How Households' Balance Sheets Affect Their Asset Allocation—
Implications for Future Private Outflows from Japan

Sachiko Miyamoto
Financial and Economic Research Center
Nomura Securities
s-miyamoto@frc.nomura.co.jp

Abstract

In Japan, population aging is occurring at a speed unseen in the rest of the world and there is growing interest in the economic impact from this demographic change. By analyzing current households' asset allocation, this study suggests how demographic change affects money flow from Japan. A rising trend in holdings of risk-less assets with stable cash flow income is generally anticipated as a country's population ages. In addition to these concerns about the effects of aging, it is often claimed that Japanese households fundamentally prefer safe assets. This study presents an alternative view that aging population could increase households' allocation toward risky assets.

Real estate has important meaning for both the asset and the liability sides of Japanese households' balance sheets. This paper uses portfolio allocation model that can take into account real assets as well as liabilities, which are neglected in the traditional household asset allocation model, to examine how housing and its related debt burden affected risk-taking by Japanese households. The result brought to light that Japanese households' risk tolerance was not low as was generally believed in the period after 1995, for example, when they could not unload their holdings of real assets, with the associated liabilities, despite their dismal relative performance.

In the future, both repayments of existing housing loans and decreasing population in the prime house-buying age brackets will contribute to a declining liability ratio at the macro level. Returns on real and financial assets, which will be an important factor affecting risk tolerance and the liability ratio, have finally started improving after falling since 1990. From now, these changes are likely to have a significant impact on household asset allocation, increasing flows to risky financial assets, including overseas assets.

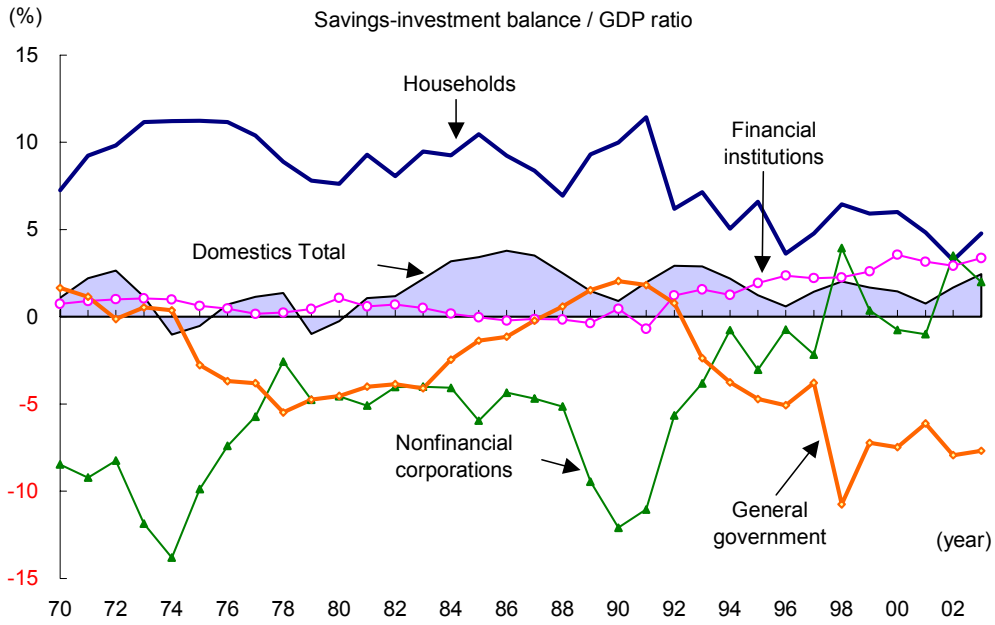
.

1. Introduction

In Japan, population aging is occurring at a speed unseen in the rest of the world. According to UN statistics, the average age of Japanese will rise from 43 years old at present to 46 in 2015 and 48 in 2025. At this pace, we can anticipate that the ratio of people aged 65 and over to the total population will climb from 19.7% today to 29.1% by 2025. What impact will this demographic change have on household financial asset choice, and, by extension, on private money outflow from Japan?

For various reasons, many people expect that the supply of funds from Japanese households looking for risky assets, including foreign assets, will dwindle as population aging continues. Some observers expect the savings rate to fall to zero or even below when the baby boom generation reaches mandatory retirement age in the years 2007 to 2009 (Horioka, 2004). Such a shift toward a deficit in the household sector, along with the already large deficit in the government sector, suggests the risk of rapid decline in the current account balance (figure 1). Moreover, as the population ages, the proportion of salary-earning households can be expected to decline and the proportion of dis-saving households to increase. In these circumstances, it can be anticipated that, with cash flow income stable, the household sector will increase allocation to "safer" financial assets. On top of these concerns about the implications of aging population, Japanese households are often said to fundamentally prefer safe assets. The reason for this claim is that cash equivalents are much more prominent in household financial asset holdings in Japan than in other countries.

Figure 1. Savings-Investment Balance Ratio to GDP 1970-2003



Note: Data are 68SNA series until 1979 and 93SNA series for 1980 and later.
Source: Bank of Japan and Nomura Securities.

The present study presents an alternative view that aging population could increase households' allocation toward risky assets. This view is based on analysis of the role of housing as an asset and a

liability in the portfolio of Japanese households and, through this, the effect of demographic changes on the balance sheet of the household sector. We use a portfolio model that takes into account the liability burden to analyze the influence of housing and risk tolerance on financial asset allocation by Japanese households. Then, we use the results to project how the flow of household funds to risky financial assets may increase due to demographic changes up to 2010.

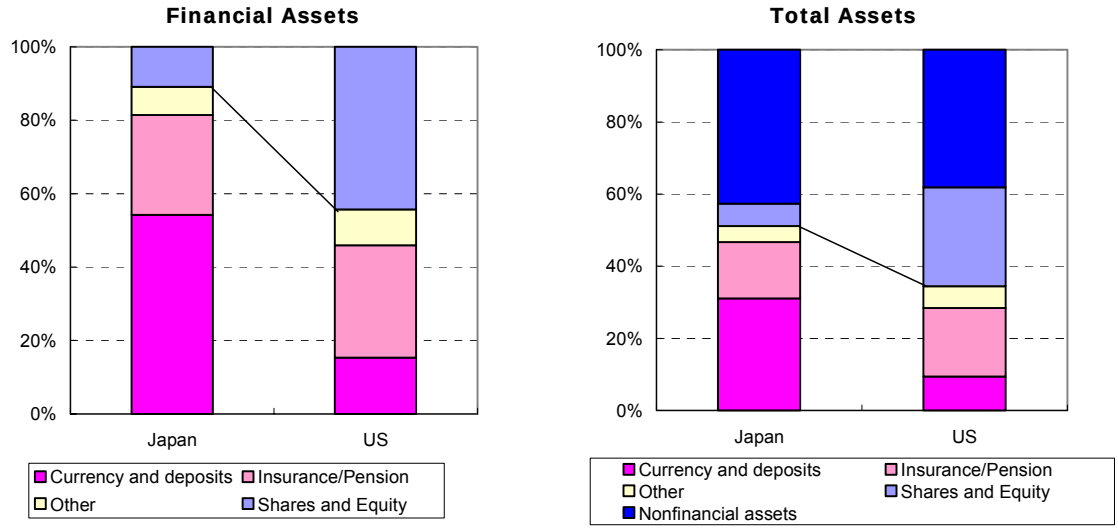
The next section is a background discussion about Japanese household balance sheets and risk-taking, focusing on home ownership. Section 3 summarizes the asset allocation model and the data used to apply this model to Japanese households. Section 4 presents the estimation results and based on these results examines the prospects for asset allocation by Japanese households in the coming years. Section 5 summarizes the study's findings on the key factors in household asset allocation and their implications for future funds flow.

2. A Perspective on Japanese Households' Balance Sheets and Risk-taking

From our perspective the exceptional thing about Japan is not the risk preferences of the people, but the circumstances of the balance sheet of the household sector. Specifically, home ownership has a big place in the balance sheet and this has meant that the severe decline in the value of housing assets in the last decade and imperfections of the housing market have had a large impact on households' asset allocation.

First, the predominance of "safe" assets in the portfolios of Japanese households largely disappears when we consider financial and real assets together (figure 2). The ratio of market-sensitive assets (including equities, mutual funds, and real estate) to total (financial plus real) assets for Japan is roughly similar to that for other countries.

Figure 2. Composition of Financial and Total Assets



Note: Japan includes private unincorporated enterprises. US includes nonprofit organizations. UK includes nonprofit institutions. The data are end of 2003 for Japan and end of 2004 for US and UK.
Source: Cabinet Office Annual Report on National Accounts; FRB Flow of Funds; ONS Blue Book.

Instead, as the IMF (2005) pointed out, what characterizes Japan is the large share of real assets in market-sensitive assets. The dominant place of real estate in household assets in Japan is due to structural problems such as an insufficient supply of rental housing and the high ratio of house prices to disposable income per worker, which makes Japanese households devote a larger share of disposable income to housing than households in other countries (as will be shown below).

That home ownership is a big item in the balance sheets of Japanese households can be seen in micro-level data. For example, in 2003, the ratio of the house price to income was 5.6 in Japan compared to 2.8 in the United States and 4.4 in the UK (table 1). (At the same time, house loans in Japan average 4.1 times income versus 3.1 times in the United States and 2.7 times in the UK.)

Table 1. Home Purchase Characteristics in Japan, the United States, and the UK

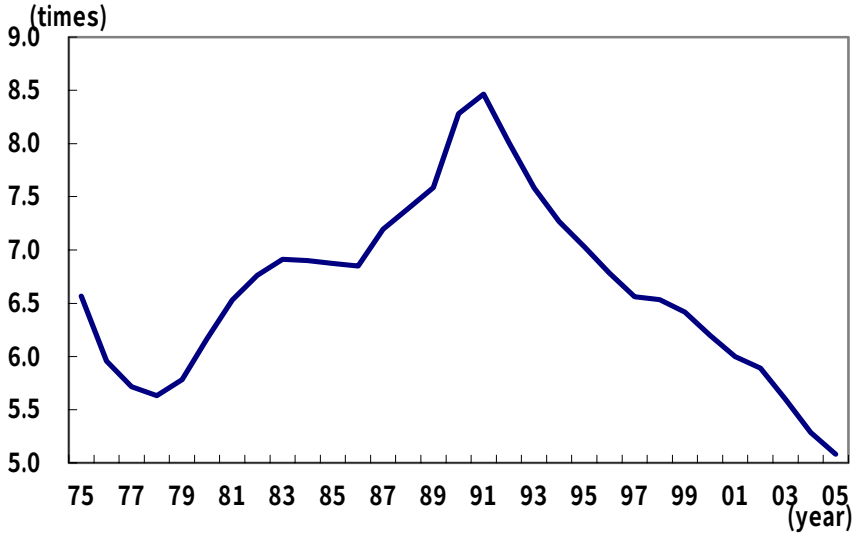
	Japan 2003	US 2003	UK 2003
House price/income	5.60	2.80	4.41
House loan/house price	73.0	75.0	68.4
House loan/income	4.09	3.06	2.72

Notes: Data refer to owner-occupied, new housing. Japan data from Government Housing Loan Corporation, Survey Report of GHLC Borrowers (Purchasers of Built-for Sale Homes) US data from American Housing Survey for the United States: 2003, Current Housing Reports, U.S. Department of Commerce and US Department of Housing and Urban Development Office of Policy Development and Research, H150/Q3, Sept. 2004. Price/income and loan/price are median values for houses less than 4 years old. UK data from Housing Statistics 2004, Office of National Statistics

Moreover, this comparison reflects the situation in 2003, when housing assets were appreciating in other countries and still performing poorly in Japan. Indeed, in 2003 the ratio of house prices to income in Japan was at its lowest level in 30 years (figure 3).[1] In other words, housing was even more significant on the asset side of Japanese balance sheets in past years.

[1] The OECD's *Economic Outlook* No.78, which was published after the conference, also confirmed this observation.

Figure 3. House Price as a Multiple of Annual Income



Note: According to a survey by the Government Housing Loan Corporation, the ratio of total housing price to annual income was 5.6 in 2003. The ratio in the chart is calculated from indexes for land prices and earned income assuming a value of 5.6 in 2003.
Source: Government Housing Loan Corporation, Japan Real Estate Research Institute, Health, Labor and Welfare Ministry, and Financial and Economic Research Center, Nomura Securities.

The importance of real assets for Japanese household balance sheets is also evident on the macro level. According to the OECD, even after declining for a decade, the ratio of real assets to disposable income in the household sector in Japan is twice that in the United States, above that in Germany, and was surpassed by that in the UK and France only in 2003 (table 2).

Table 2. Ratio of Real Assets to Disposable Income

(times)

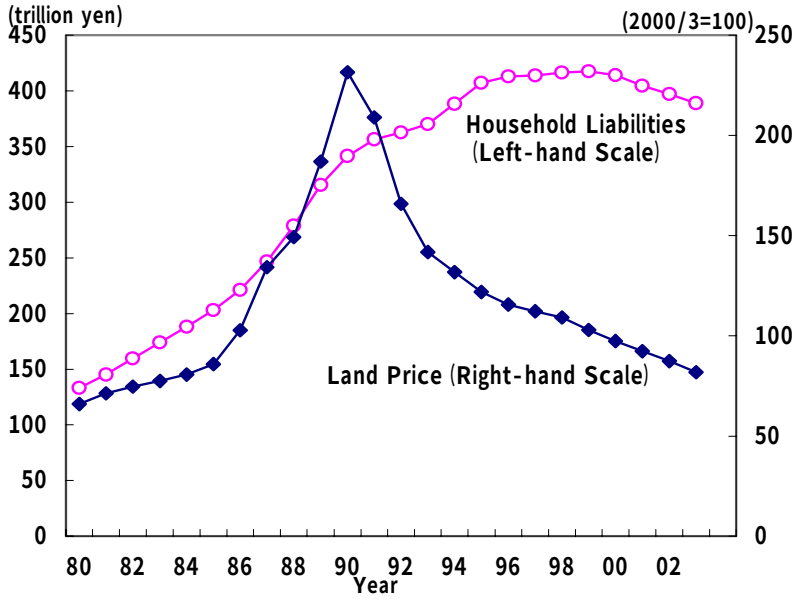
	1985	1990	1995	2000	2003
Japan	4.0	6.8	4.7	4.2	3.7
USA	2.3	2.2	2.1	2.2	2.5
Canada	2.4	2.4	2.6	2.6	2.9
Germany	N.A.	4.0	3.6	3.5	3.4
UK	3.1	4.0	2.7	3.6	4.5
France	2.9	3.7	3.1	3.5	3.8

Source: OECD 2005. *Economic Outlook* 77.

In addition, almost all of the debt held by Japanese households is related to the purchase of a house (Matsuura and Shiraishi, 2003). At the same time, OECD data show the ratio of liabilities to disposable income in Japan above the ratios in the United States, France, Germany, and the UK throughout the 1990s. Thus, home ownership has a big significance on both the asset and liability sides of the balance sheet.

Moreover, the balance sheets of Japanese households have suffered a dramatic change since the beginning of the 1990s. On one hand, the value of housing assets fell as land prices, which comprise most of their value in Japan, plummeted, while on the other hand the level of outstanding debt from house purchases has remained high (figure 4).

Figure 4. Household Liabilities and Land Prices in Japan



Note: Land price is an index for 6 major cities.
Source: Japan Real Estate Research Institute, Bank of Japan, and Financial and Economic Research Center, Nomura Securities.

The explanation for why real assets still make up such a large portion of market-sensitive assets for Japanese households, given their dramatic fall in value with the bursting of the bubble, can be found in the peculiar characteristics of the real estate market in Japan. Structural problems in the housing and land markets in Japan create housing market distortions. For one thing, the supply of quality rental properties is insufficient. According to data from the Ministry of Internal Affairs and Communication, average floor space of rental housing in Japan is only 1/3 the amount for owner-occupied housing, and this differential is much greater than in other advanced economies. Government regulations and taxation policies also cause many distortions in the markets for land and housing.

In contrast to other countries, in Japan, the market for existing homes is much smaller than the market for new construction and existing homes have little resale value apart from the land. Market value of housing structures tends to follow the same pattern as book value, which is zero after 22 years based on annual depreciation of about 5%. The low market value for existing housing may be related to the short the useable lifespan of the housing stock. According to the government's Housing Stock Survey, the lifespan of the housing stock in Japan is just 30 years, compared to 79 years in Germany, 86 in France, 96 in the United States, and 141 years in the UK.[2] The underdeveloped mortgage market in Japan also contributes to the illiquidity in the market for existing housing; homeowners generally cannot take equity out of their real property—in the way that they do in the US and UK. In this market context, then, spending money on a house in Japan is "consumption," not "value accumulation" or investment as it is in the United States or the UK.

[2] Ministry of Internal Affairs and Communications, Housing Stock Survey, 1993

While the illiquid housing market made it difficult for Japanese to adjust their balance sheets in response to the bursting of the real estate bubble, there are several reasons to expect the balance sheet picture for Japan's household sector will improve in the coming years. In particular, the burden of housing debt should decrease in conjunction with the changing age composition of the population. The easing of the housing debt burden could trigger a change in financial asset allocation. It could be a force to drive more money toward risk assets as households reallocate their financial portfolios and concomitantly this force could lead Japanese households to invest in more foreign assets. With household financial assets totaling ¥1,400 trillion, Japan ranks next to the United States on both an aggregate and a per capita basis. Given the huge size of this pool of assets, it is easy to see that understanding the factors that influence household asset allocation is important to speculating about the flow of funds from Japan in the future.

2. A Portfolio Allocation Model for Households with Liabilities

Against this background, we want to analyze the effect of housing assets on financial risk-taking by Japanese households in a portfolio allocation framework that takes into account the burden of liabilities. There is a vast literature on portfolio allocation, but only a few papers include real estate or housing as one of the assets, and most of those are panel studies on sample survey data for individual countries. Following Cocco (2002), Flavin and Yamashita (2002), Iwaisako (2003), Matsuura and Shiraishi (2004), and others we consider the role of holdings of real assets in households' allocation of financial assets. Unlike the others, we consider the influence of housing debt on asset allocation by modeling liabilities *per se* as a factor in portfolio allocation.

We adopted a well-known portfolio allocation model developed by Sharpe and Tint (1990). This model is a modification of the traditional mean-variance model and is commonly used in asset-liability management (ALM) for pension funds since it accommodates the structure of a fund's liabilities such as future benefit obligations. Of course, in applying a pension framework to the case of households we must pay attention to certain points. For one thing, while pension funds are perpetual (as long as they are not dissolved), individuals will inevitably die, which means we must think about the bequest motive. From a macro perspective, however, households in the aggregate can also be thought of as perpetual, since they are reproduced with the birth of children, and so we can ignore the differences with pension funds and apply the same framework.

The Sharpe-Tint model has two main attractions for our purposes. First, it allows us to consider the burden of liabilities (the liability ratio) as well as risk preferences (investors' risk tolerance) in the allocation of household assets. In the typical mean-variance approach, the objective is maximizing assets and the optimal asset allocation, given risk tolerance, is determined by the efficient frontier, which reflects the risk and return of each asset. In the Sharpe-Tint model, on the other hand, the objective is to find the asset allocation that maximizes the value of the surplus of assets over liabilities.[3] The optimal allocation, given risk tolerance, is determined by the efficient frontier, which—in this

[3] In an economic, as opposed to financial, context it is useful to think of the surplus as "net worth."

case—reflects the risk and return on liabilities as well as on assets. Including assets that hedge against current liabilities affects the change in the surplus, and the portfolio's total return.

A second attraction is that the Sharpe-Tint model is as easy to estimate as the more familiar traditional asset-only allocation model. The objective of the traditional model is:

Maximize $\{\text{Expected}(R_A) - [\text{Variance}(R_A)]/t\}$

where,

R_A is return on assets
R_L is return on liabilities, and
t is risk tolerance

In comparison, the objective function of the Sharpe-Tint Model is:

Maximize $\{\text{Expected}(R_A) - [\text{Variance}(R_A)]/t + [2k\ L_0/A_0\ \text{Covariance}(R_A, R_L)]/t\ \}$

The variables are the same as above with the addition of

k, which is the degree of importance attached to liabilities, and
L_0/A_0, which is the liability ratio in the current period.

As Sharpe and Tint point out, this objective function is composed of the expected return on assets, a risk penalty, and a liability hedging credit, the term which distinguishes it from the objective function of the traditional approach. (A detailed derivation can be found in the appendix.) In words, given the model's assumptions, for any given level of risk tolerance, not only risk and return of each asset, but also the ratio of liabilities to assets (the liability ratio) and the covariance between asset and liability returns affect the optimal asset allocation[4]

Data and specification issues

To apply this model to portfolio allocation by Japanese households, we took year-end values of financial assets and liabilities from the Bank of Japan's Flow of Funds. We estimated return and risk for short-term assets based on the overnight call rate (secured); for bonds we used the Nomura-BPI Aggregate Index; for equities, the Japan Total Performance Index; and for liabilities, the long-term prime rate.[5] Risk financial assets include equities, investment derivatives, mutual funds, foreign securities, and foreign currency deposits. All other financial assets are categorized as low-risk assets.[6]

We included real as well as financial assets in the optimal allocation analysis since real assets

[4] In the results discussed below, we report correlation coefficients for assets and liabilities, rather than the covariance. The reader should note that Covariance (R_A, R_L) = $\rho_{AL}\ \sigma_A\sigma_L$ where ρ_{AL} is the correlation between assets and liabilities, σ_A is the standard deviation of R_A and σ_L the standard deviation of R_L.

[5] The reason for using the long-term prime rate is that historical data is readily available back to 1960. The results do not differ much from results using the interest rate on housing loans.

[6] It might help the reader to explain why we included bonds as low-risk financial assets. In an asset-allocation model focused on net worth, with assets separate from liabilities, bearing liabilities has the same economic value as selling long-term bonds. Households with long-term liabilities can partially offset this risk by holding long-term bonds, so bonds can be considered a low-risk asset. Details can be found in the appendix.

comprise a large portion of total assets for households, unlike for pension funds. We took land and fixed asset holdings from SNA statistics and calculated the return and risk based on the urban land price index from the Japan Real Estate Research Institute and house rent (imputed rent plus house rent income) from SNA.

The risk, return, and correlation for each asset and liability, calculated from annual data for the previous 20 years are shown in table 3 at five-year intervals starting with 1980.

Table 3. Estimates of Return, Risk, and Correlation for Japanese Households' Assets and Liabilities

		Return	Standard Deviation	Correlation				
				Short-term	Equities	Bonds	Real Assets	Liabilities
1980								
	Short-term	7.6%	2.7%	1.0	-0.6	0.8	-0.1	0.9
	Equities	12.2%	16.1%		1.0	-0.4	0.3	-0.5
	Bonds	7.2%	0.7%			1.0	-0.3	0.9
	Real Assets	18.9%	11.8%				1.0	-0.1
	Liabilities	8.5%	0.6%					1.0
1985								
	Short-term	7.3%	2.3%	1.0	-0.6	0.7	0.0	0.8
	Equities	13.2%	14.7%		1.0	-0.4	0.2	-0.5
	Bonds	7.3%	0.6%			1.0	-0.3	0.8
	Real Assets	14.2%	9.2%				1.0	-0.2
	Liabilities	8.4%	0.7%					1.0
1990								
	Short-term	6.6%	2.4%	1.0	-0.6	0.8	-0.1	0.8
	Equities	14.9%	17.9%		1.0	-0.5	0.1	-0.5
	Bonds	7.0%	1.1%			1.0	-0.3	1.0
	Real Assets	14.4%	9.2%				1.0	-0.3
	Liabilities	7.8%	1.2%					1.0
1995								
	Short-term	5.5%	2.2%	1.0	-0.1	0.9	0.4	0.9
	Equities	9.3%	16.9%		1.0	0.0	0.4	0.0
	Bonds	6.3%	1.4%			1.0	0.4	1.0
	Real Assets	8.5%	9.9%				1.0	0.4
	Liabilities	7.0%	1.6%					1.0
2000								
	Short-term	3.9%	2.7%	1.0	0.1	1.0	0.5	1.0
	Equities	8.2%	18.7%		1.0	0.2	0.4	0.1
	Bonds	5.0%	2.1%			1.0	0.4	1.0
	Real Assets	5.7%	9.9%				1.0	0.5
	Liabilities	5.5%	2.3%					1.0

Source: Aurora Database, Financial and Economic Research Center, Nomura Securities.

Real assets and equities earned a much higher return than other assets until 1990, but from 1995 their relative returns were not so high. The return on real assets fell from 18.9% in 1980 to 5.7% in 2000, with the biggest drop coming between 1990 and 1995. Returns on equities also suffered a big drop with the bursting of the bubble, from 14.9% to 9.3% between 1990 and 1995, but the change was not as great as for real assets so that in 2000 equities out-performed real assets with returns of 8.2% versus 5.7%. In addition, we should point out that the correlation between the return on real assets and the return on liabilities (the borrowing rate) was negative up to 1990 and then turned positive from 1995, when the real economy entered the prolonged post-bubble slump.

The final specification issues for estimating the model concern the parameters *t* and *k*. In another paper, Sharpe explains that t = 2/c, where c is investors' risk aversion,[7] but we cannot observe households' risk aversion or risk tolerance directly. Some of our results are based on an assumed value for *t* while others report the values of *t* implied if actual household portfolio allocations were optimal. In the Sharpe-Tint model, the parameter *k* represents the importance attached to liabilities, with 1 indicating full-surplus optimization. If the surplus represents net worth in the household context, then it seems appropriate to target full surplus optimization, and we therefore chose *k* equal to 1.

4. Estimation Results and Implications for Asset Allocation in the Next Decade

Model estimates for 1980-2000

First, table 4 reports the optimum asset allocations with risk tolerance set at 0.5 along with the actual asset allocations of Japanese households.[8] Until 1990, the optimal allocation called for households to put an even larger share of their portfolios in real assets than they actually did. Also, household allocations to low-risk assets were much higher than optimal. On the other hand, from 1995, households actually allocated a larger share to real assets than was optimal according to the model. For 2000, the optimal allocation was to hold 23% in risky financial assets and 75% in low-risk assets with only 2% in real assets, while, in fact, households allocated 47% of their portfolios to real assets. So, given our assumptions, the model suggests that Japanese households over-invested in low-risk assets during the 1980s and over-invested in real assets after the bubble burst.

Table 4. Household Asset Allocation, Assuming Constant Risk Tolerance

	Liability Ratio	Risk Tolerance	Asset Allocation					
			Real Assets		Risk Financial Assets		Low-risk Financial Assets	
			Model Result	Actual	Model Result	Actual	Model Result	Actual
1980	13.5%	0.50	100%	63%	0%	5%	0%	32%
1985	13.8%	0.50	86%	57%	14%	8%	0%	35%
1990	12.5%	0.50	79%	63%	21%	8%	0%	30%
1995	15.5%	0.50	48%	52%	17%	7%	35%	41%
2000	15.6%	0.50	2%	47%	23%	7%	75%	47%

Note: Risk financial assets include equities, investment derivatives mutual funds, foreign securities, and foreign currency deposits. All other financial assets are included as low-risk assets.
Source: Actual asset amounts from Bank of Japan and SNA statistics. Calculation by Financial and Economic Research Center, Nomura Securities.

The finding of higher-than-optimal allocations to real assets in 1995 and 2000 in table 4 is consistent with the argument in section 2 that it was difficult for Japanese households to adjust real asset holdings in response to their drastic change in performance after 1990. Illiquidity of the housing market

[7] http://www.stanford.edu/~wfsharpe/mia/rr/mia_rr2.htm.
[8] We assumed 0.5 as the fixed value for risk tolerance because we understand it indicates risk neutrality.

suggests that the portion of household portfolios allocated to real assets is somewhat fixed. At the same time, holding on to poorly performing assets entails taking on a higher level of risk. For Japanese households, then, the interesting questions are: how did they allocate the remaining portion of their portfolios between risky and low-risk financial assets given their allocation to real assets, and what do their actual holdings imply about the level of risk they will tolerate? To answer these questions, we re-estimated the model based on actual holdings of real assets.

Table 5 reports the model allocations after fixing the allocation to real assets at the actual level and the corresponding level of risk tolerance implied if the actual allocation were optimal.[9] In 1980 and 1985, households' actual allocation of financial assets was close to optimal. Households' large allocation to real assets is optimal with a relatively low level of risk tolerance, with the implied t only 0.16, given the returns on assets and liabilities and the liability ratio in these years. During this period, real assets were performing better than financial assets—giving rise to the saying "if you own land you will get rich" and to the Myth of Ever Rising Land Prices.

Table 5. Household Asset Allocation Based on Actual Holdings of Real Assets

	Liability Ratio	Risk Tolerance	Asset Allocation					
			Real Assets		Risk Financial Assets		Low-risk Financial Assets	
			Model Result	Actual	Model Result	Actual	Model Result	Actual
1980	13.5%	0.16	63%	63%	4%	5%	33%	32%
1985	13.8%	0.16	57%	57%	16%	8%	27%	35%
1990	12.5%	3.20	63%	63%	37%	8%	0%	30%
1995	15.5%	2.18	52%	52%	48%	7%	0%	41%
2000	15.6%	1.70	19%	47%	77%	7%	4%	47%

Note: Risk financial assets include equities, investment derivatives mutual funds, foreign securities, and foreign currency deposits. All other financial assets are included as low-risk assets. Due to the poor relative performance of real assets for the year 2000, the model generates the maximum allocation to real assets, 19%, when risk tolerance is 1.70. Raising risk tolerance above 1.70 results in greater allocation to equities and less to real assets.
Source: Actual asset amounts from Bank of Japan and SNA statistics. Calculation by Financial and Economic Research Center, Nomura Securities.

In 1990, the liability ratio fell to 12.5% from 13.8% in 1985 as assets continued to appreciate. The model suggests that household could optimally maintain relatively high allocations to real assets, given the good performance of real and financial assets, by accepting greater risk, with the implicit t rising to 3.20. At this level of risk tolerance, though, they should have allocated more to risk financial assets and less to low-risk financial assets.

In the aftermath of the bubble, in 1995 and 2000 households faced a different market situation. The

[9] At the Tokyo Club Foundation for Global Studies conference, Catherine Mann suggested thinking of this as a "derived" risk tolerance.

liability ratio climbed over 15% as the value of real and financial assets plummeted. At the same time, although returns on real assets had fallen by 40% or more, households did not adjust their allocation to real assets in proportion to the change in performance. Implicitly they had to accept a higher level of risk as a consequence of their "sticky" real asset holdings.

The results for 1995 can be understood readily in these terms. The implied level of risk tolerance to make the actual 52% allocation to real assets optimal was relatively at high 2.18. Again, at this level of risk tolerance, households should have taken on more risk financial assets as well.

The results for 2000 are more difficult to interpret. As table 5 shows, although households had adjusted their real asset allocation down to 47%, the model called for only 19%. In fact, given the liability ratio and returns for 2000, there was no level of risk tolerance at which the model would allocate 47% to real assets. We reported the 19% result, with implied risk tolerance of 1.7, because that was the maximum the model could generate; any higher level for risk tolerance resulted in a smaller allocation to real assets and more to risk financial assets. Perhaps we can understand that having to hold over twice that share in real assets (i.e., 47%) forced households to tolerate a very high level of risk. The rigidity in the housing market and the extreme change in market conditions seem to have stretched the model to its limit.

In any case, our results suggest that Japanese households are not really "risk averse" if we think in terms of real and financial assets together. Another result from this analysis is to show that there is an inverse relationship between the implied risk tolerance and the liability ratio. This is illustrated in table 6, which shows the results of estimating the model based on actual real asset holdings and varying only the liability ratio, (i.e., holding all returns and the level of utility constant). Other things equal, as the liability ratio falls, the implied level of risk tolerance increases. The table also shows that as the liability ratio falls, the optimal allocation toward risk financial assets increases. In other words, the level of risk that households tolerate in their financial asset allocations is conditional on the burden of their liabilities; as the burden lightens, the ability to tolerate risk rises. This implies, for example, that households with lower liability ratios should allocate a greater portion of their portfolios to risk financial assets.

Table 6. Relationship between the Liability Ratio and Risk Tolerance

Liability Ratio	Risk Tolerance	Financial Asset Allocation	
		Risk Assets	Low-risk Assets
0%	1.79	100%	0%
5%	1.76	98%	2%
10%	1.73	97%	3%
15%	1.70	95%	5%
20%	1.68	93%	7%
25%	1.65	92%	8%
30%	1.62	90%	10%
35%	1.60	89%	11%
40%	1.58	88%	12%
45%	1.55	86%	14%
50%	1.52	85%	15%

Note: Calculation based on the model using 2000 data.
Source: The liability ratio from the National Survey of Family Income and Expenditure, Ministry of Internal Affairs and Communications, 2000. Calculation by Financial and Economic Research Center, Nomura Securities.

To conclude the discussion of the model results we need to mention the hedging credit, which is the special characteristic of the Sharpe-Tint model. Interestingly, despite the low returns on real assets after the bubble, their attraction as a hedge against financial risk increased, because of the positive correlation between falling interest rates and falling asset returns observed in table 3. Overall, however, the dismal return on real assets far outweighed this attraction and accommodating the risk inherent in their existing holdings of real assets required households to tolerate a high level of risk.

Prospects for asset allocation

Finally, we would like to understand how future demographic changes in Japan might affect households' asset allocation, particularly to risky financial assets. It is common to think that households should shift toward holding more safe assets after retirement, since their regular income is limited. But in Japan, households with heads in the 50-60 age bracket hold almost twice the share of risk financial assets as households with heads in their 30s and 40s (National Family Income and Expenditure Survey). We can understand this age pattern in terms of the age distribution of housing loans and what the model suggests about the relationship between housing loan status and financial asset allocation, which follows from the inverse relationship between the liability ratio and allocation to risk financial assets (table 6).

Table 7 gives the liability ratio for home-owning households that have a housing loan and those which do not, based on sample survey data. The table also gives the optimal financial asset allocation estimated for the two categories of homeowners based on these liability ratios and other data for 2000. Homeowners with housing loans have both lower risk tolerance and a smaller allocation to risky financial assets than homeowners that do not have housing loans.

Table 7. Relationship between Housing Loan Status and Allocation to Risky Financial Assets

Owner households:	Liability Ratio	Risk Tolerance	Financial Assets Allocation	
			Risk Assets	Low-risk Assets
Without housing loan	0%	1.79	100%	0%
With housing loan	30%	1.62	90%	10%

Note: Calculation based on the model using 2000 data.
Source: The liability ratio from the National Survey of Family Income and Expenditure, Ministry of Internal Affairs and Communications, 2000. Calculation by Financial and Economic Research Center, Nomura Securities.

Putting this result together with the fact that Japanese families typically purchase a home when the heads are in their 30s or 40s and aim to payoff the loan by the time the heads reach the age of compulsory retirement explains the age pattern of risky financial asset holdings in Japan. Housing loan liabilities prevent younger households from holding financial risk assets and the decline in liability ratios as households in older age brackets repay their loans means that they can allocate more to risky financial assets.

Table 8 shows the optimal allocations generated by the model using the average liability ratio by age bracket of households from survey data. As the liability ratio falls with age (due to repayment of housing loans), the allocation to risky financial assets increases from 91% for households with heads in their 30s to 98% for households in their 60s.

Table 8. Relationship between Age of Household Head and Household Asset Allocation

Householder's Age	Liability Ratio	Risk Tolerance	Financial Assets Allocation	
			Risk Assets	Low-risk Assets
30-39	27%	1.64	91%	9%
40-49	20%	1.68	94%	6%
50-59	10%	1.73	97%	3%
60-69	4%	1.76	98%	2%

Note: The calculation is based on the model using 2000 data.
Source: The liability ratio is from the National Survey of Family Income and Expenditure, Ministry of Internal Affairs and Communications, 2000. Calculation by Financial and Economic Research Center, Nomura Securities.

Table 9 summarizes the calculation of the projected change in risk financial assets that might result from this reallocation of Japan's household assets as the population ages. Column A shows total financial assets per household in 2000 by age of the household head. Population aging means that

the number of households in the older age brackets will increase relative to the number in younger age brackets. Specifically, for example, those households in the 30-39 age bracket in 2000 will be counted in the 40-49 age bracket in 2010. Using this fact and the results of the optimal allocation of risk financial assets from table 8, we calculated the percentage point change in risk financial assets as a share of total financial assets as the households in each age bracket move up one level from 2000 to 2010 (column B).

Table 9. Projected Change in Risk Financial Assets by 2010

Age of Household Head	Financial Assets per Household in 2000	Difference in Risk Financial Assets as % of Total Financial Assets	Change in Risk Financial Assets per Household	Number of Households in 2010	Total Change in Risk Financial Assets
	(A)	(B)	(C = A * B)	(D)	(E = C * D)
	(\ thousands)	(%)	(\ thousands)	(thousands)	(\ millions)
under 30	3,651	N.A.	N.A.	4,426	N.A.
30-39	7,072	-1.1	-76	7,662	-582,558
40-49	11,083	2.3	255	8,522	2,174,664
50-59	16,183	2.9	465	8,527	3,964,770
60-69	21,894	1.4	312	9,734	3,041,508
over 70	22,229	1.0	216	10,272	2,220,038
				Total	10,818,422

Note: Risk asset holdings as a percent of total assets by age bracket in 2000 calculated from 1) the liability ratio by age of household head from the MIC survey and 2) model estimates of risk assets as a percent of total assets by liability ratio. Column B shows the difference in this ratio from 2000 to 2010 assuming each age group advances to the next age group in 2010. The number of households in 2010 (Column D) is from estimates by the National Institute of Population and Social Security Research. Coverage of the MIC survey is 47% of BOJ Flow of Funds data coverage.
Source: Data from Ministry of Internal Affairs and Communications (MIC) and National Institute of Population and Social Security Research. Calculation by Financial and Economic Research Center, Nomura Securities.

Multiplying column B by column A gives the change in risk financial assets per household between 2000 and 2010 for each age bracket. Then, multiplying by the projected number of households in each age bracket in 2010 (column D) gives the projected change in risk financial assets by age category. Finally, summing over all households, we find 11 trillion yen additional funds going to risk financial assets in the year 2010. Further, adjusting for the 47% difference in coverage between the sample data used for this calculation and the BOJ Flow of Funds suggests that additional holdings of risk financial assets in 2010 could amount to on the order of 23 trillion yen. This means that aging alone could create additional funds flow equivalent to roughly 5% of the current market capitalization of the Tokyo Stock Exchange.

Of course, this is a rough calculation and does not show to which type of assets such funds would flow. Nor does it reflect the influence of declining population on different categories of asset returns. Nevertheless, the lighter debt burden from housing loans, and the falling liability ratio, that should accompany population aging can be expected to result in a reallocation of household portfolios toward more risk assets, and a potentially significant increase in the flow of funds from the household sector to

risk financial assets.

5. Conclusion

Our portfolio allocation model suggested that given their actual holdings of real assets, Japanese households did tolerate a high level of risk during the last decade, albeit in the form of real rather than financial assets. If we accept the relative illiquidity of housing assets in Japan, the burden of housing loans and the severe decline in the value of real assets in Japan since the 1990s meant that Japanese households had little room to take on risk financial assets.

Similarly, the keys to thinking about future asset allocation by Japanese households are risk tolerance, the return on assets (and the correlation with other assets and with liabilities), and the liability ratio. Since household risk tolerance is already at a high level in Japan today, it looks difficult to raise it further in the future without a change in the other variables. Moreover, since we cannot observe risk tolerance we cannot guess how it will change. If anything, to speculate on future household asset allocation we have to focus on changes in asset returns and liability ratios.

For example, if real assets appreciate, their relative return will improve compared to other assets, and households could increase their allocation to real assets under the same level of risk tolerance. In addition, households could increase their risk tolerance with appreciating real assets, because the higher asset value in the denominator would lower the liability ratio. Moreover, there are two reasons to expect the liability ratio to decline: because of repayments by households currently having loans and because the aggregate amount of housing loans will decrease. We expect housing loans in aggregate to fall, first, because demographic change will mean fewer people in the prime house-buying age group and, second, because a decade-long decline has brought the ratio of house prices to disposable income to its lowest level in 30 years. As a result, some households are able to purchase a house without incurring the liability of a housing loan and these households thus have room to raise their risk tolerance. In this way, movements in the real estate market will become an important factor in household asset allocation in the future.

Those who think that population aging will bring about a decline in the savings rate expect holdings of risk assets to decrease as a result. For Japanese households, however, this is not necessarily the case. From now, falling liability ratios and changes in asset returns are likely to have a significant impact on household asset allocation.

References

Bodie, Zvi, and Robert Merton. 1999. *Finance.* New York: Prentice-Hall, Inc.

Bosworth, Barry P., Ralph C. Bryant, and Gary Burtless. 2004. *The Impact of Aging on Financial Markets and the Economy: A Survey.*
www.brookings.edu.dybdocroot/views/papers/20040722survey.pdf

Cabinet Office. 2005. Economic and Fiscal White Paper (in Japanese). Government of Japan.

Chinn, Menzie, and Eswar Prasad. 2003. Medium-term Determinants of Current Accounts in Industrial and Developing Countries: An Empirical Exploration. *Journal of International Economics* 59(1) January. Also NBER Working Paper No. 7581 (March 2000).

Cocco, Joao F. 2000 Portfolio Choice in the Presence of Housing. Forthcoming *Review of Financial Studies*, 18(2) 2004.

Flavin, Marjorie, and Takashi Yamashita 2002. Owner-occupied Housing and the Composition of the Household Portfolio. *American Economic Review*. March.

Higgins, Matthew. 1998. Demography, National Savings, and International Capital Flows. *International Economic Review*. 39, May.

Horioka, Charles Yuji. 2004. Dankaisedai no Taisyoku to Nihon no Kakei Cyochikuritsu. Ministry of Education, Culture, Sports, Science, and Technology (MEXT) Discussion Paper No. 38.

International Monetary Fund. 2005. *Global Financial Stability Report.* April.
http://www.imf.org/External/Pubs/FT/GFSR/2005/01/index.htm.

Iwaisako, Tokuo. 2003. Household Portfolios in Japan. NBER Working Paper No. 9647.

Matsuura, Katsumi and Shiraishi, Sayuri. 2003. Jyuutaku, Tochi to Kinnyuusisan no Sougokankei. JCER Discussion Paper No. 87.

_____ 2004. *Shisansentaku to Nihon Keizai*. Tokyo: Toyo Keizai.

Nakagawa, Shinobu and Katagiri, Tomoko. 1999. Nihon no Kakei no Kinyusisan Sentakukoudou. Bank of Japan *Research Monthly Report*. November.

OECD. 2005. *Economic Outlook* No.77. June.

_____*Economic Outlook* No.78. December

Pelizzon, Loriana, and Guglielmo Weber. 2002. Are Italian Household Portfolios Efficient? An Analysis Conditional on Housing.
http://www.efmaefm.org/AcceptedPapers2003/PelizzonLoriana_WeberGuglielmo/PelizzonLoriana_WeberGuglielmo_abstract.pdf

Sharpe, William F., and Lawrence G. Tint. 1990. Liabilities– New Approach. *Journal of Portfolio Management*, Winter.

Appendix on the Derivation of the Sharpe-Tint Model

Sharp and Tint begin with the notion of the surplus, which is the difference between assets, A, and a factor, k, times liabilities, L.

$$S = A - k\,L$$

The factor k can range between 0 and 1 and represents the importance the decision maker attaches to liabilities. With k = 1, full weight is put on liabilities and S is the traditional notion of surplus A – L. With k = 0, meaning no importance is attached to liabilities, S = A, and the model is identical to the simple asset allocation model.

The decision maker is interested in allocating the assets he holds today to maximize next period's surplus. Following traditional practice, next period's surplus can be expressed relative to the initial asset value. Using subscripts 0 for the initial period and 1 for the next period, and indicating unknown quantities in italics, the decision maker is interested in

$$S_1 = A_1/A_0 - k\,L_1/A_0.$$

The rate of return on assets, R_A, is $A_1/A_0 - 1$. Similarly, R_L the growth rate or rate of return on liabilities, is $L_1/L_0 - 1$. Given these relationships, Sharpe and Tint express next period's surplus in terms of returns

$$S_1 = 1 + R_A - k\,L_0/A_0\,(1 + R_L)$$

or

$$= [1 - k\,L_0/A_0] + [R_A - k\,L_0/A_0\,R_L].$$

They note that since the first bracketed term involves only predetermined quantities, it cannot be affected by how the portfolio is allocated and so it can be ignored. That leaves only the second term $[R_A - k\,L_0/A_0\,R_L]$ subject to the allocation decision. In other words, how the portfolio is allocated affects the surplus through the return on assets and the return on liabilities weighted by the importance of the liabilities to the decision maker and the initial value of the liabilities relative to assets.

In the mean-variance model framework, if *t* represents the decision maker's risk tolerance, optimizing the surplus means the decision maker chooses the asset mix that maximizes utility, or

$$U = \text{Expected}(R_A - k\,L_0/A_0\,R_L) - [\text{Variance}(R_A - k\,L_0/A_0\,R_L)]/t.$$

or

$$U = \text{Expected}(R_A) - k\,L_0/A_0\,\text{Expected}(R_L) - [\text{Variance}(R_A - k\,L_0/A_0\,R_L)]/t.$$

Again, noting that asset allocation decisions affect only Expected(*R*A) and not $k\,L_0/A_0$, Expected(R_L), simplifies the surplus optimization to maximizing

$$\text{Expected}(R_A) - [\text{Variance}(R_A - k\,L_0/A_0\,R_L)]/t.$$

This expression can be rewritten as

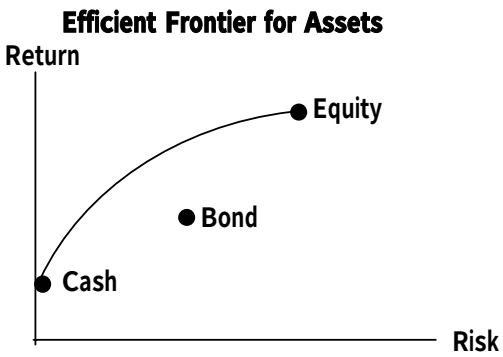
$$\text{Expected}(R_A) - [\text{Variance}(R_A) - 2k\,L_0/A_0\,\text{Covariance}(R_A, R_L) + k^2L_0^2/A_0^2\,\text{Variance}(R_L)]/t.$$

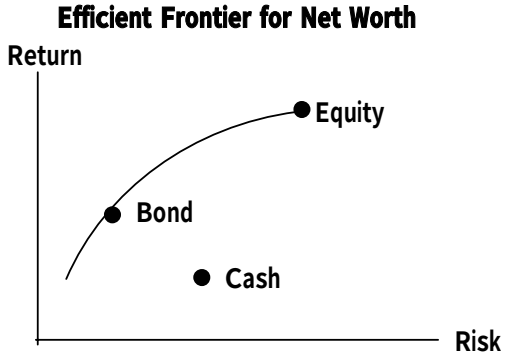
Once more, since the decision maker's asset allocation choice does not affect the return on liabilities, R_L, the last term can be ignored, making the objective of surplus optimization to

$$\text{Maximize Expected}(R_A) - [\text{Variance}(R_A)]/t + [2k\,L_0/A_0\,\text{Covariance}(R_A, R_L)]/t.$$

Appendix on Risk and Low-Risk Financial Assets

In an asset-allocation model focused on net worth, with assets separate from liabilities, bearing liabilities has the same economic value as selling long-term bonds. Households with long-term liabilities can partially offset this risk by holding long-term bonds, so bonds can be considered a low-risk asset.





Note that this does not address the issue of how to measure risk, but it suggests that we also need to think about what factors to consider when we classify assets as high- or low-risk.