlier criteria (outlier ki-jyun)" on their websites. This is the ratio of the potential loss they will suffer when JGB yields

increase sharply to the sum of Tier 1 and Tier 2 capital, which should be less than 20% according to official recommendations. By looking at “the outlier criteria,” we can infer whether the interest rate risk is a serious concern for a particular bank, and therefore whether it is a constraint for the megabank’s continued purchase of JGB.

In Table 3, the outlier criteria of the three megabank groups and postal savings group are reported. According to these data, Mitsubishi–Tokyo UFJ has the highest outlier criteria among the three megabank groups. However, it is 9.5% in FY2012, far below the critical level. Hence, Basel II is not a binding condition for the purchase of JGB by megabanks. Under a slow gradual increase in the JGB yield, further purchases of JGB might be induced. On the other hand, the number of outlier criteria for the postal savings group exceeded 20% consistently until 2010. Then, probably responding to the criticism from some diet members about its sloppy risk management, the postal saving has decreased its outlier ratio significantly in last two fiscal years. As of March 2012, its outlier ratio is 10.9%, just 1.5% above Mitsubishi–Tokyo UFJ financial group.

[Table 3]

The discussions regarding JGB holdings in the banking sector in this subsection can be summarized as follows. While JGB holdings among deposit-taking financial institutions as a whole increase almost proportionally to the increase in deposits these institutions accept, the institutions’ portfolio choices exhibit apparent heterogeneity. The first group we identify is ***large banks*** or domestic banks, which consist of relatively large banks including three megabank groups. They are sensitive to conditions in the JGB market and have changed their JGB holdings weights through the 2000s. Technically, it is possible that they could suddenly decrease their JGB holdings for some reason so as to trigger a fiscal crisis. This probability seems to be slim, however, because they have already lowered their share of government debt holdings over the last 10 years. Domestic banks held 54% of JGB in FY 2000, but since then this had decreased to 29% in FY2007. After the Lehman

shock, their share increased to 40%, but the majority of their new purchases are short-term maturity T-bills. If we limit our attention to JGB and FILP bonds whose maturities exceed one year, the domestic banks' share was 52% in 2000, 20% in 2007, and 30% in 2010. Therefore, the decline in their presence in long-term government debt markets is obvious.

The major players in the second group, which we call ***smaller banks***, are the financial institutions specialized in small-firm lending (credit cooperatives and small regional banks) and specialized in agricultural lending (JA bank groups), and postal savings banks. Exact information about their JGB holdings is relatively limited, but we make inferences based on the differences between deposit-taking financial institutions as a whole and the first group, ***large banks***. It seems to be obvious that the second group has increased its JGB holdings much more quickly than the first group.

They probably did so in rather a passive manner. ***Smaller banks***' holdings of JGB are a result of their inaction in portfolio diversification reflecting their lack of awareness of risk management, and insensitivity to the risk–return trade-off. The possibility that ***smaller banks*** will trigger a fiscal crisis is even less than that the ***large banks*** will. However, given that they have increased their JGB holdings much more aggressively than ***large banks***, there are concerns whether the financial institutions in the ***smaller banks*** category are conducting appropriate risk management. The decline of outlier ratio of postal savings bank reported in Table 3 suggests they might be aware of such risk and trying to straighten the things up in last several years. Still, it is most likely this group which will suffer heavy losses if a sharp increase in the JGB interest rate occurs, so that will create a serious threat of systemic risk.

4.2 Life insurance companies

Next, we discuss ***life insurance companies***, which hold about 15% of the total JGB on

issue. As discussed in Kano (2011), Tokushima (2010), and Morimoto (2010), this group has increased their purchase of JGB, especially at the long end of the yield curve throughout the second half of the 2000s.

Two factors contribute to such portfolio shifts. First, life insurance companies, as well as pension/social security funds, have to decrease their risky-asset portfolio shares and increase liquid asset holdings in preparing for future increases in life insurance payouts. They attempt to match the timing of payouts and the maturities of the JGB they hold. As a result, the average maturity of their JGB holdings has become substantially longer. The second factor contributing to the increase in long-term government bond holdings is recent developments in financial and accounting regulations. New regulations such as the solvency margin regulation and the international accounting standard advanced by IASB have started to affect life insurance companies' portfolio behaviors since the mid-2000s. Almost all new regulations require better transparency in portfolio management and force life insurance companies to evaluate their assets in economic/fair value terms. As a result, Japanese life insurance companies had to increase their holdings of safe/liquid assets, and hence their holdings of JGB.

Figure 9 shows the average durations of JGB portfolios for the four largest life insurance companies (Nissei, Dai-ichi, Sumitomo, Meiji-Yasuda), extending the data of Kano (2011). The largest two, Nissei and Dai-ichi, had started to increase the maturity of their JGB portfolios earlier than the other two companies. However, Sumitomo and Meiji-Yasuda quickly caught up after the Lehman shock. As at the end of fiscal year 2010, all four companies' average JGB portfolio maturity is about 11 years.

[Figure 9]

A more extreme example is Sony Life Insurance's portfolio management, described by Morimoto (2010). In panel A of Table 4, its shares of JGB in its general

account are shown for 2001, 2006, and 2011. The JGB share was only 6.6% in 2001FY, but increased to 82.5% in 2011FY. Over the same period, the share of municipal bonds decreased from 10.6% to 0.1%. Hence, Sony Life Insurance has rapidly shifted its portfolio toward safe/liquid assets drastically, but perhaps it does not consider bonds issued by local governments as safe assets. In panel B, the shares of JGB of various maturities are reported. In 2001, 72% of JGB holdings had maturities of less than three years. However, by 2006, about half the JGBs had seven- to 10-year maturities. At the end of 2011FY, about 85% of Sony Life Insurance's JGB holdings had maturities longer than 10 years. Therefore, Sony's current average maturity is likely to be well above 10 years, much longer than that of the largest life insurance companies reported in Figure 9.

[Table 4]

Whether larger companies do not or cannot undertake portfolio adjustments as quickly as Sony Life Insurance is not obvious. However, it is highly likely that other life insurance companies including the biggest four companies given in Table 4 will continue to shift their portfolio weights to longer maturities, at least for the next several years.

4.3 Pension/social security funds

Finally, we examine the portfolio choices of ***pension/social security funds***. Unfortunately, the discussion must be brief because disclosure of the information regarding their portfolio management is much more limited than those of the private sector financial institutions in the previous subsections. Still, the outflow of funds from pension/social security funds should be determined primarily by changing demographic patterns, just as in the case of life insurance companies. Hence, our argument related to the trends and prospects of life insurance companies' JGB holding will be extended to ***pension/social security funds***.

In Table 5, we present the six-year data of corporate pension funds' portfolio management based on a survey by Pension Fund Association. From 2006 to 2011, the share of domestic bonds increased from 21.8% to 27.2%, 5.4 percentage points. On the other hand, the domestic equity share has decreased substantially from 28.0 % to 17.4%. Finally, the share of short-term funds share has fluctuated, but not really increased. The speed of portfolio adjustment is much slower than that of life insurance companies, but the basic trend is the same: they have increased the shares of JGB in their portfolios, especially those of longer maturities.

5. Conclusions

The analyses of Japan's fiscal sustainability in this paper will be summarized as follows. First, even though the decline in household savings caused by population aging is unavoidable over the longer term, there has not been the sharp decline as we had observed in the late 1990s and into the early 2000s. Corporate savings have remained relatively high because of the lack of good investment opportunities for Japanese firms.[7] Given such trends in the domestic private saving–investment balance, it is most likely that Japan will run current account surpluses for another five years or so. Recent trade account surplus has decreased and record deficit on occasions, depending on the yen exchange rate at the time. However, the position of accumulated large net foreign assets will provide enough factor income inflow from abroad to ensure a current account surplus.

If the current account surpluses continue, the Japanese government should be able to finance fiscal deficits solely from domestic demand for JGB, as long as domestic

[7] In the unlikely scenario that the Japanese economy is on the road to a strong self-sustained recovery, equipment investment is likely to increase, meaning that corporate savings would decline. However, strong business conditions would increase household savings through higher labor income growth and contribute to improve the government budget.

institutional investors continue to maintain their JGB positions. There are enough reasons to believe that this will be the case for a while. First, life insurance and pension/social security funds will continue to shift their portfolio weights to reduce risky assets such as equities and to increase long-term JGB. The reason for the latter is because they want to match the maturities of their liquid asset holdings to their future payout schedules for the asset liability management (ALM). Second, households that received pension and/or insurance payments are unlikely to consume them immediately. Rather, they will deposit the payments in their banks. Responding to the increase in demand deposits on the liability side, banks are likely to increase their holdings of liquid assets, that is, short-term JGBs on the asset side of their balance sheets.

These discussions might sound optimistic, but this is not the case. The main implications of this paper's analyses is that the likelihood of a fiscal crisis that affects the general public—a sharp increase of long-term JGB yields and/or decline of the yen's value—must be a nonlinear function of time. Current state of JGB market suggests that the consensus of domestic market participants is that such a crisis will not occur in the near future—at least not in the next several years. On the other hand, it is not difficult to imagine that they also share a more pessimistic view of Japan's fiscal situation in the long run, over say a ten year period. Yet, nobody is really sure when Japan's fiscal situation will create a crisis or what combination of the debt/GDP ratio and current account position will be the threshold for such a regime switch.

There are some important factors enhancing such a nonlinearity of the likelihood of a fiscal crisis. First, a crisis could be triggered by forward-looking decisions of market participants. However, there is too much uncertainty about the future prospects of Japan's fiscal situation, both positive and negative, so that a clear consensus for the future is unlikely to be obtained. Second, such smart and forward-looking market participants in the JGB market tend to be rationally short-sighted because of institutional limitations. The best and highest-paid JGB traders and portfolio managers tend to move frequently from one

financial institution to another. As they are not sure whether they will be in the same position or in the same company several years into the future, they simply do not care about the longer term. The same thing can be said more or less about the top executives of domestic banks who will typically retire within five years. Hence, as long as there is a strong, possibly irrational common belief or a norm among the market participants that JGB yields will not increase in the immediate future, there is little incentive for domestic smart market participants to actively bet against the market.

Even though the Japanese government will be able to continue to finance its budget deficits domestically for the next several years, a section of the financial system, namely those financial institutions specialized in small-firm lending including postal savings banks and agricultural lending, already hold too many JGB from the point of view of ALM, so that the interest rate risk is concentrated within these financial institutions. This fact is perhaps creating a larger potential systemic risk such that the damage could be much greater once JGB yields starts to increase. Yet, those financial institutions seem to be convinced that they will be rescued by the financial authorities if a crisis occurs. Such beliefs allow them to accumulate even more JGB. This means that, as the grace period before an actual fiscal crisis gets longer, the potential damage, if the crisis occurs, could be more severe.

References

Bank of Japan (2012), *Financial System Report* (October 2012), Available at http://www.boj.or.jp/en/research/brp/fsr/fsr121019.htm/

Blanchard, O.J., J. Chourqui, R.P., Hagemann and N. Sartor (1990). "The Sustainability of Fiscal Policy: New Answers to an Old Question". OECD Economic Studies No.15.

Broda, C. and D.E. Weinstein (2005) "'Happy News from the Dismal Science: Reassessing the Japanese Fiscal Policy and Sustainability", in T. Ito, H. Patrick and D. E. Weinstein eds., *Reviving Japan's Economy*, MIT Press.

Doi, Takeo and Takeo Hoshi (2003) "Paying for the FILP", in Magnus Blomstrom et al. eds. *Structural Impediments to the Growth of the Japanese Economy*, University of Chicago Press.

Faruqee, Hamid and Martin Mühleisen (2001) "Population Aging in Japan: Demographic Shock and Fiscal Sustainability." IMF Working Paper 04/40. Available at SSRN: http://ssrn.com/abstract=879420

Global Agenda Council on Ageing Society (2012) *Global Population Ageing: Peril or Promise?*,World Economic Forum. http://www.weforum.org/reports/global-population-ageing-peril-or-promise.

Hoshi, Takeo and Takatoshi Ito (2012) "Defying gravity: How long will Japanese government bond prices remain high?" NBER Working Paper 18287.

Iwaisako, Tokuo (2010) "Corporate saving and recent financing behaviors of Japanese non-financial corporations (in Japanese)", *Economic Review* 61:1, 18–32.

Iwaisako, Tokuo and Keiko Okada (2009) "Consumption and saving in Japanese economy: overview since 1980s (in Japanese)" in Kyoji Fukao and The Economic and Social Research Institute eds., *Macro Economy and Industrial Structure*, Keio University Press, 33–58.

---- and ---- (2012) "Understanding the Decline in Japan's Saving Rate in the New Millennium", *Japan and the World Economy* 24:3, 163-73.

Kano, Takefumi (2011) "Effects of changes in accounting and financial regulations on life

insurance companies' portfolio management (in Japanese)", *Finance*, January 2011 issue.

Morimoto, Yuji (2010) "Investment behaviors of life insurance companies and JGB market ---- Evaluation of debt based on economic value induce the purchase of long-term bonds", Monetary and Fiscal Issues Weekly (Sukan Kinyu Zaisei Jijyo), October 18, 2010.

Nagano, Teppei, Eiko Ooka, and Naohiko Baba (2007) "Arbitrage activities between offshore and domestic Yen money markets since the end of the Quantitative Easing Policy", March 2007, Money Markets and Fixed Income Financial Markets Department Bank of Japan. Available at: http://www.boj.or.jp/en/research/wps_rev/rev_2007/data/rev07e02.pdf.

The National Institute of Population and Social Security Research (2012) *The Population Projections for Japan*. Available at: http://www.ipss.go.jp/site-ad/index_english/esuikei/gh2401e.asp

Steinberg, Chad and Masato Nakane (2012) "Can Women Save Japan?" IMF working paper WP12/248.

Tokushima, Katsuyuki (2010) "JGB investments by the life insurance companies", Seminar presentation at Ministry of Finance.

Table 1

Debt/GDP, net external positions and the relative size of GDP

Debt/GDP ratios, net external positions as percentages of GDP,
and the relative size of GDP in 2010

	(1) Gross Debt/GDP: OECD	(2) Gross Debt/GDP: IMF 2010	(2A) Gross Debt/GDP: IMF 2011	(3) Net Debt/GDP: IMF 2010	(3A) Net Debt/GDP: IMF 2011	(4) Net External position	(5) GDP
France	93.8	82.4	86.9	76.6	81.0	Δ11.5	49.4
Germany	80.9	84.0	82.6	57.6	57.2	42.1	68.1
Greece	129.1	142.8	165.6	NA	NA	Δ91.3	7.4
Ireland	82.9	94.9	109.3	78.0	98.8	Δ90.9	4.1
Italy	132.0	119.0	121.1	99.4	100.4	Δ17.1.	41.1
Portugal	95.0	92.9	106.0	88.7	101.8	Δ108.5	5.7
Spain	72.8	60.1	67.4	48.7	56.0	Δ87.1	31.8
UK	82.3	75.5	80.8	67.7	72.9	Δ13.2	50.5
USA	89.6	94.4	100.0	68.3	72.6	Δ19.4	336.0
Japan	199.2	220.0	233.1	117.2	130.6	52.5	100.0

Note: (2A) and (3A) are estimated values.

(1) Gross government debt/GDP ratios (OECD) in 2010.

(2) &(2A) Gross government debt/GDP ratios (International Financial Statistics IMF).

(3) &(3A) Net government debt/GDP ratios (International Financial Statistics IMF).

(4) Net international investment positions as fractions of GDP (International Financial Statistics IMF and the statistical releases from various central banks) in 2010.

(5) Relative size of GDP, taking Japan as the benchmark = 100. (IMF World Economic Outlook. Values are converted to US dollar terms using PPP exchange rates) in 2010.

Table 2

Sectoral shares in JGB holdings

Panel I: Sectoral shares in JGB holdings at March 2011

	(1) Financial institutions	(2) Nonfinancial corporations	(3) General government	(4) Households	(5) Nonprofit institutions	(6) Foreign
T-Bills	67.7(%)	0.0	15.3	0.0	0.0	17.0
JGB & FILP bonds	77.2	1.1	10.4	4.3	2.0	5.0
Municipal bonds	75.1	3.4	11.3	2.0	8.0	0.2
Agency Bonds	70.5	5.3	15.3	0.8	4.3	3.8

Author's calculation from the flow of funds data by Bank of Japan. Item (5) corresponds to "private nonprofit institutions serving households" in the SNA statistics.

Panel II: Breakdown of item (1) "Financial institutions" in Panel I

A. Deposit-taking financial institutions

	Total	A1. Domestic banks	A2. Agricultural lending	A3. Small-size firm lending	A4. Others
T-Bills	50.0	38.1	8.8	2.0	1.1
JGB & FILP bonds	39.4	11.8	2.9	24.2	0.5
Municipal bonds	41.9	18.5	3.9	19.5	0.0
Agency bonds	40.3	18.6	1.0	20.5	0.2

Table 2 (continued)

Panel II (continued)

B. Insurance and pension funds

	Total	B1. Life insurance	B2. Pension funds	B3. Others
T-Bills	2.3	2.3	0.0	0.0
JGB &FILP bonds	24.0	16.3	3.8	3.9
Municipal bonds	30.8	16.7	2.6	11.5
Agency bonds	26.4	17.2	2.7	6.5

C. Other financial institutions

	Total
T-Bills	15.4
JGB &FILP bonds	13.8
Municipal bonds	2.4
Agency bonds	3.8

Note: Panel I item (1) = Panel II item A+B+C.

Table 3

Outlier criteria in Basel II

Outlier ratio is the ratio of interest rate risk volume in the banking book against the sum of Tier 1 and Tier 2 capital. Source: financial institutions' disclosed information to investors on their web pages.

	2008	2009	2010	2011	2012
Mitsubishi–Tokyo–UFJ	7.92%	10.1	11.78	8.68	9.49
Mizuho	8.8	8.5	8.8	9.9	6.2
Sumitomo–Mitsui	5.4	8.6	6.1	7.8	2.6
Postal savings banks	26.12	22.18	24.15	13.77	10.88

Table 4

Portfolio adjustment of Sony Life Insurance

(a) Shares of JGB and municipal bonds

	2001	2006	2011
JGB	6.6%	36.3	82.5
Municipal bonds	10.6	1.0	0.1

(b) Shares of JGB by maturities

	2001	2006	2011
Less than 1 year	25.4	—	—
1 to 3 years	46.7	8.5	—
3 to 5 years	26.5	17.5	2.2
5 to 7 years	0.9	23.0	2.3
7 to 10 years	—	51.0	4.8
10 years and over	0.5	—	84.8

Data source: Annual reports of Sony Life Insurance.

Table 5

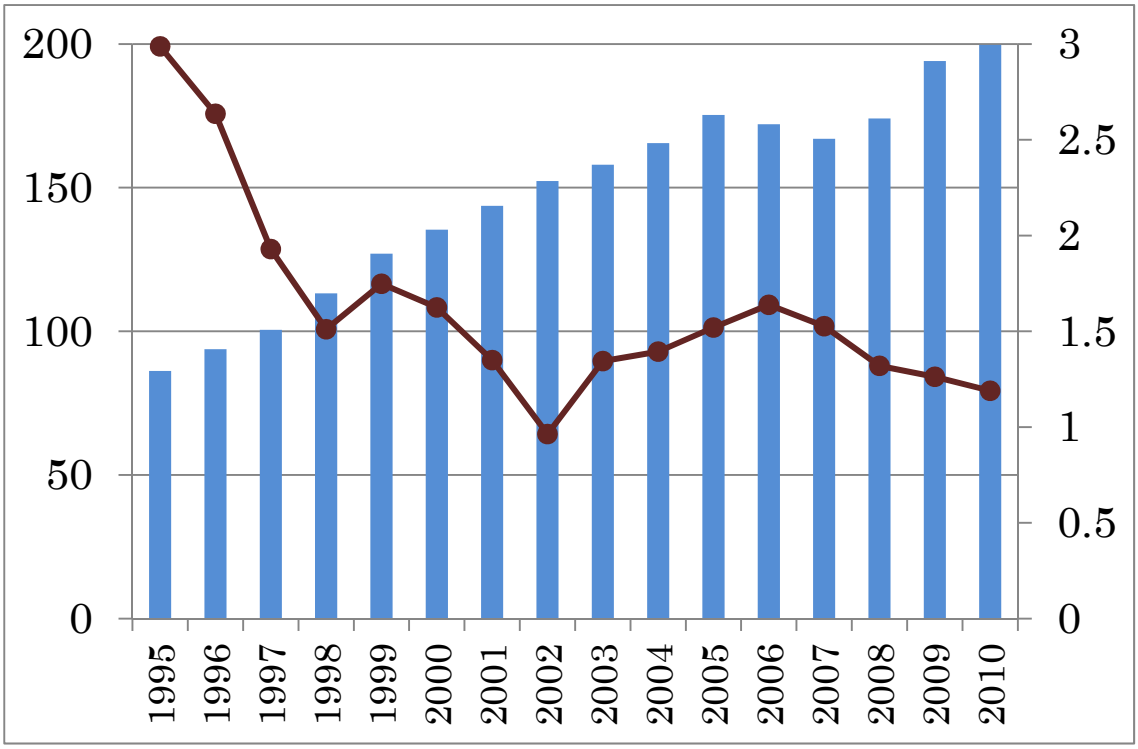
Portfolio adjustments of corporate pension funds

	Domestic bonds	Domestic equity	Foreign bonds	Foreign equity	General account	Hedge funds	Others	Short-term funds
2011	27.2	17.4	12.0	16.3	14.0	5.2	3.6	4.2
2010	26.8	18.9	11.5	17.5	13.0	4.9	3.7	3.7
2009	26.1	21.3	12.2	16.7	11.7	4.7	3.2	4.2
2008	27.0	20.3	13.3	13.3	12.6	5.7	3.3	4.4
2007	24.9	23.5	13.1	16.2	10.1	5.6	3.1	3.5
2006	21.8	28.0	12.5	18.8	8.2	4.8	2.9	2.9

Data source: Survey of Corporate Pensions' Portfolio Management (2011)

Figure 1

Debt/GDP ratio and JGB yield: 1995–2010



Bar graph (left scale): Gross government debt as a percentage of current GDP

Line graph (right scale): 10-year Japanese government bond yield, the average of daily data in December of the corresponding year.

Figure 2: Infant mortality rate

Infant mortality rate for both sexes combined; infant deaths per 1,000 live births.
Source: UN, the 2010 Revision of the World Population Prospects
(http://esa.un.org/wpp/index.htm).

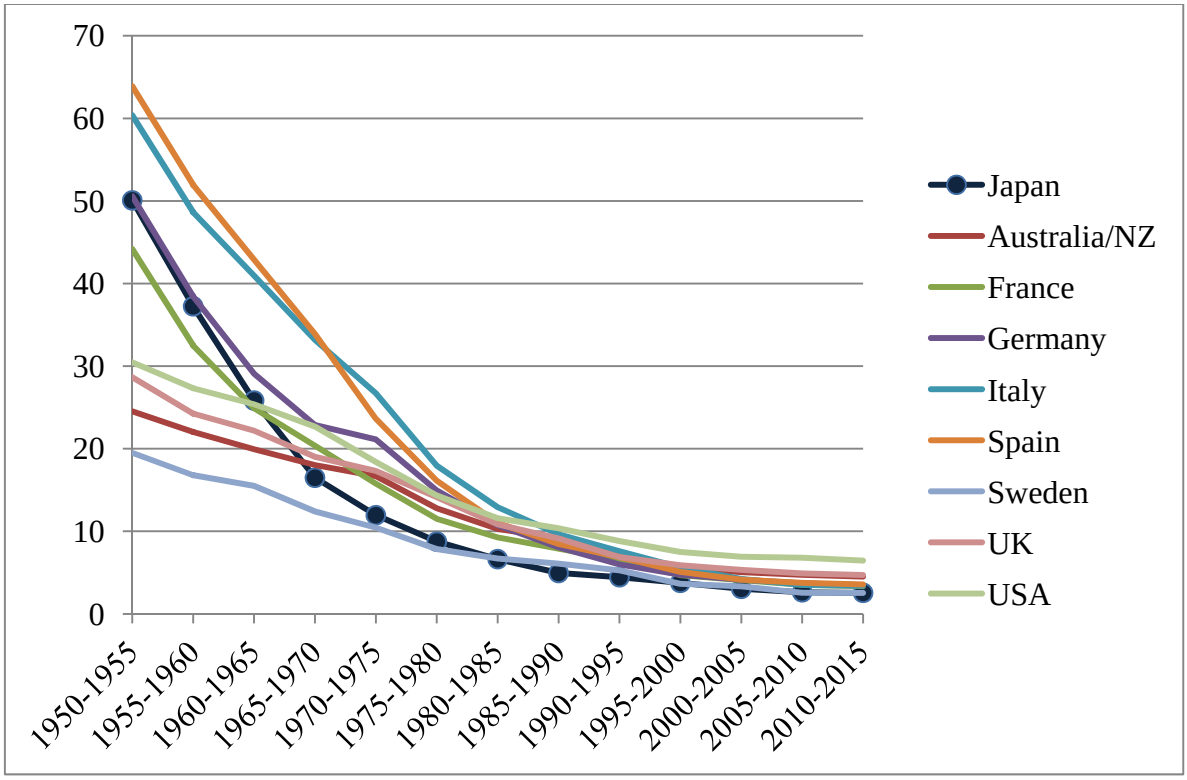


Figure 3: Life expectancy

Life expectancy at birth for both sexes combined (years).
Source: same as Table 1.

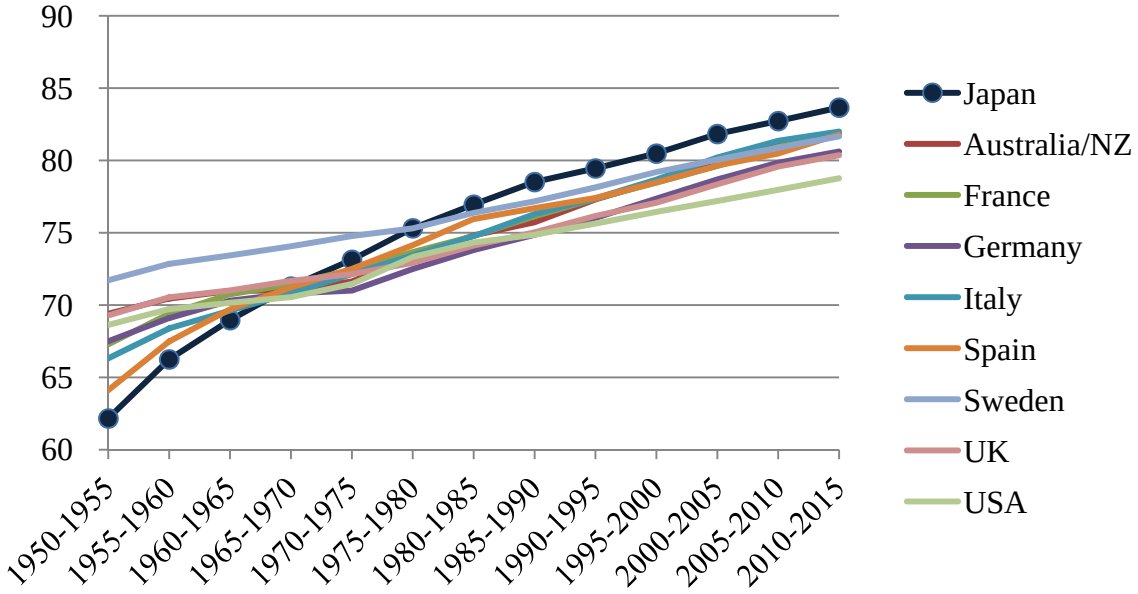


Figure 4: Total fertility

Total fertility; children per woman. Source: same as Table 1.

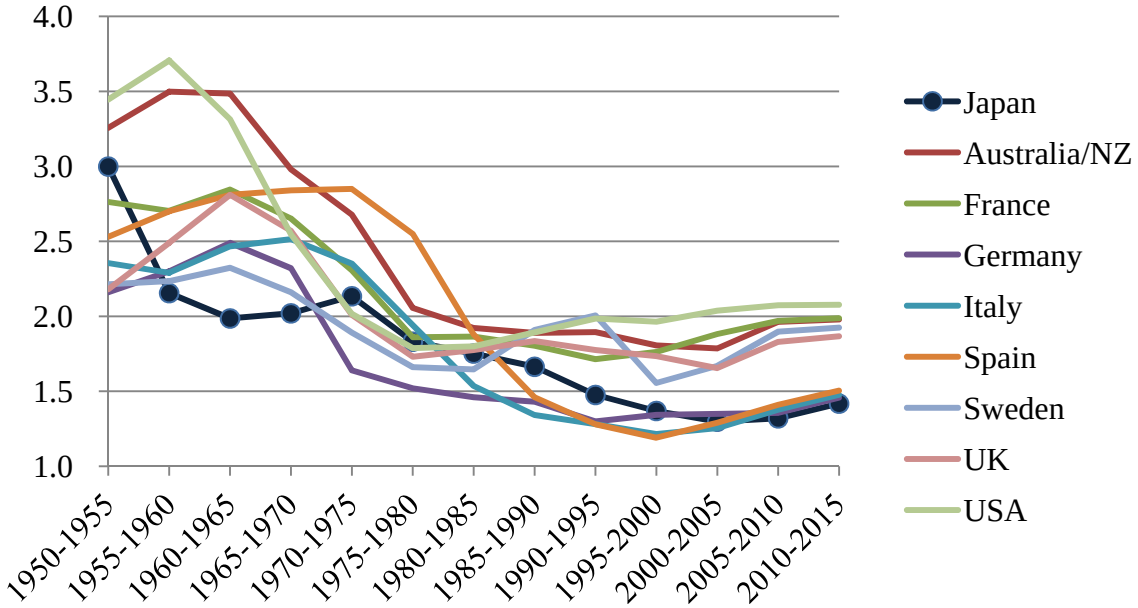
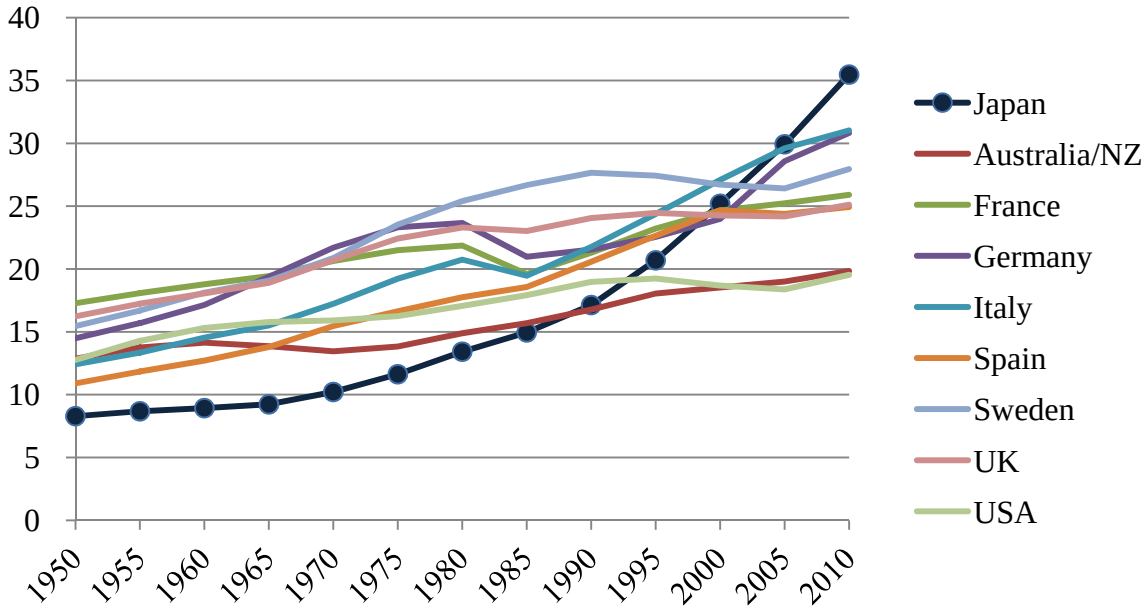


Figure 5: Old age dependency ratio

Old-age dependency ratio; ratio of population 65+ per 100 population 15-64.
Source: same as Table 1.

(1) Japan, Australia/NZ, Western Europe, and USA: 1950-2015



(2) Japan, Australia/NZ, Western Europe, and USA: 1950-2100

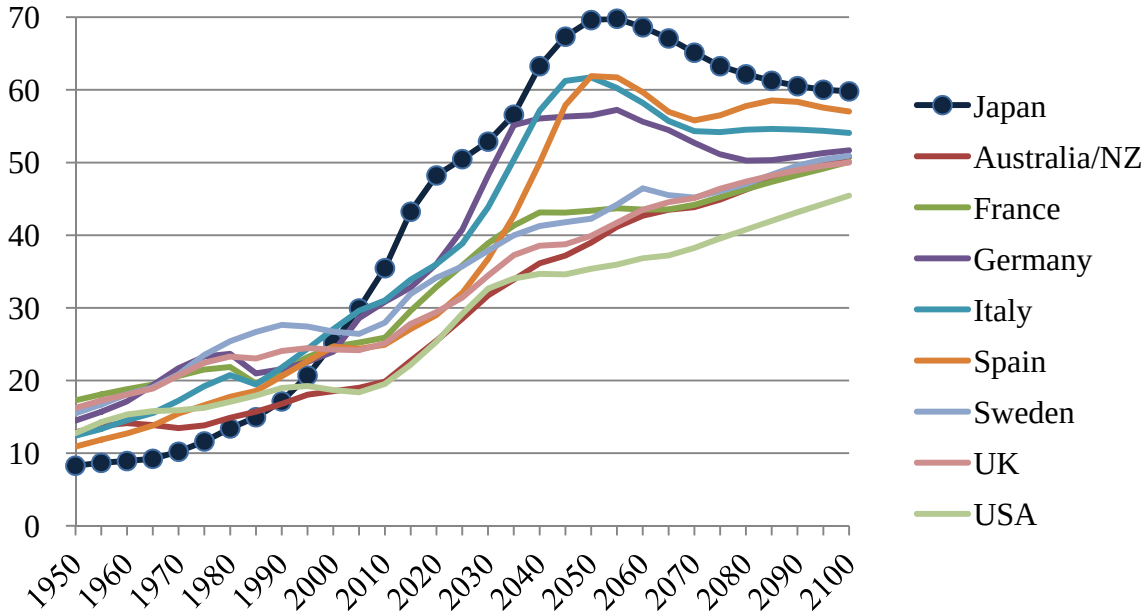
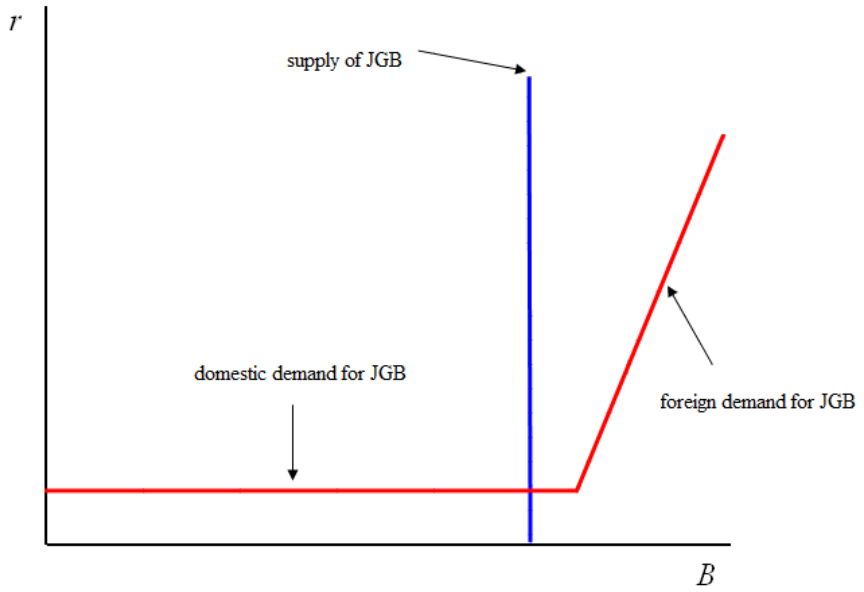


Figure 6

Domestic and foreign demand for JGB

(A) When foreign demand is more elastic to the interest rate than domestic demand.



(B) The effect of a decline in domestic JGB demand.

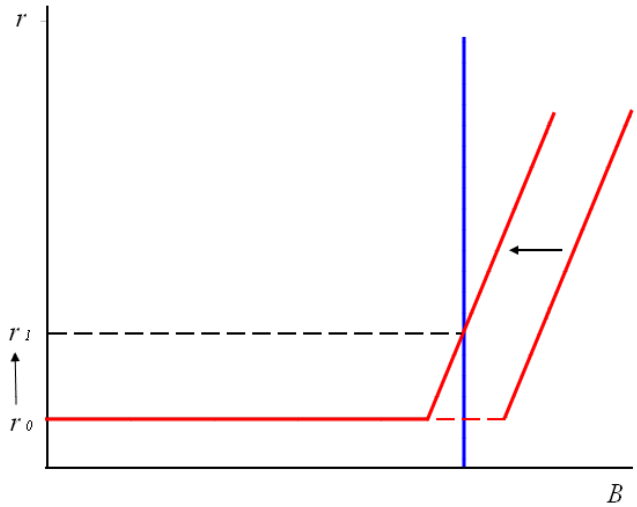


Figure 6 (continued)

(C) The effect of a decline in domestic JGB demand: the required rate of return of foreign investors is much higher than for domestic investors.

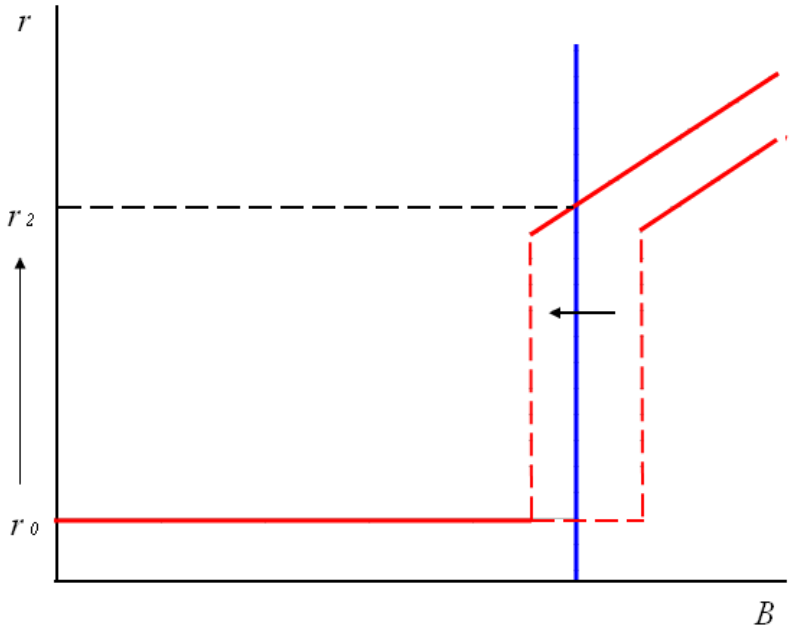


Figure 7

Domestic sectoral savings as a percentage of GDP

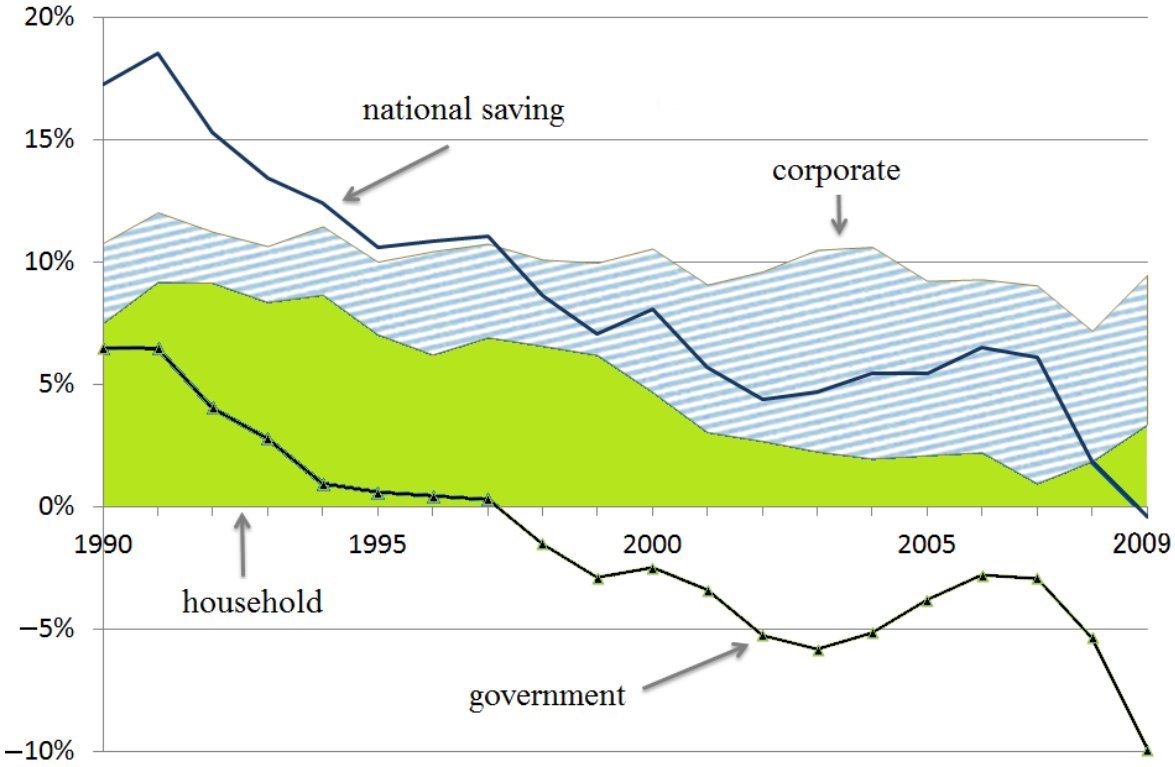
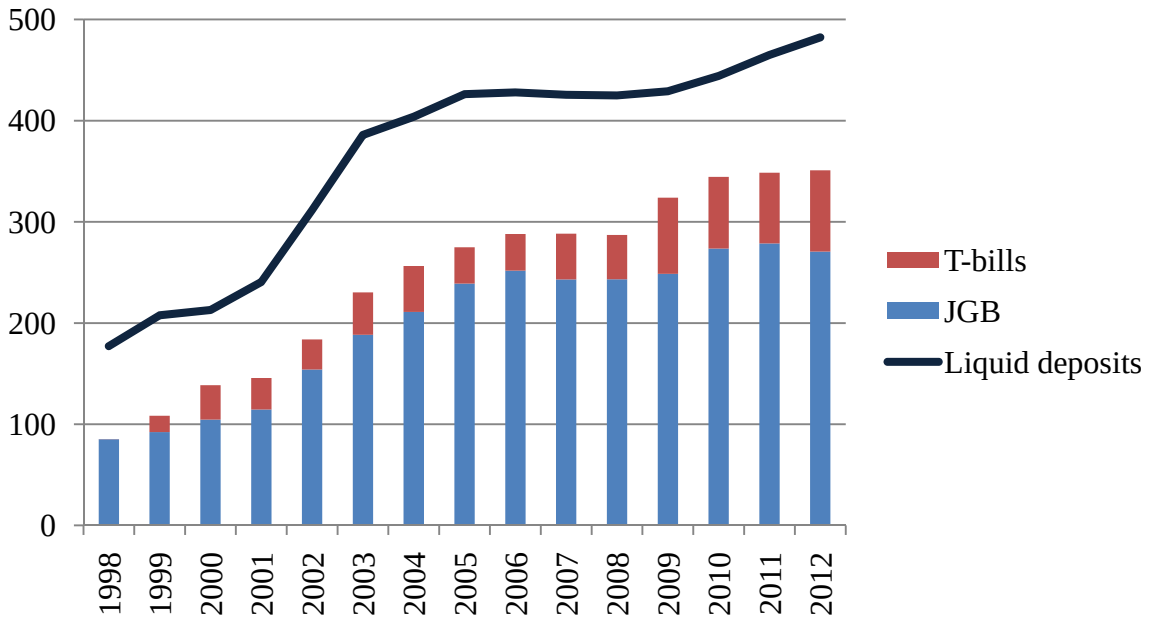


Figure 8: Deposits and government debt holdings of deposit-taking financial institutions

Panel A: All deposit-taking financial institutions (trillion yen)



Panel B: The subgroup excluding *large banks* (consists of *Financial Institutions for Small Businesses* and *Financial Institutions for Agriculture, Forestry and Fisheries*, trillion yen)

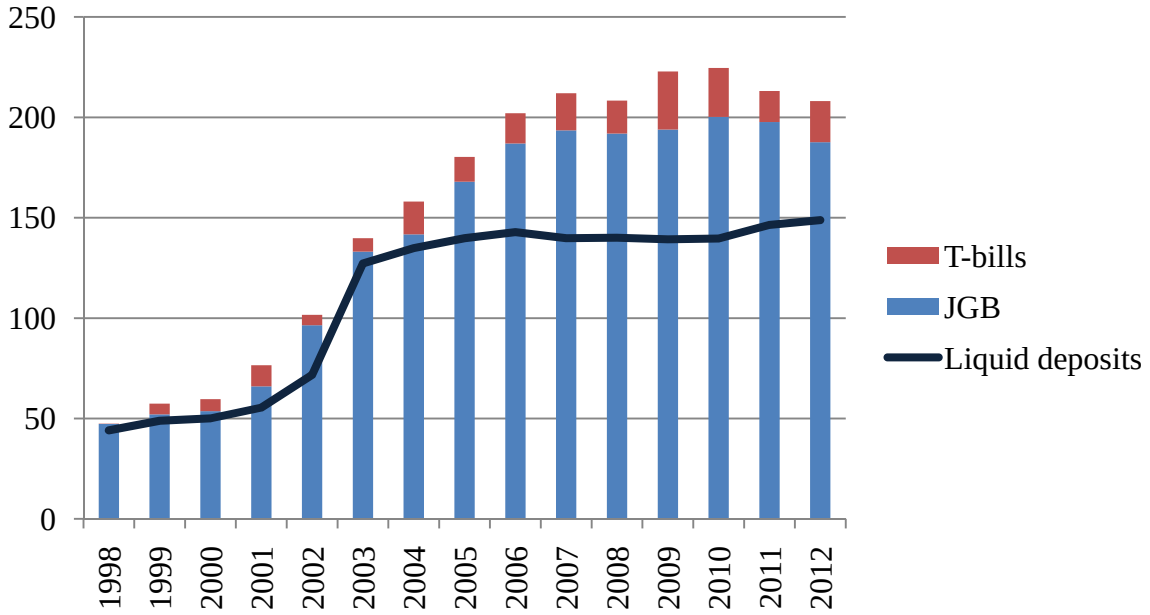


Figure 9

Average durations of largest life insurance companies' bond portfolios