

The JGB Mystery

Masaki Kuwahara
Nomura Securities

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Abstract

Japan's government debt amounted to 220 percent of GDP as of 2010, yet interest rates on Japanese government bonds (JGBs) are very low. This is obviously a mystery: why do bonds issued by the most indebted government carry the lowest yields? The purpose of this paper is to survey various hypotheses that explain this JGB mystery and pin down the most reasonable explanation.

Keynes (1936) postulated that a market tends to form a tacit convention, under which investors expect the current price to be maintained. This seems to be the most accurate description of the state of the JGB market; JGB investors may be following a convention that JGBs are a safe asset. Of course they don't expect the current state to continue indefinitely. But they do assume the current state will continue until they have good enough reasons to expect otherwise. Admittedly Japan's government debt has reached an unprecedentedly high level, but no one can tell exactly where the upper limit is. If anything, many hypotheses have been put forth that justify low interest rates on JGBs. Perhaps JGB investors do not think they have good enough reasons to abandon the convention yet. If the current account balance turns negative, or if the amount of government debt exceeds household financial assets, they may do so, but those events are not likely to occur in the next ten years.

I. Introduction

According to the IMF database, Japan's government debt amounted to 220 percent of GDP as of 2010, the highest among all countries. At the same time, however, the interest rate on Japanese government bonds (JGBs) is the lowest among those countries for which the IMF has government bond yield data for 2010. There is obviously a mystery here that has been puzzling market participants as well as academics: why do we see the lowest yields on bonds issued by the most indebted government? Many hypotheses have been proposed to explain this JGB mystery. The purpose of this paper is to survey various views in academia and the financial market, and pin down the most reasonable explanation for this mystery.

We begin with a basic question: is Japanese government debt sustainable? Academics have proposed many criteria for judging fiscal sustainability and applied them to Japan. Unsurprisingly, most recent studies have rejected the notion of sustainability of Japan's fiscal position. It indeed seems safe to assume that Japan's government finance is not sustainable.

Why, then, do investors buy JGBs? Explanations that have been proposed include Japan's large current account surplus, its massive household financial assets, the existence of deflation, the risk-averseness of households and the micro behavior of financial institutions. However, most of those explanations seem to require an assumption that investors do not think a fiscal crisis is an immediate threat. What we really want to know is why investors feel this way.

A theoretically reasonable hypothesis is that investors are expecting fiscal policy will change in the future. According to this hypothesis, investors believe that the government will eventually raise tax rates or slash expenditures to attain fiscal balance in the foreseeable future. Therefore it is okay to hold JGBs now even if the current government is not managing fiscal policy in a sustainable way. Ito, Watanabe and Yabu (2010) attempt to describe this view quantitatively. I am skeptical of this hypothesis, however, because my experience talking with investors in Japan's financial markets suggests that market participants are not confident about a future change in policy.

I find a description of market behavior in Keynes' *General Theory* (1936) to explain most plausibly the current state of the JGB market. Keynes postulates that a market tends to form a *convention* under which investors expect the current state to continue. It is not that market participants expect the current prices to be maintained indefinitely. However, they do assume the existing state will continue until there is good enough reason to expect a change. JGB investors may be simply following a such a tacit convention that JGBs are a safe asset. Admittedly, the level of Japan's government debt

is unprecedentedly high. But no one can tell exactly where the upper limit is. If anything, many hypotheses have been put forth that justify the low interest rates on JGBs. Perhaps JGB investors simply do not think they have good enough reason to abandon the convention that they are safe, at least right now. Moreover, the daily experience of Nomura's sales people supports the idea that investors in JGBs are following such a tacit convention.

This explanation of the current situation in the JGB market means, in other words, that the market may collapse when investors come to think they have good enough reason to abandon the convention. In this light, it is noteworthy that many investors today seem to agree that Japan's current account surplus and large accumulation of household financial assets are important to the country's ability to continue to meet its debt obligations. Thus, investors might abandon the convention of JGBs' safety if the current account balance turned negative or the amount of government debt surpassed total household financial assets. These events could trigger a market collapse even if investors' belief in their influence on fiscal sustainability has no basis in theory.

It is often said that the continued aging of its population will drive Japan's current account balance into deficit, but the theoretical background of this view is weak. The future of Japan's current account balance is uncertain. On the other hand, at the current rate of new JGB issuance, we can be fairly sure that government debt will eventually exceed household financial assets, but also that will not happen for another ten years. The day of reckoning is still far away in investors' timeframe.

II. Sustainability of Japanese government debt

Many ways of testing the sustainability of government finance have been proposed. They usually begin with the inter-temporal budget constraint of government.

$$B_t = (1 + r_t)B_{t-1} - (R_t - G_t) ,$$

where B = outstanding debt,

r = interest rate,

R = government revenue,

G = government expenditure excluding interest payment

Solving forward with respect to B_t ,

$$B_t = E_t \left[\sum_{i=1}^n \left\{ \prod_{j=1}^i \frac{1}{1+r_{t+j}} \right\} (R_{t+j} - G_{t+j}) \right] + E_t \left[\left(\prod_{i=1}^n \frac{1}{1+r_{t+i}} \right) B_{t+n} \right] . \quad (1)$$

According to Hamilton and Flavin (1986), government finance is sustainable if

$$\lim_{n \rightarrow \infty} E_t \left[\left(\prod_{i=1}^n \frac{1}{1+r_{t+i}} \right) B_{t+n} \right] = 0 \quad (2)$$

Therefore, to establish sustainability, we have to show that (2) cannot be rejected.

Another way of deciding whether government finance is sustainable utilizes a cointegration test. Similarly to (1),

$$B_{t-1} = E_t \left[\sum_{i=0}^{\infty} \left\{ \prod_{j=0}^i \frac{1}{1+r_{t+j}} \right\} S_{t+j} \right] + \lim_{i \rightarrow \infty} E_t \left[\left(\prod_{j=0}^i \frac{1}{1+r_{t+j}} \right) B_{t+i} \right] \quad (1)'$$

$$B_t = E_t \left[\sum_{i=0}^{\infty} \left\{ \prod_{j=0}^i \frac{1}{1+r_{t+j+1}} \right\} S_{t+j+1} \right] + \lim_{i \rightarrow \infty} E_t \left[\left(\prod_{j=0}^i \frac{1}{1+r_{t+j+1}} \right) B_{t+i+1} \right] \quad (1)''$$

where $S = R - G$.

Subtracting (1)' from (1)'',

$$\begin{aligned} \Delta B_t = & E_t \left[\sum_{i=0}^{\infty} \Delta \left\{ \prod_{j=0}^i \frac{1}{1+r_{t+j+1}} \right\} S_{t+j+1} \right] + \lim_{i \rightarrow \infty} E_t \left[\left(\prod_{j=0}^i \frac{1}{1+r_{t+j+1}} \right) B_{t+i+1} \right] - \\ & \lim_{i \rightarrow \infty} E_t \left[\left(\prod_{j=0}^i \frac{1}{1+r_{t+j}} \right) B_{t+i} \right] \end{aligned}$$

The first term on the right-hand side can be shown to follow an $I(0)$ process under reasonable assumptions. Therefore, we can write

$$\Delta B_t = G_t - R_t + r_t B_{t-1} = I(0) \text{ process} + \text{limiting term} \quad (3)$$

The limiting term needs to be zero for the government debt to be sustainable. That can be shown by establishing that G_t , R_t and $r_t B_{t-1}$ are cointegrated.

Asako et al. (1993) tested both equation (2) and cointegration of the terms in (3). Their finding is that sustainability cannot be rejected in the post-war period. Also, Doi and Nakazato (1998) tested (2) and could not reject sustainability.

On the other hand, Kato (1997) rejected cointegration of R_t , G_t , and $r_t B_{t-1}$, and hence they also rejected sustainability. Ihori, Nakazato and Kawade (2003) tested (2) and found that sustainability cannot be rejected when they used data from 1957 to 1996, but it could be rejected when they extended the data through 1999.

Bohn (1998) proposed a different method to test debt sustainability. Supposing a growing economy, he rewrites government budget constraint as

$$B_{t+1} = (1 + r_{t+1})(B_t - S_t)$$

Letting Y be GDP and dividing by Y ,

$$b_{t+1} = x_{t+1}(b_t - s_t) \quad (4)$$

$$\begin{aligned} \text{where } b_t &= B_t / Y_t, \\ s_t &= S_t / Y_t, \\ x_{t+1} &= (1+r_{t+1}) Y_t / Y_{t+1} \end{aligned}$$

On the other hand, he estimates a response function of the government surplus (s_t) to the debt level and other factors:

$$s_t = \rho b_t + \mu_t \quad (5)$$

From (4) and (5),

$$\Delta b_{t+1} = -\{1 - x_t(1 - \rho)\}b_t - x_{t+1}\mu_t$$

If $0 < x(1 - \rho) < 1$, then the debt-to-GDP ratio is a stationary, mean-reverting process. Ihori et al (2000) applied this method to Japan and rejected the hypothesis of sustainability.

Broda and Weinstein (2004) applied yet another criterion to Japan's fiscal situation. They began from a budget constraint of the form

$$B_t = B_{t-1} + r_t B_{t-1} + G_t + H_t - T_t - (M_t - M_{t-1})$$

$$\begin{aligned} \text{where } H &= \text{transfers to the elderly,} \\ G &= \text{other government non-interest expenditure,} \\ T &= \text{tax revenue,} \\ M &= \text{money supply.} \end{aligned}$$

In terms of ratios to GDP:

$$b_t = \frac{1+r_t}{1+\eta_t} b_{t-1} + r_t B_{t-1} + g_t + h_t - \tau_t - \lambda_t m_t$$

$$\begin{aligned} \text{where } \eta &= \text{nominal GDP growth,} \\ \lambda &= \text{money supply growth.} \end{aligned}$$

Assuming r and η to be fixed, the debt-to-GDP ratio at period n can be written as

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

Following Blanchard (1990), they say that government debt is sustainable if current policy can be applied indefinitely with a stable government debt-to-GDP ratio. Setting $b_n = b_0$, it can be rearranged as

$$b_0 + \left\{1 - \left(\frac{1+\eta}{1+r}\right)^n\right\}^{-1} \sum_{t=1}^n \left(\frac{1+\eta}{1+r}\right)^t (g_t + h_t - \tau_t - \lambda_t m_t) = 0$$

Let τ^* be a fixed tax rate that satisfies the equation. Solving for τ^* ,

$$\tau^* = \frac{i-\eta}{1+\eta} \left[b_0 + \left\{ 1 - \left(\frac{1+\eta}{1+i} \right)^n \right\}^{-1} \sum_{t=1}^n \left(\frac{1+\eta}{1+i} \right)^t (g_t + h_t - \lambda_t m_t) \right] .$$

Setting b_0 to Japan's debt-to-GDP ratio in 2002, they calculated τ^* over a one-hundred year horizon under various assumptions for interest rates, GDP growth rates, government expenditure and money growth. The result suggests that Japan has to raise tax rates to attain sustainability under reasonable assumptions. The authors discuss their findings in an optimistic tone, arguing that the required tax rate hike is not very large. Nevertheless, the findings do suggest that the current tax rate is not high enough. Furthermore, Doi (2006) repeats a similar exercise and finds that the necessary tax rate hike is likely to be bigger than what Broda and Weinstein (2004) found.

Doi, Hoshi and Okimoto (2011) tests sustainability with three methods proposed by Davig and Leeper (2004), which examines the response of tax revenue rather than the debt level itself to debt level, as well as Broda and Weinstein (2005) and Bohn (1998). Sustainability is rejected on all of those criteria.

Except for some early studies in the 1990s, most research have rejected the sustainability of Japanese government debt. Watching the Japanese government debt-to-GDP ratio climb above 200 percent, this should not be a surprise.

III. Reasons why JGBs are still held

Given the overwhelming rejection of sustainability by academic research, it seems to be safe to assume that Japan's government debt is indeed unsustainable. I believe many market participants would agree with the research results. If that is the case, why are JGBs still being held with such low interest rates? Many hypotheses have been proposed to explain the mysterious combination of the lowest interest rates on the most indebted government's bonds. Below we consider the merits of three commonly voiced explanations.

1. Japan's current account surplus and household financial assets

About 94 percent of JGBs are held by domestic investors. It is often suggested that the high ratio of domestic holdings is why the prices of JGB have remained stable so far. and further it is said that domestic investors are able to hold most JGBs because Japan's current account surplus runs about 3 percent of GDP and its household financial assets stand at about 300 percent of GDP. In short, the argument goes that

JGB prices have been stable because of the current account surplus and massive accumulation of household financial assets.

This seems to be the most popular hypothesis. For example, according to Takada (2011), “credibility of JGBs has been largely maintained by the existence of a current account surplus.” Similarly, a special article in *Shukan Economisto* on Japan’s current account balance (“Japan as a Current Account Deficit Country”, June 7, 2011) suggested that if the current account falls into deficit in the future, Japan would no longer be able to support its financial needs domestically, it would be exposed to scrutiny in global financial markets, and interest rates on JGBs would shoot up. Finally, in *Shukan Toyo Keizai* magazine a cover story on Japan’s sovereign risk stated: “currently, Japanese households are supporting JGB prices. . . [I]f we lose household purchases, our choices will be either finding foreign investors or direct purchases by the Bank of Japan” (“Avoiding a JGB Crash”, April 2, 2011).

Admittedly, Japanese investors as a whole have enough money to absorb almost all the JGBs the government issues domestically. But that does not mean that Japanese investors necessarily have to buy JGBs. They are entirely free to buy other assets with higher yields. The real question, then, should be why they *choose* to buy bonds issued by the most indebted country in the world with the lowest yields, but this question is rarely addressed. As an economist at the University of Tokyo told me, “it doesn’t make sense to explain stable JGB prices by the mere existence of a current account surplus or a large accumulation of household financial assets. We cannot say ‘company A’s stock price does not fall because shareholders are all Japanese.’ Similarly, we cannot say ‘JGB prices do not fall because they are mostly held by Japanese.’”

2. Deflation and risk-averseness

Another type of explanation for the JGB mystery appeals to investors’ asset allocation decisions. For example, deflation is often mentioned as a reason why yields on JGBs are lower than yields on other countries’ government bonds. If investors have an expectation of deflation, they will expect yen appreciation in the future. If that is the case, relatively low yields on JGBs are a natural consequence of interest rate parity. Kono (2011) mentions deflation as one factor that explains low JGB yields. An economist at the University of Tokyo also suggested this possibility to me.

Another example of an explanation based on investor preferences, suggested by Doi (2007), points to the extreme risk-averseness of Japanese households. We know the risk premium on equity is much larger than what can be explained by typical assumptions on the degree of risk-averseness (equity premium puzzle). It could be that

households are much more risk-averse than we normally think they are. The flip side of the equity premium puzzle is low interest rates on risk-free assets. In addition, if households are extremely risk averse, perhaps they don't want to take currency risk either. This could explain why yields on JGBs are lower than those on other countries' government bonds.

These hypotheses may seem convincing at first. However, note that they require an *assumption* that there will be no fiscal crisis in the near future. For example, investors would not usually anticipate yen appreciation if they expected a near-term fiscal crisis, in which case inflation and yen depreciation are more likely. It is the expectation of no near-term fiscal crisis that makes deflationary expectation possible, not vice versa. Similarly, risk-averse households cannot hold JGBs if they expect a near-term fiscal crisis. It is the expectation of no near-term fiscal crisis that allows risk-averse households to buy JGBs.

Admittedly, in general, the existence of deflationary expectations and the risk-averseness of households make JGB interest rates low. But what we really want to know is why investors still think deflation will continue and why risk-averse households still think JGBs are safe, despite an apparently unsustainable level of government debt. The explanations examined so far miss the point.

3. Behavior of banks

The behavior of Japanese banks is often mentioned as a reason why JGB prices are stable. For example, *Shukan Toyo Keizai* magazine quotes a bond analyst as saying; “[People in charge of money allocation in banks, life insurance companies and pension funds] are worried about Japan's government finance as private citizens. However, as employees of financial institutions, if they are told by their bosses to invest in JGBs and make profits, they cannot say no” (“Avoiding a JGB Crash”, April 2, 2011). Also, I personally often hear people in the markets say that the reason why Japanese banks still invest in JGBs is that they cannot find alternative investment opportunities.

But, again, this explanation requires an assumption that the banks do not think fiscal crisis is an immediate threat. As a Nomura bond analyst put it, “bond investors are worried about Japan's fiscal problem. They think fiscal crisis may come in five years or ten years, but not right now. If the fiscal crisis does not come so soon, they have to invest their excess liquidity in JGBs.” What we really want to know is why they do not view a fiscal crisis as immanent..

IV. Future policy change

Japan's total tax revenue-to-GDP ratio averaged 27 percent for the years 2000 to 2008; this was well below the OECD average of 35 percent. A frequent explanation for why the JGB market has been stable despite the high level of government debt is that Japan still has room for a tax hike and investors expect Japan to raise the tax rate in the future, thereby improving its fiscal position.

In my understanding, this hypothesis is the most reasonable one from the point of view of economic theory. In fact there are many advocates of this view in academia. According to Ihuri (2000), "the reason why public bonds of our country are purchased at low interest rates despite the primary balance deficit is that investors are optimistic about the future fiscal system of Japan, thinking that the primary balance will return to surplus in the long run. They think so because Japan can tolerate higher tax rates as the current tax rate is still low." Another economist at the University of Tokyo told me, "if you want to explain low interest rates on JGBs, you must appeal to the fact that we still have room for further tax hike."

Ito, Watanabe and Yabu (2010) attempt to express this view quantitatively. Following Davig and Leeper (2005), they postulate that a country's fiscal policy stance is not fixed over time. Government attitude switches between Ricardian, under which the government shows strong fiscal discipline, and non-Ricardian stances. Using data spanning more than hundred years, they estimate a government's fiscal policy function of the form

$$b_t = \begin{cases} \mu_0 + \alpha_0 b_{t-1} + u_{0t}, & \text{if } S_t = 0 \\ \mu_1 + \alpha_1 b_{t-1} + u_{1t}, & \text{if } S_t = 1 \end{cases}$$

where b = debt-to-GDP ratio and S = state of government fiscal policy.

A value of $\alpha < 1$ implies a Ricardian regime, whereas $\alpha > 1$ implies a non-Ricardian stance. They find that Japan's fiscal policy has been switching between Ricardian and non-Ricardian in the past, with some transition probability.

Using the parameters obtained from historical data, they simulated the future path of Japan's debt-to-GDP ratio. They found the ratio is likely to rise over the next 20 years, but will start declining after that and finally converge to zero. In the simulation although Japan's fiscal policy is currently non-Ricardian, it switches to Ricardian and stays there for a sufficiently long time so that the system is globally stationary. This is because the estimated transition probability suggests that the government is more likely to be Ricardian than non-Ricardian at any given point in time.

If investors believe that in the future Japan's fiscal policy will switch to a Ricardian stance (as described in Ito, Watanabe and Yabu), they do not necessarily have to sell JGBs even though the current regime is non-Ricardian. In fact, the current DPJ government declared that it will attain a primary balance surplus by FY2020. According to Doi (2007), "apart from monetary policy or inflation, the reasons why interest rates on JGBs are low are extensive risk averseness of households and government commitment to improve fiscal balance."

The problem with this view is that I find it hard to believe that investors are indeed confident about a future policy change, based on my experience in Japan's financial markets. Non-Japanese investors, especially, are skeptical. For example, *Shukan Economist* magazine introduced several foreign investors who are short-selling JGBs ("A Countdown to JGB Crash", October 11, 2011). Of course, Japanese investors are also skeptical as suggested by a recent cover story in *Shukan Diamond* magazine titled "Rich Japanese Abandoning Japan" (October 8, 2011). According to the article, more and more rich Japanese are leaving Japan because of threats of earthquakes, radiation, yen appreciation and future fiscal crisis. I have personally heard Japanese investors voice great concern about the future. Anticipation of future policy change is a theoretically sound hypothesis, but it does not fit my everyday experience.

V. Convention

Japan's government finance is not sustainable. And investors do not seem to believe that government policy will change in the future. Are they not worried about a future fiscal crisis? According to a bond analyst at Nomura, "they are. They are worried about the timing when the fiscal problem explodes. But they just don't change their behavior right now."

In that case, then we must ask what are investors thinking when they put money in JGBs? A comment from a JGB salesperson at Nomura may describe what is actually going on in the heads of Japanese investors: "Domestic banks and life insurers are assuming that there won't be an immediate fiscal crisis. They know the JGB market is a closed market in the sense that most of the participants are domestic investors. There is a kind of tacit agreement among investors; we can hold JGBs domestically if everyone participates. So, you know what you do."

I found in Keynes' *General Theory* (1936) a description of market behavior that is very close to this comment.

In practice we have tacitly agreed, as a rule, to fall back on what is, in

truth, a *convention*. The essence of this convention – though it does not, of course, work out so simply – lies in assuming that the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect a change. This does not mean that we really believe that the existing state of affairs will continue indefinitely. We know from extensive experience that this is most unlikely. . . . Nevertheless the above conventional method of calculation will be compatible with a considerable measure of continuity and stability in our affairs, *so long as we can rely on the maintenance of the convention*.

Note that Keynes describes a tacit agreement among investors, which is exactly like the situation the JGB salesperson explained to me. Perhaps Japanese investors keep investing in JGBs under a tacitly agreed convention that JGBs are safe. Keynes says it is not that investors believe the existing state will continue indefinitely, and neither do JGB investors. But they do assume the current state will continue unless there is good enough reason to expect a change.

Japan's unprecedentedly high debt-to-GDP ratio may seem to be a good enough reason to abandon the convention. But no one can tell where the upper limit on the ratio actually is. If anything, we have a whole list of hypotheses that seem to justify today's very low interest rates on JGBs, as we already discussed. It is possible that Japanese investors have heard more reasons to assume the current state will continue than reasons to suggest otherwise. Perhaps JGB investors just do not think there are good enough reasons to stop relying on the convention that JGBs are safe, at least for right now.

In a sense, those hypotheses discussed in this paper may be being used as excuses to continue investing in JGBs. For example, the bond analyst mentioned above told me; "The reason why we have not had a fiscal crisis is that we still have a current account surplus and a large amount of household assets. Investors do not care why or how the current account surplus or the accumulation of household financial assets can sustain JGB prices. These benchmarks are used just as excuses to purchase JGBs."

Several others explain the current state of the JGB market as the consequence of interdependent decisions by investors. Ito (2011), among others, suggests the possibility of a bubble in the JGB market, but I am not sure that we can define a bubble for an asset with a fixed repayment schedule. In addition, an economist at Keio University suggested to me the possibility of a beauty contest, which was originally discussed by Keynes (1936). However, Keynes used the analogy of a beauty contest to

explain why market prices can be volatile, while, in contrast, the JGB market has been calm for a long time. Hence, it seems to me that the idea of a tacit convention among investors regarding the safety of JGBs fits best to what is happening in the JGB market.

VI. Future current account balance and government debt

According to Keynes, market prices that are formed based on a tacitly agreed convention can be stable, so long as there is not enough reason to expect otherwise. In other words, if there are good enough reasons to expect a change, JGB prices may go down. From this point of view, the fact that many market participants agree on the importance of the current account surplus and the relative size of household financial assets versus government debt is noteworthy. JGB prices may collapse if Japan's current account balance turns to deficit, or if the amount of government debt exceeds the amount of household financial assets, exactly because that is what many investors believe, regardless of its theoretical soundness. Kodama (2011) says "there would be no wonder even if the market starts to price in the risk of fiscal crisis, given the current level of fiscal deterioration. It is difficult to predict when that will happen . . . [T]he market is focusing on the timing when the current account balance turns to deficit and when government debt exceeds household net assets."

1. Future current account balance

Many market participants believe that Japan's current account will fall into deficit because of the aging of the population. Kanno (2011), chief economist at JPMorgan Securities, predicts that Japan's current account will turn negative in three or four years. Haji (2011), chief economist at NLI Research Institute, also mentions the possibility that population aging can cause the current account to slide into deficit.

There are also opponents to this view. For example, while three out of the four business economists interviewed for a *Nikkei* newspaper article appearing on May 17, 2011 said Japan would have a current account deficit in the future, with the predicted timing ranging between 2013 and 2018, the remaining interviewee argued that growth in Japan's exports to Asia and other countries would sustain the current account surplus.

I could find a surprisingly small amount of academic research on the relationship between population aging and current account balances or on projecting current account balances, at least for Japan. Noguchi (1989) is a notable exception that provides a simple theoretical framework. Let us consider the theoretical implication of population aging for the current account balance using his framework.

Consider an overlapping generation model in which two generations reside at a time. Each household maximizes the utility function of the form

$$U = C_y^{1-\beta} C_o^\beta$$

subject to the budget constraint

$$w = C_y + \frac{C_o}{1+r}$$

where C_y = consumption when young,

C_o = consumption when old,

w = wage rate,

r = interest rate.

Solving the problem,

$$\begin{cases} C_y = (1 - \beta)w \\ C_o = \beta(1 + r)w \end{cases}$$

Savings when young is $w - C_y = \beta w$, while (dis)savings when old is $-C_o = -\beta(1 + r)w$.

Let the population of the young be L , and population growth rate n . Total savings of the economy is

$$S = \beta w L - \beta(1 + r)w \frac{L}{1+n} = \beta w L \left(1 - \frac{1+r}{1+n}\right)$$

S is clearly an increasing function of n . That is, a slower rate of population growth (lower n), which occurs as a population ages, can reduce the total amount of savings in the economy. In this sense, the commonly expressed view is correct; population aging reduces the supply of funds.

The common argument goes on to say that therefore population aging implies higher interest rates and a current account deficit. But this argument is too simplified since it ignores the demand for funds. Let the production function of the firm be

$$Y = L^\alpha K^{1-\alpha} = Lk^{1-\alpha}$$

where K = capital, $k = K / L$.

The maximization problem yields familiar results:

$$\begin{cases} w = \alpha k^{1-\alpha} \\ r = (1 - \alpha)k^{-\alpha} \end{cases} \quad (6)$$

We can rewrite (6) as $k = \{(1 - \alpha) / \alpha\} w / r$, or

$$K = \frac{1-\alpha}{\alpha} \frac{w}{r} L$$

This result says that demand for capital is a function of the relative price of labor and capital and the amount of labor. In this model, population is exogenously determined, with growth rate of n . Thus, population aging, or lower growth of L , implies less demand for capital. That is, population aging not only reduces the supply of funds, as found above, but also the demand for funds. Hence the implication of population aging cannot be determined a priori. We have to solve the entire system.

First we assume a closed economy. Total consumption of the young is

$$LC_y = L(1 - \beta)\alpha k^{1-\alpha} = \alpha(1 - \beta)Y$$

The elderly receive a return on their assets. Also, they sell the principal to finance their consumption. So the total consumption of the elderly must be equal to

$$(1 + r)K = \{1 + (1 - \alpha)k^{-\alpha}\}Lk^{1-\alpha}k^\alpha = \{k^\alpha + (1 - \alpha)\}Y .$$

Since population grows at the rate n , investment at the steady state must be equal to

$$nK = nLk^{1-\alpha}k^\alpha = nk^\alpha Y .$$

Hence, the equilibrium condition in the goods market is

$$Y = \alpha(1 - \beta)Y + \{k^\alpha + (1 - \alpha)\}Y + nk^\alpha Y .$$

Solving for k , yields

$$k = \left(\frac{\alpha\beta}{1+n}\right)^{\frac{1}{\alpha}} .$$

Therefore, the interest rate in the steady state is

$$r = (1 + n) \frac{1-\alpha}{\alpha\beta} .$$

We can see that r is an *increasing* function of n .

Next we turn to the case of a small open economy and look at the implication of population aging on the current account balance. The interest rate is determined at the global level i . Therefore, from (6),

$$k = \left(\frac{1-\alpha}{i}\right)^{\frac{1}{\alpha}} .$$

Hence, the level of domestic capital is

$$K = kL = \left(\frac{1-\alpha}{i}\right)^{\frac{1}{\alpha}} L = \frac{1-\alpha}{i} Y . \quad (7)$$

On the other hand, the level of total capital, K^* , which includes overseas assets as well, can be expressed as

$$K^* = \{w - (1 - \beta)w\} \frac{L}{1+n} = \frac{1}{1+n} \alpha \beta Y \quad (8)$$

since it is equivalent to the savings of older generation. Note that, apart from the impact through Y , population aging does not affect the level of domestic capital, while it increases total capital. From (7) and (8), overseas assets are

$$K^* - K = Y \left(\frac{1}{1+n} \alpha \beta - \frac{1-\alpha}{i} \right) .$$

Since the current account balance, CA , is by definition equal to a change in net overseas assets, in the steady state it must be that

$$CA = n(K^* - K) = nY \left(\frac{1}{1+n} \alpha \beta - \frac{1-\alpha}{i} \right) .$$

Dividing by Y and taking derivative with respect to n ,

$$\frac{d\left(\frac{CA}{Y}\right)}{dn} = \frac{\alpha \beta}{(1+n)^2} - \frac{1-\alpha}{i} \quad (9)$$

which is negative for values of the parameters normally used. For example, with

$$\alpha = 0.7, \beta = 0.5, n = 0, i = 0.03$$

equation (9) becomes -9.65 . The current account balance is a *decreasing* function of n , the rate of growth of population.

In sum, in a simple model proposed by Noguchi (1989), population aging implies lower interest rates in a closed economy and a larger current account balance in an open economy, contrary to what is usually argued.

The only academic study I found that projects Japan's current account balance is by Ito and Tsuru (2006). Their research reveals considerable difficulties with projecting current account balances. They managed to estimate two components of the current account balance, the future investment-savings (I-S) balance of households and of government, but found it difficult to estimate the third component, the I-S balance of firms. They produced alternative current account projections—by extrapolating the I-S balance for firms to maintain the historical correlation between government and firm I-S balances and by simply assuming the IS balance for firms stays constant.

Ito and Tsuru tried various assumptions for GDP growth, interest rates, government fiscal balance, as well as for the I-S balance of firms. Under different assumptions, they found that Japan's current account could turn negative in 2015 or it may never turn negative through the year 2050.

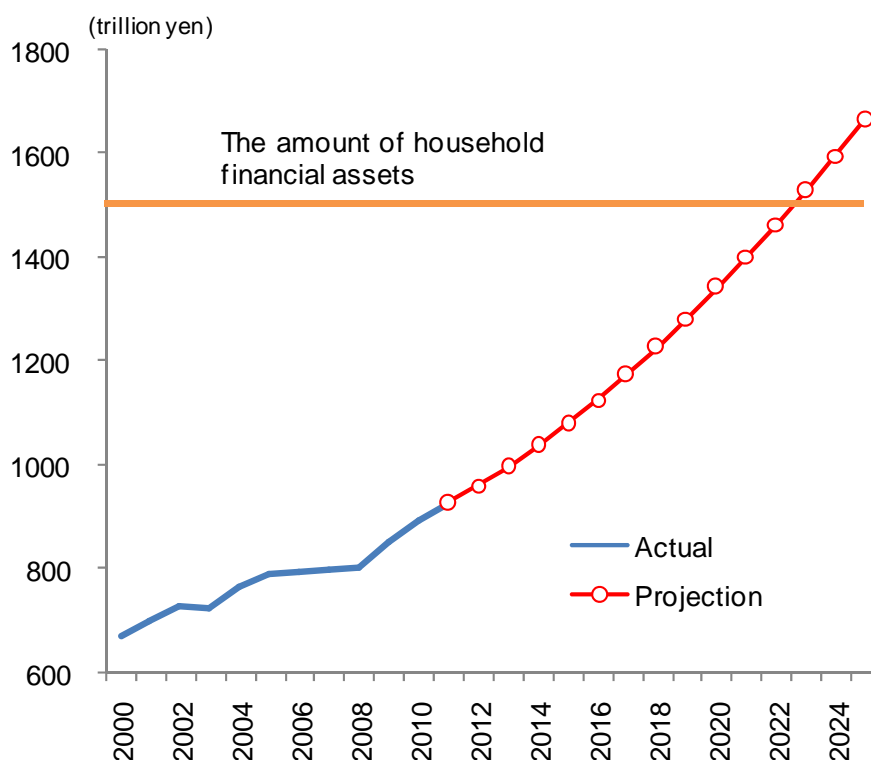
Although many market participants think Japan's current account balance will turn to deficit because of population aging, the theoretical basis for that view is very weak. Furthermore, actual projections for the current account balance vary greatly depending on the assumptions. I have to conclude that there remains significant uncertainty on Japan's future current account balance.

2. Future government debt

Even if we are not sure about the future current account balance, we can be fairly sure that government debt will keep accumulating and will eventually exceed household financial assets sometime in the future, if the government keeps issuing JGBs at the current rate.

According to Oguro (2010), if we assume the amount of household financial assets stays flat and government debt increases at the rate equal to the 1980-2008 average, debt will exceed household assets in the year 2022. In my own calculation with a bit more elaboration on the calculation of government debt, the timing is 2023 (figure 1). These projections imply that the day of reckoning does not come until ten years from now. Perhaps that time frame is too far in the future for JGB investors to take into consideration.

Figure 1: Household financial assets and government debt in Japan, 2000 - 2025



Source: Nomura

VII. Conclusion

In my view, the JGB market is being sustained by the tacit convention among domestic investors that JGBs are safe assets. Of course investors don't assume the current state will continue indefinitely. But they do expect it will continue until they have good enough reasons to expect otherwise. Admittedly Japanese government debt has reached an unprecedentedly high level, but no one can tell where the upper limit is. If anything, there has been provided many hypotheses that justify low interest rates on JGBs. Perhaps JGB investors do not think they have good enough reasons to reject the convention, at least for right now. If Japan's current account balance turns to deficit or the amount of government debt exceeds total household financial assets, the convention may no longer be maintained, but those events are not likely to occur in the next ten years.

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