Macroeconomic Impacts of Aging in Japan on the Balance of Current Accounts

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Abstract

This paper investigates questions regarding the saving rates by age brackets and aggregate savings, and then conducts a simulation analysis of the current account, from the I-S balances of households, corporations and the government.

Saving rates of the old (65 years old and above) with publicly available data are high because of a selection bias in household head, that excludes the old living with younger family members and being non-head of the household. The paper estimates the true saving rates by age brackets rather than of household head's age brackets with taking the non-head households' member into account. Estimated saving rates of the old are still positive (about 10% to 20% which are less than those of the young) even after adjusting for the bias. The impact of aging on the aggregate saving rates will not be large if the future old people continue to save as the current old people.

We forecast the current account in several scenarios, using data of demographic changes, the estimated aggregate saving rates, and the estimated interest payments of government bonds. It is of our particular interest whether the current account will turn to be negative by the rapid demographic change. It is found that the IS balances would remain positive under a condition that the government bond issues would be constrained by fiscal sustainability.

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1. Introduction

As the birth rate declines and the average life expectancy increases, the ratio of the retired (age 65 and older) to the productive (ages between 15-64), is increasing in most advanced countries and some emerging market economies. This is commonly known as aging of the society. The speed of aging in Japan is particularly high. In 2000, about five productive age people support one retired, but by 2025, only two productive people will be supporting one retired, and by 2050 the ratio become 70 percent.

Aging is expected to have profound impacts on various microeconomic institutions and overall macroeconomic activities. To name a few, the aggregate saving rate will be affected, the pension system will be adversely affected, the long-term care and welfare system has to change, the potential growth rate will be affected, and the current account will be affected.

It is straight-forward to show that aging makes it extremely difficult to maintain a pay-as-you-go pension system. As the ratio of the number of pension receivers to the number of pension premium paying workers increases, changes have to happen in the benefit level, a premium amount, broadening premium paying base, increasing the age to qualify pensions, or some combinations of the above. Foreseeing this possibility, surpluses in the social security account have been built up in the past, but the current surpluses are expected to vanish in the next fifteen to twenty years, even though the qualifying age is scheduled to be raised in steps.

The growth potential will be lowered as less labor input is expected. When the population of working age starts to decline, contribution of labor input from the number of employees to economic growth turns negative. Hours per worker will decline too, contributing to further decline. Unless, the labor productivity increases dramatically, overall labor contribution to growth will soon turn negative. Then, unless capital accumulation accelerates and total factor productivity increases more than before, the potential growth rate will decline. The impact of absence of growth does not only lower standard of living, but also create macroeconomic difficulties. The decline in growth rate will make it more difficult to grow out of fiscal debt, which has become the worst among the G7.

The life cycle theory predicts that lower population growth rate tends to lower the aggregate household saving rate. In a typical life cycle model, working population is assumed to save for their retirement. The population ratio of retired to workers becomes higher, then the aggregate saving rate will decline. With a lower net saving of household, the national saving-investment balance will shift, provided that the corporate and government sectors will not change their saving-investment balance. The large current

account surpluses that Japan has been recording in the past decades may soon disappear due to aging. If that happens, it will have an impact on the global financial and capital flows.

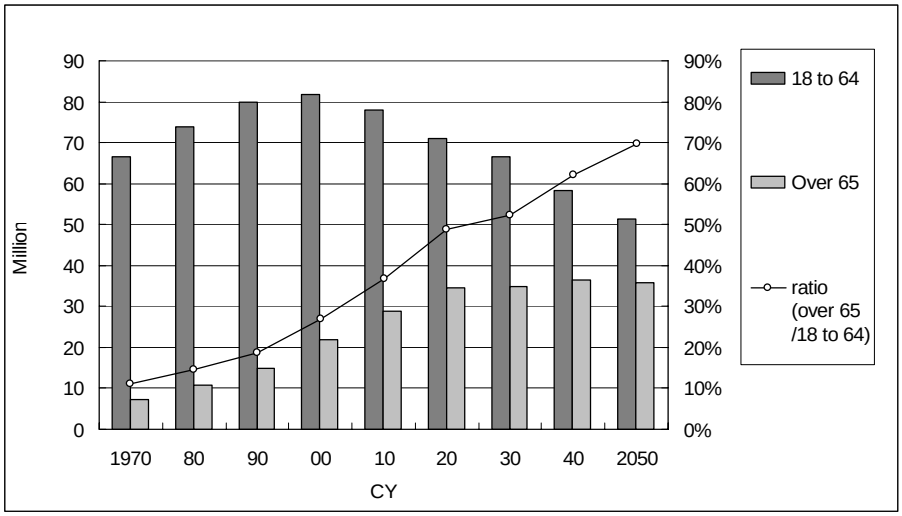
This paper will examine macroeconomic issues associated with aging population in Japan. We will attempt to answer the following questions regarding the macroeconomic impact of aging: (1) Will aging necessarily lower the household saving rate?; (2) Will aging necessarily lower the size of current account surpluses (or turn them negative)?

2. Household Saving Rate

2.1 Impacts of Population Aging

Japan is going to face the rapid population aging. One important implication of low saving rates of the older is that it could lead to the low aggregate savings due to the population aging. Figure 1 shows the number of the old (over 65) and that of the young (defined as the population of 18 to 64), and their ratio estimated by National Institute of Population and Social Security Research (NIPSSR). As shown in the figure, the number of the young has been declining since 2000, the number of the old will almost double between 1990 and 2020, and the ratio of the old to the young will be 70% in 2050.

Figure 1 Number of population, and ratio of over 65



Source: National Institute of Population and Social Security Research (2002)

Note: The scale of population is on the left axis, and the scale of ratio is on the right axis. The ratio = (population of over 65 or more) / (population of 18 to 64), including both male and female.

2.2 Savings and Three Statistical Data

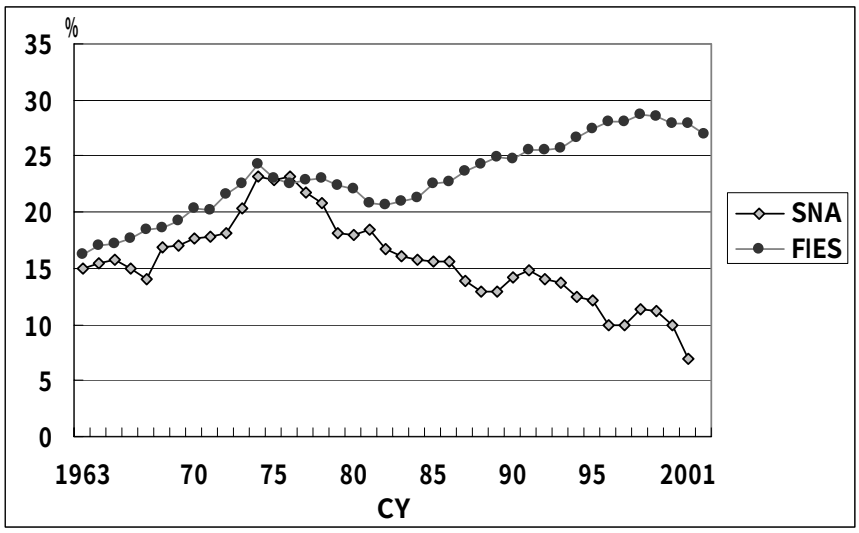
Traditionally, there are three different statistical data sources to infer household consumption-saving behavior: (1) the Family Income and Expenditure Survey (FIES), the Ministry of Public Management, (2) the National Survey of Family Income and Expenditure (NSFIE), the Ministry of Public Management, and (3) SNA, have data of household saving rates. Since methods of sampling households, and methods to estimate disposal income and consumption are different, the household behavior shown by these three different data sources bring different results.

The Ministry of Public Management publishes both the FIES and the NSFIE. Both are based on surveys of households. The NSFIE is conducted infrequently but covers larger samples with detailed information. The NSFIE survey is based on household expenditures and income of 60 thousand households in September, October, and November of every 5 years. The FIES survey is conducted frequently—every month—with much smaller samples—8 thousand households (9 thousand households after 2002).

There are other differences between the NSFIE and FIES. One-person households are included in the NSFIE survey, but not in the FIES survey before 2002. The NSFIE has data of income taxes and social insurance premium payments, that are relevant in estimating correctly household saving rates with disposable income.

The FIES or NSFIE, and SNA show quite different movements of saving rates. Figure 2 illustrates the saving rates of the FIES and SNA. The SNA saving rate has been declining since 1975. On the other hand, the FIES saving rate has an upward trend after 1980. The reasons of such a difference is that the FIES does not include the imputed values of owner-occupied housing rents, public expenses such as social insurances and education, and one-person households. On the other hand, FIES includes the transfers such as allowances and donation. (see Ueda and Ohno (1993) in detail.)

Figure 2 Saving Rates, SNA and FIES



Note: Saving rates are defines as the ratios of savings (net) over disposal income (net) in SNA. Those in FIES are the ratios of (disposal income – consumption expenditure) over disposal income of worker's households.

2.3 Estimation of Saving Rates

The FIES and the NSFIE have disadvantages, for example, in capturing the costs of house rents, the effects of credit cards. However, data in these statistics have detail figures of the ages and types of employment. We cannot analyze the saving rates of the different ages with SNA. We use the NSFIE rather than the FIES, since it has an advantage of larger samples and has data of one-person households.

The saving rates based on the NSFIE are estimated following Takayama *et. al.* (1989), Hayashi (1997), and Higo (2001). The basic definition is,

$$\textit{saving rates} = \frac{\textit{disposal income}^* - \textit{living expenditure}^*}{\textit{disposal income}^*}$$

where * indicates that the variables are estimated, and

$$\textit{disposal income}^* = \textit{annual income} - \textit{income tax}^* - \textit{social insurance}^* - \textit{other non-living expenditure}^*$$

The data of the income tax and the social insurance are monthly base, so we need to transform them into the annual base by multiplying by twelve. Note, the direct income tax levies on bonuses so that it is estimates as,

$$\textit{direct income tax}^* = \textit{annual income} \times \frac{\textit{direct income tax(per month)}}{\textit{income(per month)}} \quad .$$

The expenditures also need to be transferred to the annual bases. Expenditures has usually seasonality, thus the multiplier is not twelve but by estimated values so that

$$\textit{annual expenditure*} = \textit{estimated multiplier*} \times \textit{expenditure(per month)} \ .$$

Expenditures of the NSFIE are the value of average monthly expenditures only during three months from September to November for two or more person households. For the one person household, the data is the value of average monthly expenditure during two months of October and November. Since the household expenditures usually show seasonality, simple multiplying by twelve is not appropriate as annual expenditure.

To solve this problem, the researches of the existing studies multiply the three-month expenditures by the factor estimated from the ten-year averages of the three months (September, October, and November) of the FIES, which has monthly data. We follow this method. The ten-year averages are from 1991 to 2000 for 1999, from 1986 to 1995 for 1994, and from 1981 to 1990 for NSFIE 1989. The estimated multipliers are generally more than 12.5 and less than 13, for example, that of the workers' expenditure is 12.79.

Even after calculating disposal income and living expenditure, there still exist some problems for estimating a future trend of saving rates. First one is that the data used here are categorized according to the ages of household's head, not to the ages of individual family members. Second one is that the accurate saving rates of older cannot be estimated because many of them are absorbed in the households of other heads. The previous researches do not give figures of age brackets, but we estimate the saving rates of age brackets (not households' heads) in the following sections.

2.4 Saving Rates of the Retired

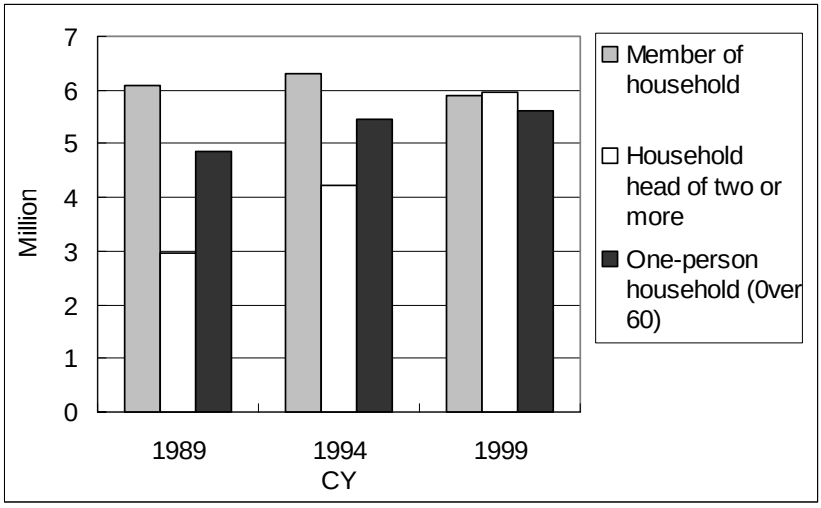
The life cycle theory (without bequest motive) predicts that the retired people will run down their asset, so that their saving rate (saving/current flow of income) is most likely negative. However, according to the statistics (the National Survey of Family Income and Expenditure) the households headed by older people (65 and older) show the positive saving rate, and the level is sometimes even higher than the young. There are two well-known reasons for this apparent anomaly. First, the statistical sampling picks up biased samples of retired people as a household headed by older people. Those who remain as household head, when they retire, are relatively high income people. They may continue working after age 65, and continue to accumulate their assets. Those who have little asset and zero working income may be absorbed into the son's and daughter's household, losing the status of household head. Therefore the saving rate of the retired

people as a generation needs to be calculated with some assumptions on the saving behavior or retired who are not household heads. Second, even if the bias is adjusted, the positive saving rate may be true for the retired generation. This may be explained by several factors. They may leave intended and unintended bequests. Intended bequests may come from altruistic or dynastic motive. Unintended bequests may come from uncertainty on the timing of death. They may also use up saving in the last few months of life for hospitalization and expensive medical care. The health care of the few months before death may not be captured by household saving surveys.

The older age people are divided into the four categories of household status, (1) head of one-male household, (2) head of one-female household, (3) head of household with two or more, and (4) not a head but a member of household. Each is divided into two categories, (1) employed and (2) unemployed. As found in the preceding section, the behavior of the old age is different depending in the types of household.

The choice of these household statuses is most likely endogenous. Wealthier and working old people tend to maintain an independent household, while those with less wealth and income tend to be absorbed in the son's or daughter's household. Actually 89% of the non-head older, who are members of the workers' households, are unemployed and 79% of the member of non-workers' households in 1999, and 87% and 84% respectively in 1994.

Figure 3 Number of over 65 years



Note: Number of household heads is distribution of households multiplying by forty. The number of over 65 members is induced by number of under 65 times 65 over or more

To find the average saving rates of old people, we need to estimate the savings rates of old people in different categories of household separately. To find accurately the living expenditure of the older member of a household headed by the young is almost impossible from the NSFIE which has some data of the behavior of the older. Some researches, such as Hayashi (1986), Yashiro and Maeda (1994), Nakagawa and Sugou (2000) take this problem into account. Hayashi (1986) derive the old ages' income by taking the difference of income or expenditure between households which have the old ages and which have not. Nakagawa and Sugo (2000) derived the saving rates of the old ages, using micro (individual entry) data of the 1994 NSFIE.

It is desirable to use micro data but it is not publicly available. Hence we develop another method to derive the saving rates of ages, using the ratio of over 65 of household which is available in NSFIE of 1989 and after.

First, we make an assumption of the income of old people (age 65 and older). Since the ratio of public pension to total income of non-workers' in FIES are about 80%, 1/8=1.25 is used for a blow-up factor. The assumed income of over 65 members are the average of public pension benefits of over 65 heads household multiplied by 1.25. Then, the income per household of each age bracket's can be given as multiplying this by the over 65 ratio. This method can be justified because most of the non-head older are unemployed. Their source of income is limited just to something like the public pensions. The estimated income of the older who are members of households is about 1.53 million yen in 1999.

The expenditure from disposable income of over 65 members per household is simply assumed as the same ratio as the number of over 65 in household. For example, the ratio over 65 in the household headed by 40-44 age old in 1999 is 0.28, and the average expenditure is 43 million yen, the expenditure per household of over 65 is estimated as 12 million yen (= 0.28 × 43 million yen). Results of other age brackets are presented below in detail. A first glance at them reveals that the saving rates of the old is about 20% or less[1].

2.5 Estimation of Saving Rates: Age Brackets

Next, we investigates the saving rates of other ages. The NSFIE's categories are based on the household heads' ages. Hence we need to estimate the saving rates not by heads but by ages. We have five different types of person in an age bracket. Those are heads of one-person households (of employers or non-employers), heads of two-or-more

[1] Note, Nakagawa and Sugou (2000) obtains the rate of about 12% (older than 60 years old).

households (of employers or non-employers), and other than heads. Population of an age bracket is equal to the number of total heads plus total members of households. Hence, the total number of an age bracket other than heads is by definition,

Members other than heads of households =

Age population − Heads of one-person households and of two-or-more households.

Once we get the number of ages in each household, then we have to consider the allocation problem of income. The income of the old has been already described above, so that the income of non-head members other than the old is considered here. There are two distinguished problems. The first problem is how to treat the income of ages under 18 who have usually no income but consume. The second one is how to determine the rate of allocation to non-head members. We investigate two cases in each problem.

For the problem of ages under 18, we assume two cases. One case is that the other elder ages take burdens of their consumption expenditure according to where ages under 18 belong. Hence the households who have children of ages below 18 have extra expenditures to support the ages under 18. Another case is not to make such assumption, but assume the ages under 18 take some income from their heads.

For the problem of allocation, one case is to assume different allocation ratios so that a head takes a biggest ratio of income, a spouse takes second biggest, and others take smallest ratios. The allocation ratio of income for a spouse[2] is one times one over the total number of members in a household, and ratios for others are 0.5 times the number of others over the total number of members. The head takes the rest of income.

The NSFIE has average numbers of ages under 18 and ages older than or equal to 65 in a household. The NSFIE has information on the number of family members under age 18, and that of over 65 in a household. The information on age of household head is also available. Hence, we can find four categories of ages in a household: (a) an age of household head; (b) under 18, (c) over 65, and (d) other ages. The number of other ages can be derived by subtracting (1)-(3) from the total number of a household.

Suppose the number of a household is n, the number of others (18-64 years old) is $n^{18\text{-}64}$ and the household's income is m, then a spouse will take,

$$\frac{m}{n}$$

Others (18-64 years old) except a husband or a wife will take

[2] Mostly, the number of others (18-64 years old) is 1 to 1.8.

$$\frac{0.5m(n^{18\text{-}64}-1)}{n}.$$

We aggregate all others' (18-64 years old) income and allocate this aggregate income to each age bracket using the ratio of one-person household's pattern of income level across age brackets.

Another case is just to allocate income proportionally to the number in a household. Each member takes same income per person.

In both cases, each member consumes an amount in proportion to its average number in a household.

The estimated results are shown in Figure 4 to Figure 7. First two figures show the results of saving rates in which the income allocation is adjusted depending on their character. Next two figures show the saving rates of equal income allocation. Figure 4 and Figure 6 shows the result of adjustments of ages under 18. Figure 5 and Figure 7 show the rates of no adjustments under 18. The rates under 18 in them are the implied rates from macroeconomic resource restriction so that the saving rates of all are same in both cases.

All figures show that the saving rates are higher in their middle ages and lower in younger ages and old ages. The Saving rates over 60 are still not negative.

Basically, the saving rates are higher in 1999 than in 1994, and higher in 1994 than in 1989. However the ages over 60, the trend is quite different. Their saving rates show no apparent difference across years.

Figure 4 Saving rates: Allocation adjusted, and ages under 18 adjusted

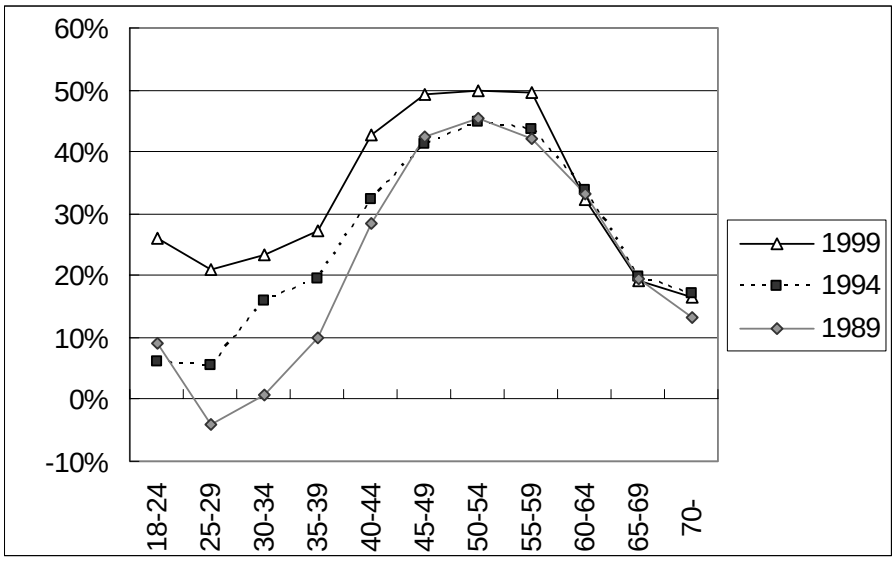


Figure 5 Saving rates: Allocation adjusted, and ages under 18 not adjusted

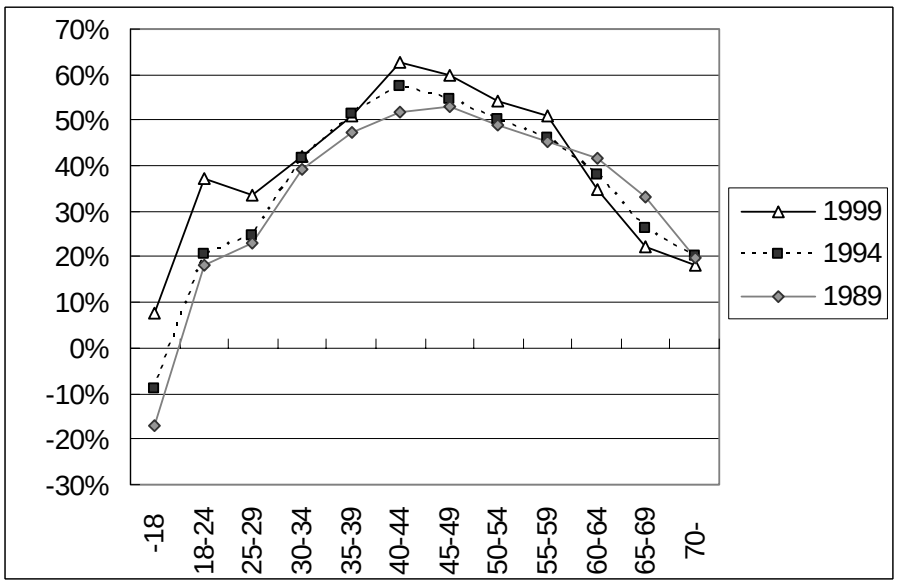


Figure 6 Saving rates: Allocation not adjusted, and ages under 18 adjusted

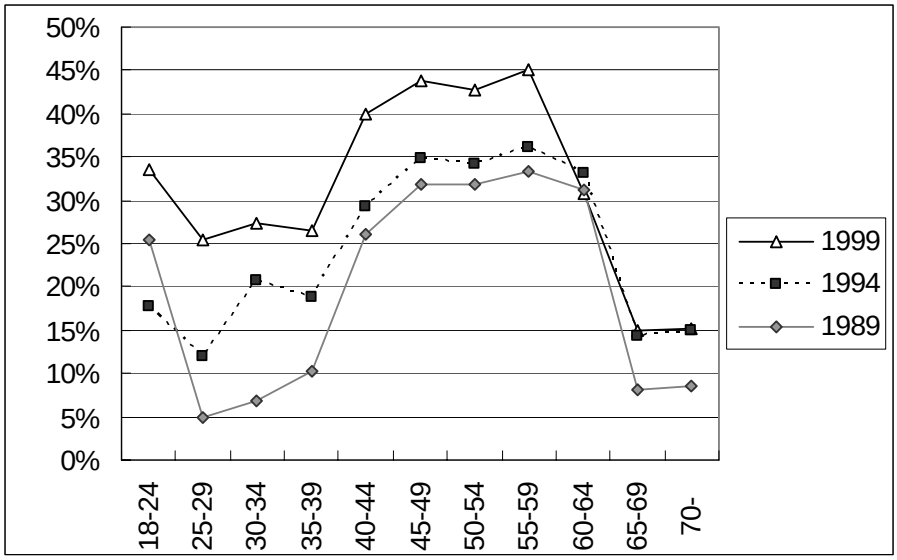
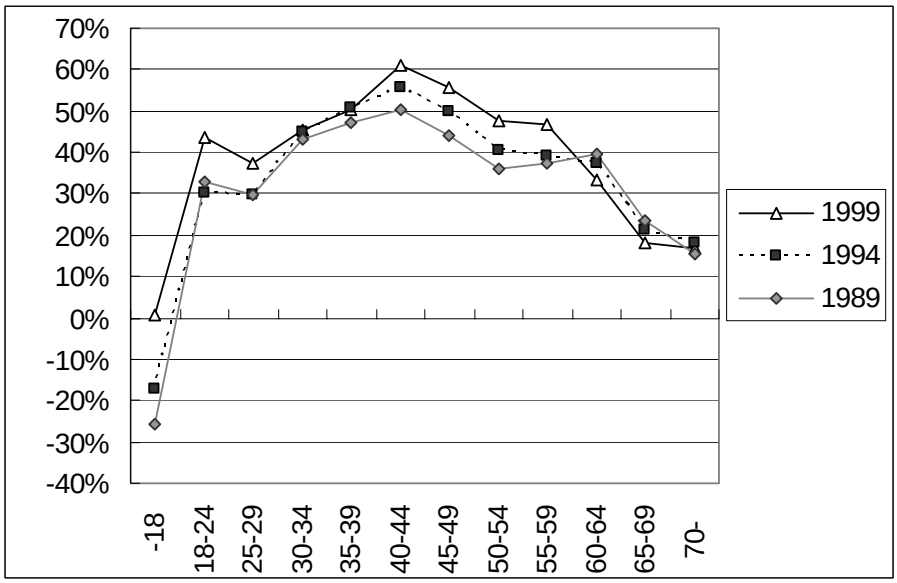


Figure 7 Saving rates: Allocation not adjusted, and ages under 18 not adjusted



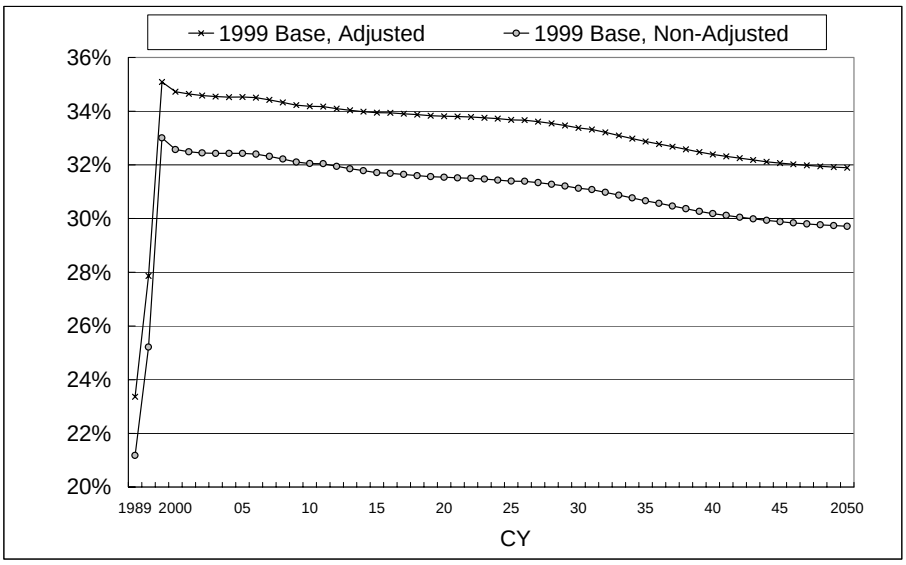
2.6 Simulation of the Household Saving Rate

As shown in the previous section, the saving rate of the old is lower and the population is aging so that the average saving rate is likely to decrease. In this section we simulate the future trend of saving rates given the demographic change. Four assumptions are important. First, the economic situation including future expectation for the aging or taxation may have much impact on the saving rate as seen in the estimation of saving rates. The estimated weighted averages of saving rates (with allocation adjustment) are 23.4% in 1989, 27.9% in 1994, 35.1% in 1999 so that the difference between 1989 and 1999 is more than 10%. The estimation is limited to the pure effects of aging. Many economic factors, such as government behavior, economic situation, and investment movements, may change the saving rates. Second the saving rates of households depends on taxation (or disposal income) so that if the government reduces the primary deficits by imposing taxation, then the saving rates of households which smoothes the expenditure will decrease. However, we simply assume other things to be equal to analyze the effects of aging alone. To add other things would need to build an *ad hoc* model without appropriate general equilibrium framework.. The weighted averages of 1999 saving rates are used as bench rates to be stable ever after 2000. The only resource of changes in all households' saving rates is age brackets.

Data of 1999 and before are from the NSFIE, and the data of 2000 and after are from the projection of the National Institute of Population and Social Security Research 2002 which have the projection for 2001-2050. There are 11 age brackets; under 18, 18-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69 and over 69 years old.

We have estimated the saving rates of workers and non-workers households separately, but we make their weighted averages since future trend of workers or non-workers cannot be estimated. In the simulation the saving rates of workers' and non-workers' are averaged by number weights of households. The estimated results are in Figure 8.

Figure 8 Saving rates: Simulation



Discussion

Although life-cycle theory predicts that aging will substantially lower the household saving rate, this may not happen in Japan, even after we correct for the bias in the data. Retired people in Japan seem to continue saving even after adjusting for a sampling bias. If the future older people continue to save like their parents' generation, then the Japanese saving rate may not be lowered too much due to aging. The excess asset will be bequeathed, intentionally or unintentionally. It is shown that in our best estimate, the saving rate will decline from 35.1% in 1999 (actual) to 34.2% in 2010, to 33.8% in 2020.

3. Current Account Surpluses

3.1 Identity

Our next task is to examine the impact of the changes in the household saving rate to the current account surpluses. First, let us review the national saving-investment balance:

$$\textit{Households' } S - I + \textit{Corporations' } S - I + \textit{Government sector surpluses}$$
$$= \textit{External sector surpluses}$$

where S stands savings and I stands investments. This is the SNA base identity. External sector surpluses in SNA are conceptually the same as the current account surpluses in the balance of payment statistics. However, the two can deviate for

technical reasons.

3.2 A Model for Simulation

Here, a model for simulation is presented, but the definitions of variables are shown in Appendix 3. The savings and investments of economic agents (households, a government, and corporations) are explained in turn.

Note the difficulty in predicting future trends of the current account lies in correlations between investments and savings. The correlations is called Feldstein-Horioka puzzle (Feldstein and Horioka (1980)), since the correlation shall be small with active international capital transactions. Especially we find that the government investments are highly correlated to the corporation's savings in Japan[3]. Hence we see the corporation's behaviors from two sides. First, case A is to assume a correlation with government deficits, and second, case B assumes no correlation and constant investment.

Household

A representative person maximizes the life-time utility given permanent incomes until the time of death D,

$$\max \; U_t = \sum_{s=0}^{D} \frac{1}{(1+\rho)^s} u_{t+s}(c_{ht+s})$$

$$\text{s.t.} \quad a_{ht+1} = (1+r)\, a_{ht} + y_{ht} - c_{ht} - (\tau_t + z_t - z'_t)$$

where U_t is the life-time utility, u_t is the instantaneous utility, c_{ht} is the household's consumption, a_{ht} is the wealth holding at the beginning of period t, a_0 is zero, y_{ht} is the household's income, τ is tax, z is the social security contribution, and z' is a transfer from government such as public pensions. The transversality condition is satisfied. First order conditions give

$$\frac{u'(c_{ht-1})}{u'(c_{ht})} = \frac{1+r}{1+\rho}$$

$$\sum_{s=0}^{D}\left(\frac{1}{1+r}\right)^{s+1} c_{hs} = \sum_{s=0}^{D}\left(\frac{1}{1+r}\right)^{s+1} (y_{hs} - \tau_s - z_t + z'_t)$$

Hence if we adopt the life cycle theory, a household will not leave any bequest to

[3] See the appendix 2.

their child. However, uncertainty about the permanent income or implicit contracts between generations may induce the old to leave intended and/or unintended bequests. Since a household tends to receive lower income when young or old, and higher income when the household is the middle aged, consumption smoothing behavior will produce a lower saving rate for the young and the old, and a higher saving rate for the middle aged.

An important factor is a possible Ricardian behavior. Different assumptions on how to treat taxes would lead to different results of the household savings. As shown in the preceding analysis, we do not make a particular assumption, but show the possible ranges of saving rates according to different scenarios..

Government

The government collects taxes, or issues bonds. If we fix the tax rates, then the total amount of government revenue is given by,

$$T_t = n_t (\tau_t + z_t)$$

where n_t is the number of households, τ_t direct and indirect taxes, z_t is social security contribution. The expenditure is

$$G_t = C_{gt} + I_{gt} + r\, B_{t-1} + Z'_t.$$

where C_{gt} is the government consumption, I_{gt} is the public investment, $r_t\ B_{t-1}$ is the interest payments, and Z'_t is the total transfer to households. The difference between expenditure and revenue shows the amount of bonds that has to be issued. The IS balance of the government sector, IS_{gt}, is defined as

$$IS_{gt} = G_t - Tt$$

Corporations

The IS balances of corporations and government sectors tend to have a negative correlation. Because of the correlation, the IS balance may not be negative by the huge government deficits. For example, in 1998, the government deficits was tripled from the last fiscal year, but the IS balance was almost the same as the last year since the corporations' IS balance turned to be positive. This correlation may be caused by the resource constraint, or demand for investments. Investigation of the mechanism required another analysis so that we simply put two assumptions in each case in this paper.

In the first case (case A), we use the result of regression of the government deficits and corporate investment. The IS balance naturally becomes positive since the government's IS balance is negative. However, the huge positive balance cannot be sustained because the positive IS balance is resourced by the banking sector whose resources are consisted mainly of savings. So the level of positive IS balance is constrained so that IS is less than households' savings.

$$IS_{ct} = -20{,}878 - 0.99\, IS_{gt} \text{ (billion yen)} \quad \text{if } IS_{ct} < S_h$$

$$IS_{ct} = S_{ht} \quad \text{if } IS_{ct} \geq S_{ht}$$

where IS_c is the IS balance of the corporate sector, S_h is the total households' savings. The intercept (–20,878) and the slope (– 0.99) are just the correlation during last ten years.

In second case (case B) we assume that the IS balance of the corporate sector is constant at 13,105 billion yen since FY2000.

Macroeconomic Identity

The macroeconomic identity is given by the relationship in that national income Y_t equals aggregate production, that also equals aggregate expenditure:

$$Y_t = D_{ht} + D_{et} + T_t = C_t + I_t + G_t + EX_t - IM_t$$

where D_h is the households' disposal income, D_e is the entrepreneurial income. Since the actual ratio of D_h to Y is stable, we assume it a constant, and assume government tax rates to be constant. Then we can rewrite,

$$Y_t = \alpha Y_t + D_{et} + \alpha \beta Y_t$$

then,

$$D_{et} = (1-\alpha-\alpha\beta)\, Y_t.$$

where α is the labor share ratio in macroeconomic income distribution, and β is the average tax rate. Hence the aggregate savings of economic sectors are,

$$S_t = s_t D_{ht} = s_t \alpha Y_t$$

$$S_{et} = \varepsilon D_{et} = \varepsilon (1-\alpha-\alpha\beta)\, Y_t.$$

where S_t is the households' aggregate savings, s_t is the aggregate saving rate, S_e is the aggregate entrepreneurial savings, and ε is the stable saving rate of the entrepreneur.

Total IS balance of an entire economy is defined by

$$IS_t = (S_t - I_t) + (S_{et} - I_{et}) + IS_g$$

$$= Y_t - C_t - I_t - G_t = EX_t - IM_t$$

The saving rates of the households and corporations are stable, while the investments are unstable. As for the investment, it is simply assumed to increase or decrease according to the changes in GDP.

GDP and Statistical Discrepancy

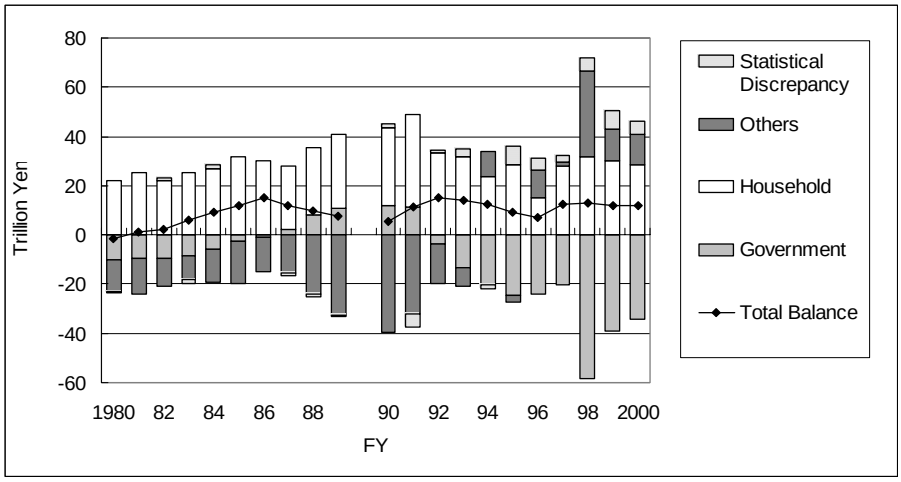
GDP is exogenously given in this paper. The changes in GDP affect the investments, consumption, and even government expenditures. Another case is constant in terms of GDP per capita. The case of per capita is examined because we expect decreases of an entire population and those of working age.

IS balance has to be equal to the external surpluses, but it is not in reality because of the statistical discrepancy. To fill the gap, we add the difference between year 2000 and 2001 as statistical discrepancy.

The most important factor in the overall IS balance is the government I-S balance. The government sector balance depends on the primary balance (expenditure without interest payments minus revenue without debt issues), and interest payments on the outstanding debts. Figure 9 shows, the corporations' or government's IS balance have more variation in trend than the household sector. Although the saving rates of households will decline as shown above, the degree of the gross savings decrease due to the decline in the household sector turns out to be overwhelmed by small changes in assumptions on corporate and government behaviors.

It is important to note that there is a relationship between household savings and government behavior. If the government levies higher taxes, then household savings will decline due to the decrease of the disposal income. If the government issues bonds instead of raising taxes, then a household may increase savings expecting the future increase of tax burden. Since the degree of such effects depends on various factors in reality, we just assume a path of the households saving that is not affected by the tax increase by interest payments of government bonds. So actual saving rates (ratio to GDP) after 2000 will be some ratio between that of "savings/GDP" and that of "(savings + interest payments)/GDP" in the figures..

Figure 9 IS Balances (Nominal)



Note: The sum of internal sectors and the external sector are not always same with an opposite sign, because of the statistical discrepancy. 68SNA before 1990, and 93SNA after. Others include corporations and NPOs.

3.3 Simulation

We investigate the investment-saving balance with four possible scenarios: (1) primary balance scenario, (2) GDP growth scenario, (3) interest rates scenario, (4) GDP per capita scenario. Assumptions of these scenarios are described in Table 1.

(1) Primary Balance Scenario

This is a scenario that the government sector tries to reduce the amount of primary deficits gradually, and assumes it to be zero after ten years. The amount of reduction is just the same every year. The government's overall deficits is still not to become zero, since it has to pay the interest on the stock of outstanding debts.. The government's expenditure includes the debt repayments which include transfers to the Debt Consolidation Fund. Hence we just exclude the interest payments from the debt repayments.

First, Case 1-1 shows a case that the government maintains the primary balance to be deficits of the same size in year 2000 that is a benchmark. The first two figures shows the case A of the corporations' IS, which is described in the previous section. The third figure shows the IS balance when the corporations' IS being constant after 2000.

In Case A, the government deficits show the ever increasing pattern so that use all domestic saving resources. The IS balance will be negative after 2039. The case A

indicates the net investment of the corporations will be kept to negative. However such situation may not be appropriate. Case B shows the constant IS balance of the corporations, and in this case, the national IS balance will turn to be negative after 2029.

The saving rates change only slightly in many scenarios, but it can decline drastically when the government imposes more taxes.

Case 1-2 is a scenario of different primary balances. If the primary balances are restored in 2010, the level of government deficits does not exceed the savings for some years. Then the trend of the IS balance depends also on the corporations' IS. Because of this dependency, the simulated figures show quite different patterns in case A and B. If the corporations' IS negatively correlated then the IS balance will just decrease gradually. If the correlation is week, then the balance will decline more rapidly.

From the two cases, the future trend of IS depends crucially on the government behavior. If the government can keep the primary deficits lower, then there is a room for IS surplus in Japan.

However, corporate sector IS deficits were highest in 1990 as shown in Figure 9. The deficits were about 40 trillion yen (real). If corporate investment stays at that level, the remaining resources for the government would be limited.

(2) GDP growth scenario

As the GDP level increases, the household income increases and so will the tax revenue for the government.

Case 2-1 is the scenario of 1% real GDP growth. In this case, the real interest rate of the government bonds is assumed to be constant at 1.64% which is slightly bigger than the rate of economic growth, 1%. Hence the government IS balance alone may exceed the household savings, but whether the national IS balance turns to be negative depends on the effects of the corporations' IS balance.

Compared to Case 1-1 which assumes no growth, the GDP growth in Case 2-1 absorbs the negative IS balance of the government by increasing the household saving. Hence the surplus level of IS balance is higher than that of the Case 1-1. However the government deficits are still high. If the corporations IS balance can absorb the governments deficits, then the IS balance may be positive even in the long-run as in Case A. However the government produces a negative influence on the national IS balance as in case B.

If the government can successfully reduce the amount of primary deficits, then the IS balance will not be negative with the 1% real growth in the long run as shown in the

Case 2-2. In this case the household savaging exceeds the government deficits, hence the IS balance is positive in both cases of A and B.

(3) Interest Rates Scenario

Until now we have assumed the constant interest rates of public bonds, but such an assumption is rather optimistic. If the government outstanding debt is accumulated then the interest rates will most likely become higher. When the interest rate increases, the government IS balance decreases. Cases that the interest rate of the government bonds increase gradually to 3% in 2050, with an annual increase by about 0.027% are examined in this scenario.

Case 3-1 analyzes when the government keeps the current primary position, and there is no growth. In this case, the IS balance turns to be negative in 2030 in case A, and in 2022 in case B. Since we assume that the gradual increase in interest rates, the turning point will not come too soon. However an impact of government debts is much greater than Case 1-1. The IS balance reaches -60 trillion yen (real) in 2050 even in case 3-1-A, while -15 trillion yen (real) in 2050 in case 1-1-A.

Case 3-2 shows the case of 1% growth. In this case, the GDP growth cannot absorb the government deficits thus the IS balance is likely to be negative, compared to the case 2-1.

If the government achieves the primary balances in 2010, then the IS balance will be kept positive for a while, but the high burden of interest payments will bring the negative IS balance in the long-run as in case 3-3.

(4) Constant real GDP per Capita Scenario

The assumption of GDP in above cases may be irreverent for the aging since the GDP may decline as population and working ages decreasing. Hence we assume the GDP per capita is constant rather than GDP in this scenario. The average rate of GDP growth in fifty years is about –0.46% per year.

Case 4-1 is a case of constant primary deficits and a constant interest rate. Composed to the case 1-1, aging has much stronger impact on the negative IS balance. Case 4-2 examines when the interest rates increases, and IS balance is negative in 2028 in case 4-2-A, and in 2022 in case 4-2-B. Case 4-3 is a case of primary balance. In the case 1-2, the IS balance is kept positive at least until 2050. In this case, it turns to be negative in 2046 in case 4-3-A and in 2043 in case 4-3-B.

Table 1 Assumptions of simulation analyses

		Corporations' IS	Primary Balance	Real GDP growh	Real Interes Rates
Case 1-1	A	Correrated to Govn't IS	Constant	Zero	Constant
	B	Constant	*(-19 trillion yen)*		*(2.32%)*
Case 1-2	A	Correrated to Govn't IS	(gradually increases)	Zero	Constant
	B	Constant	Zero in 2010		
Case 2-1	A	Correrated to Govn't IS	Constant	1%	Constant
	B	Constant			
Case 2-2	A	Correrated to Govn't IS	(gradually increases)	1%	Constant
	B	Constant	Zero in 2010		
Case 3-1	A	Correrated to Govn't IS	Constant	Zero	(gradually increases)
	B	Constant			3% in 2050
Case 3-2	A	Correrated to Govn't IS	Constant	1%	(gradually increases)
	B	Constant			3% in 2050
Case 3-3	A	Correrated to Govn't IS	(gradually increases)	Constant	(gradually increases)
	B	Constant	Zero in 2010		3% in 2050
Case 4-1	A	Correrated to Govn't IS	Constant	Constant	Constant
	B	Constant		in per capita	
Case 4-2	A	Correrated to Govn't IS	Constant	Constant	(gradually increases)
	B	Constant		in per capita	3% in 2050
Case 4-3	A	Correrated to Govn't IS	(gradually increases)	Constant	Constant
	B	Constant	Zero in 2010	in per capita	

Note: "Constant" indicates that the value is the same as that of FY2000 after FY2000. Primary balances are defined as fiscal balance minus interest payments (not debt repayments (Kokusaihi)). See also the matrix of results of Table 5 and Table 6.

4. Concluding Remarks

Aging is an important issue in many aspects of macro-economy. Household savings will be significantly affected by rapid aging, if life-cycle theory is applicable. However, it is well known that the difficulty exists in estimating, from published surveys, the saving behavior of the old age people. We have attempted to make some adjustments in estimating how much old age people are really saving in Japan. The old age people in Japan do save but the saving rate is lower than the younger middle age groups. Assuming that this trait continues in the future, the household saving rate will decline with aging.

It was found that any change in household gross saving due to aging would be completely overwhelmed by expected changes in the investment-saving (deficit) balance of the government sector. In order to maintain fiscal sustainability, the government sector is expected to restore balanced budget. A reasonable assumptions on tax increases or expenditure cuts, that are required to restore balanced budget, will generate large changes in the overall IS balance.

Effects of aging on household sector are important. However, how quickly the fiscal balance of the government is restored is at least equally important in thinking of the IS balance of the Japanese economy.

It is theoretically possible to predict that the current accounts (external balance) turning negative due to aging through the channel of household saving, if there is no adjustment to the government budget deficits. However, it is not conceivable that it would be a case, because it would mean that the fiscal situation will become unsustainable.

Therefore, we predict that a decline in household saving due to aging will be more than offset by the smaller deficits of the government sector, thus the current accounts will remain positive in the indefinite future.

Appendix 1　Comparison of Saving Rates

We estimate the saving rates of age brackets with several adjustments. We have estimated the saving rates by different characteristics in 1984, 1989, 1994, and 1999: by age brackets—11 age brackets, under 18, 18-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, over 70 or more. However originally data include the household's behavior categorized by age brackets and by working conditions—of workers' households and non-workers households; and by the number of household members—of two and more members, and one-person households (headed by male or female). Note, the definition of workers household is the household in which the head is employed by private corporations or public organization. It does not include the self-employed, such as presidents, executives, and even firm houses. Hence non-workers' households include variety types of household, for example, the unemployed and presidents.

The saving rates from the original data are shown in Figure A- 1 to Figure A- 3. The saving rates of two-or-more households show the quite different figure as estimated in this paper. Especially the saving rates of the old are higher, and the level is same as the young. This indicates that the households with old household heads are relatively rich. On the other hand, the one-person households of the older have lower saving rates.

Figure A- 1 Saving rates of two-or more household, NSFIE

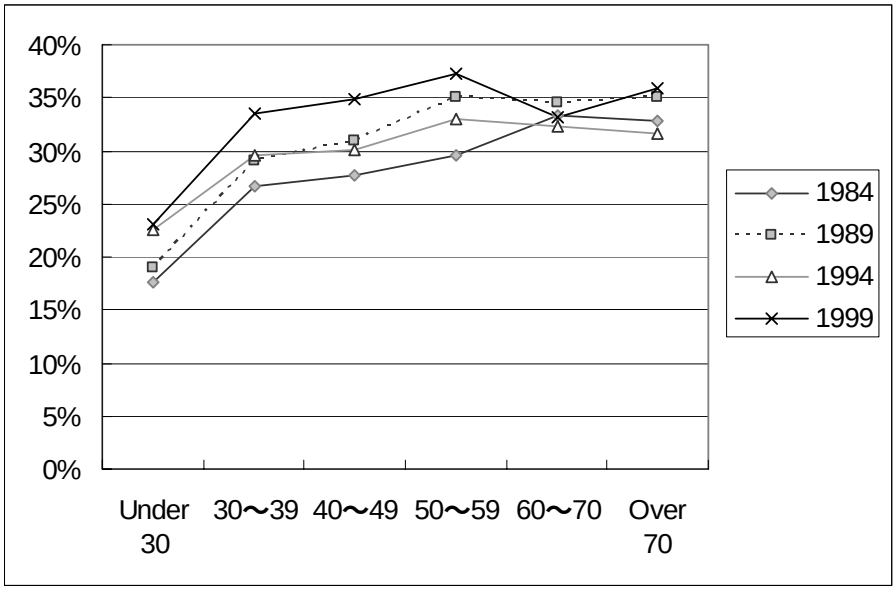


Figure A- 2 Saving rates of one-person household (male), NSFIE

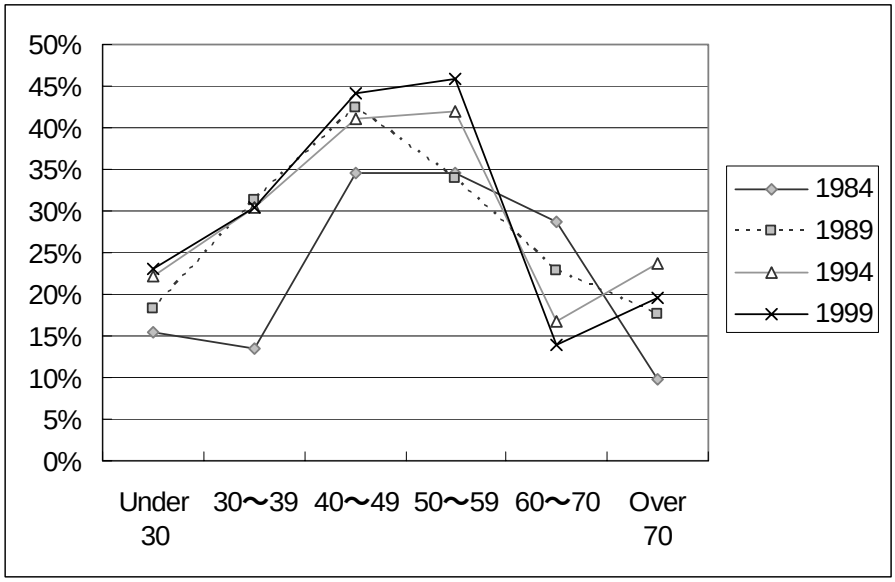
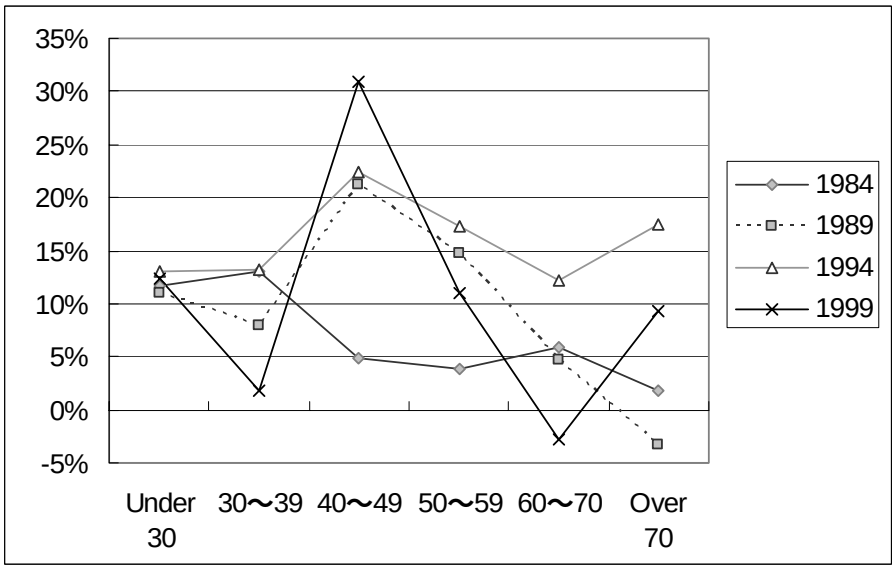


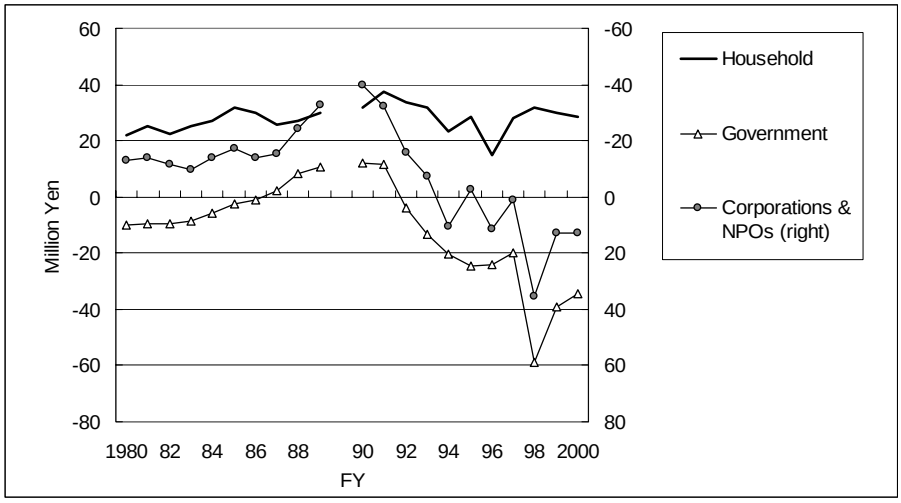
Figure A- 3 Saving rates of one-person household (female), NSFIE



Appendix 2 Investment and Government's Deficits

As Figure A- 4 indicates, the IS balance of corporations and that of government are negatively correlated. The IS balance equals to the financial surpluses or deficits by the definition of the macro-economy. If the government issues the bonds, then they are bought by the households or the corporation sector, which included the banking sector. Actually most of them are bought by the financing sector of the central bank, public banks and private banks. The increase in the bond issues bring about an increase in the ratio of the government bonds in their assets rapidly in recent years. Figure A- 5 shows the ratios. The ratio of the government bonds in the private banks' assets in 2000 is 2.5 times of that in 1990..

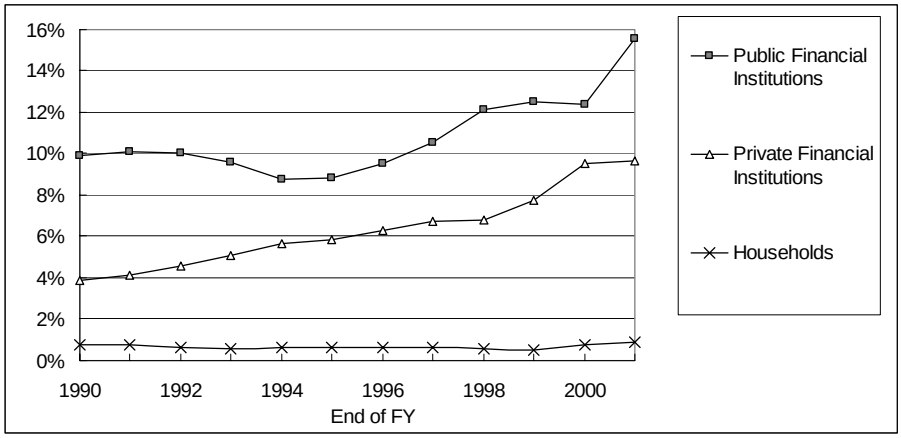
Figure A- 4 IS Balances of Government and Corporations



Source: SNA

Note: Each figure shows the IS balances. 68SNA before 1989, and 93SNA after. The IS balances of Corporations and NPOs is on the right hand showing opposite sign.

Figure A- 5 The ratios of the government's bond in assets



The question is how they are related. One mechanism is just through identity. The government deficits have to be absorbed in some sectors including the external sector. The difficulty is the allocation problem between the external and the internal. The second mechanism is crowding out. The issue of government bonds increases the interest rates then it deters the investment. However, recent interest rates of the government bonds are actually low.

We use the correlation during the period from 1990 to 2000. The slope of the corporations' IS to the government's IS is –0.99, and the intercept is about –20,878 (billion yen). The results of another regression which analyzes the relationship between the corporations' investment and the issues of the government debts are shown in Table A- 1 and Table A- 2.

Table A- 1 Estimation of corporations' investments

	(1)	(2)	(3)	(4)
Dependent Variables	Net Investment	Gross Investment	d (Net Investment)	d (Gross Investment)
Explanatory	(billion yen)	(billion yen)	(%)	(%)
Constant	50,721 **	103,290 **	3.64	5.00
	(5,763)	(6,779)	(14.60)	(3.00)
Bond Issues (billion yen)	-0.15 **	-0.12 **		
	(0.03)	(0.03)		
d (Bond Issues) (%)			-0.59	-0.24 **
			(0.41)	(0.08)
Dummy for 1990	13,466 **	-32,117 **	-6.57	28.71
	(3,963)	(4,661)	(69.98)	(14.39)
Adj. R^2	0.75	0.65 **	0.01	0.30
DW	1.24	0.80	2.41	2.68

Note: d(·) indicates the changes(%) from previous year.

Table A- 2 Unit root test

	Net Investment	Bond Issues	Gross Investment
Augmented Weighted Symmetric	-2.38	-2.29	-2.66
P-value	0.37	0.43	0.20
Lags	2	7	2
Augmented Dickey-Fuller	-2.73	-1.54	-1.38
P-value	0.22	0.81	0.87
Lags	10	10	10

Appendix 3 Simulation of IS Balance: Definitions and Assumptions

This appendix presents the method of the IS balance simulation. In the IS balance, private investment of each future year is almost unpredictable. On the other hand, saving can be guessed since the saving rate of each age bracket is assumed to be stable. The fiscal balance is partly predictable, since the interest payments are from the stocks of government debt. Hence, to find the possible IS balance or current account trends, the simulation of fiscal balance are the important in addition to the savings.

We give constant growth rates of the real GDP after 2001. The inflation rate is also assumed to be constant, thus the nominal GDP is calculated from these two assumptions.

The household income is defined by Compensation of Employees of the Income and Outlay Accounts

Households' income (Compensation of Employees)
= Disposal Income + Current Taxes
+ Social Contributions + Net Current Transfers

From the view point of national income distribution, the ratio of the compensation of employees are stable around 80% after 1990. So the employee compensations are assumed to be 80% of GDP. Then disposal income can be derived by subtracting taxes and social security contributions from compensation of employees. Current tax is about 9% of GDP, and if the government levies extra taxes then it would be added.

Others are defined as Entrepreneurial Income,

Entrepreneurial Income = GDP – Compensation of Employees.

Though entrepreneurs' saving rates are not so stable as households', we assume the 95.2% of year 2000. Then the entrepreneurs' total saving is estimated.

Interest payments in debt-servicing costs are consists mainly of 10-years public debt payments. Thus interest payments are give as,

Interest payments = (10-year average market interest rates of 10-years bonds)
× (outstanding government debt (end of the previous year)).

The difference between the estimated interest payments and the actual payments is about 15% from actual 10 trillion yen in 2000. The interest rates after 2001 are assumed in each case. The total value of debt-servicing costs is estimated by adding public bonds issued 10 years before to interest payments.

Tax revenue is the same amount as taxes paid by household, and a constant tax rate

is assumed. Therefore , tax revenues also depends on GDP.

$$\text{Tax revenue} = \text{Workers' Income}_{-1} + \text{additional tax}$$
$$= \text{Tax revenue}_{-1} + (\text{current taxes}_{-1} - \text{current taxes})$$

Then required amount of bond issues is the difference between revenues and expenditures, defined as,

$$\text{Public bonds issues} = \text{expenditure (includes debt – servicing costs)} - \text{revenue.}$$

An outstanding debt of this period is a stock of previous period plus new issues minus redemptions.

Then we have derived all of the components of national IS balance: households savings and investments, IS balance of corporation, and the IS balance of Government. One problem is that the estimated IS (after 2001) is not consistent before 2000, because of the statistical discrepancy. Hence the difference (3,141 billon yen) is added to the simulated values.

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Table 2 Saving rates by age brackets, all persons, with income adjustments

(a) Adjustments on Income Allocation, and on Ages under 18

	1989	1994	1999
-18			
18-24	0.091	0.062	0.262
25-29	-0.041	0.055	0.209
30-34	0.007	0.160	0.232
35-39	0.100	0.194	0.272
40-44	0.285	0.323	0.426
45-49	0.424	0.412	0.492
50-54	0.454	0.449	0.499
55-59	0.420	0.436	0.497
60-64	0.333	0.339	0.323
65-69	0.194	0.197	0.191
70-	0.133	0.172	0.165

(b) Adjustments on Income Allocation, and Non Adjustments on Ages under 18

	1989	1994	1999
-18	-0.172	-0.090	0.078
18-24	0.180	0.206	0.371
25-29	0.229	0.247	0.335
30-34	0.392	0.416	0.422
35-39	0.472	0.512	0.510
40-44	0.519	0.575	0.625
45-49	0.529	0.547	0.600
50-54	0.487	0.500	0.541
55-59	0.454	0.462	0.511
60-64	0.415	0.381	0.346
65-69	0.331	0.261	0.221
70-	0.198	0.202	0.181

Table 3 Saving rates by age brackets, all persons, without income adjustments

(a) Non Adjustments on Income Allocation, and Adjustments on Ages under 18

	1989	1994	1999
-18			
18-24	0.253	0.178	0.335
25-29	0.049	0.121	0.253
30-34	0.069	0.208	0.273
35-39	0.103	0.188	0.266
40-44	0.260	0.292	0.400
45-49	0.319	0.348	0.439
50-54	0.319	0.341	0.427
55-59	0.333	0.360	0.451
60-64	0.312	0.332	0.308
65-69	0.081	0.143	0.149
70-	0.085	0.149	0.151

(b) Non Adjustments on Income Allocation, and on Ages under 18

	1989	1994	1999
-18	-0.259	-0.174	0.006
18-24	0.327	0.304	0.434
25-29	0.296	0.299	0.372
30-34	0.430	0.449	0.453
35-39	0.474	0.508	0.505
40-44	0.502	0.556	0.608
45-49	0.443	0.497	0.558
50-54	0.360	0.403	0.475
55-59	0.372	0.390	0.466
60-64	0.397	0.374	0.331
65-69	0.237	0.211	0.181
70-	0.153	0.180	0.167

Table 4 Saving rates by age brackets and types, without income adjustments

(a) One-Person, Worker

	1989	1994	1999
18-24	0.158	0.191	0.194
25-29	0.158	0.191	0.194
30-34	0.261	0.239	0.249
35-39	0.261	0.239	0.249
40-44	0.343	0.368	0.422
45-49	0.343	0.368	0.422
50-54	0.268	0.287	0.393
55-59	0.268	0.287	0.393
60-64	0.412	0.320	0.239
65-69	0.412	0.320	0.239
70-	0.223	0.117	0.236

(b) One-Person, Non-worker

	1989	1994	1999
18-24	0.224	-0.163	0.352
25-29	0.224	-0.163	0.352
30-34	0.101	0.257	0.108
35-39	0.101	0.257	0.108
40-44	0.296	0.168	0.420
45-49	0.296	0.168	0.420
50-54	0.077	0.129	0.199
55-59	0.077	0.129	0.199
60-64	-0.021	0.074	-0.023
65-69	-0.021	0.074	-0.023
70-	-0.002	0.186	0.121

(c) Head, Two-or-More Persons Household, Workers

	1989	1994	1999
18-24	0.315	0.384	0.380
25-29	0.445	0.449	0.471
30-34	0.560	0.562	0.579
35-39	0.613	0.635	0.647
40-44	0.579	0.639	0.667
45-49	0.415	0.518	0.569
50-54	0.359	0.402	0.455
55-59	0.383	0.366	0.422
60-64	0.381	0.328	0.367
65-69	0.440	0.404	0.451
70-	0.562	0.490	0.541

(d) Head, Two-or-More Persons Household, Non-Worker

	1989	1994	1999
18-24	0.422	0.490	0.418
25-29	0.570	0.603	0.523
30-34	0.641	0.600	0.654
35-39	0.724	0.692	0.708
40-44	0.601	0.658	0.699
45-49	0.486	0.554	0.578
50-54	0.454	0.447	0.495
55-59	0.466	0.446	0.487
60-64	0.434	0.394	0.366
65-69	0.466	0.447	0.414
70-	0.465	0.435	0.476

(d) Non-Head, Two-or-More Persons Household, Workers

	1989	1994	1999
18-24	0.354	0.413	0.430
25-29	0.354	0.413	0.430
30-34	0.433	0.448	0.469
35-39	0.433	0.448	0.469
40-44	0.496	0.541	0.592
45-49	0.496	0.541	0.592
50-54	0.438	0.483	0.571
55-59	0.438	0.483	0.571
60-64	0.549	0.507	0.462
65-69	0.056	0.123	0.136
70-	0.056	0.123	0.136

(f) Non-Head, Two-or-More Persons Household, Non-Worker

	1989	1994	1999
18-24	0.289	-0.019	0.484
25-29	0.289	-0.019	0.484
30-34	0.176	0.349	0.290
35-39	0.176	0.349	0.290
40-44	0.355	0.271	0.538
45-49	0.355	0.271	0.538
50-54	0.154	0.237	0.362
55-59	0.154	0.237	0.362
60-64	0.064	0.189	0.185
65-69	0.150	0.164	0.156
70-	0.150	0.164	0.156

Table 5 Matrix of Results IS/GDP (%) : Case A

Purimary balances: Constant since 2000

Real GDP growth(%)		Real Interest Rate in 2050 Year 2000 plus indicated values (%)			
		+ 0	+ 1	+ 2	+ 3
	0	0.8	-1.1	-3.3	-6.0
		-8.4	-18.9	-33.8	-55.0
	1	3.2	2.4	0.6	-1.4
		0.2	-6.2	-15.2	-28.2
	2	4.0	4.1	3.6	2.0
		4.8	1.4	-4.1	-12.0
	3	4.6	4.7	4.7	4.7
		5.4	5.5	2.5	-2.3

Purimary balances: Zero in 2010

Real GDP growth(%)		Real Interest Rate in 2050 Year 2000 plus indicated values (%)			
		+ 0	+ 1	+ 2	+ 3
	0	1.9	2.0	2.1	1.1
		1.6	-4.8	-14.9	-30.0
	1	3.0	3.1	3.2	3.2
		3.5	2.3	-3.8	-12.9
	2	3.9	3.9	4.0	4.0
		4.7	4.8	2.9	-2.7
	3	4.5	4.6	4.6	4.7
		5.3	5.4	5.5	3.4

Note: Case A of the Corporations' IS which is negatively correlated to the governments' IS. The value of a upper row in a cell is the ratio IS balance over GDP in 2025 and the second value is in 2050. Real interest rates are the values in 2050 which are the values in 2000 (2.32%) plus indicated values in top of each column, and gradually increased to that value. Real GDP growth is per annual and constant through years. Constant primary balances indicate the same value (about –19 trillion yen) through years. Zero in 2010 indicates that primary balances gradually close to zero until 2010 and constantly zero after.

Table 6 Matrix of Results IS/GDP (%) : Case B

Purimary balances: Constant since 2000

Real GDP growth(%)		Real Interest Rate in 2050 Year 2000 plus indicated values (%)			
		+ 0	+ 1	+ 2	+ 3
	0	-1.5	-3.4	-5.7	-8.3
		-10.2	-20.6	-35.4	-56.5
	1	0.3	-1.2	-2.9	-4.9
		-3.7	-10.0	-19.0	-31.8
	2	1.8	0.6	-0.8	-2.4
		0.3	-3.6	-9.1	-17.0
	3	2.8	1.9	0.9	-0.4
		2.6	0.2	-3.2	-8.0

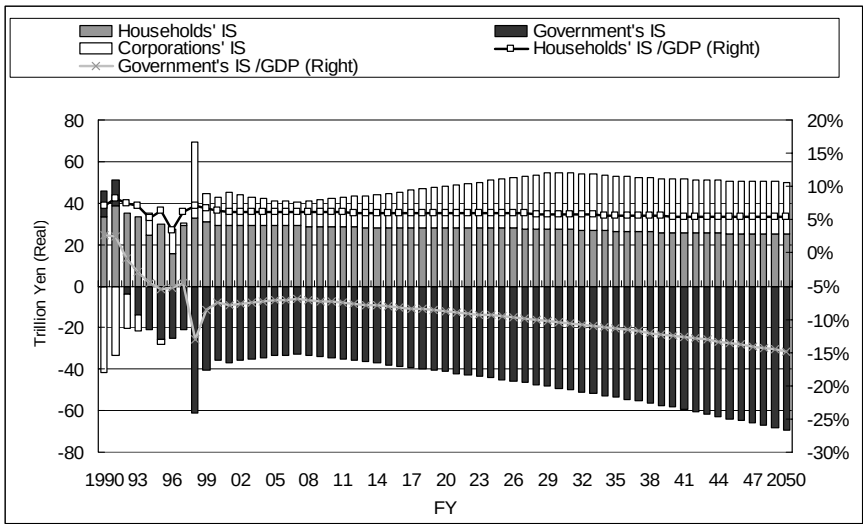
Purimary balances: Zero in 2010

Real GDP growth(%)		Real Interest Rate in 2050 Year 2000 plus indicated values (%)			
		+ 0	+ 1	+ 2	+ 3
	0	3.9	2.3	0.5	-1.6
		-0.4	-7.0	-16.9	-32.0
	1	4.5	3.4	1.9	0.2
		2.3	-1.7	-7.8	-16.9
	2	5.0	4.1	3.0	1.7
		3.9	1.4	-2.3	-7.8
	3	5.4	4.7	3.8	2.8
		4.8	3.3	1.0	-2.4

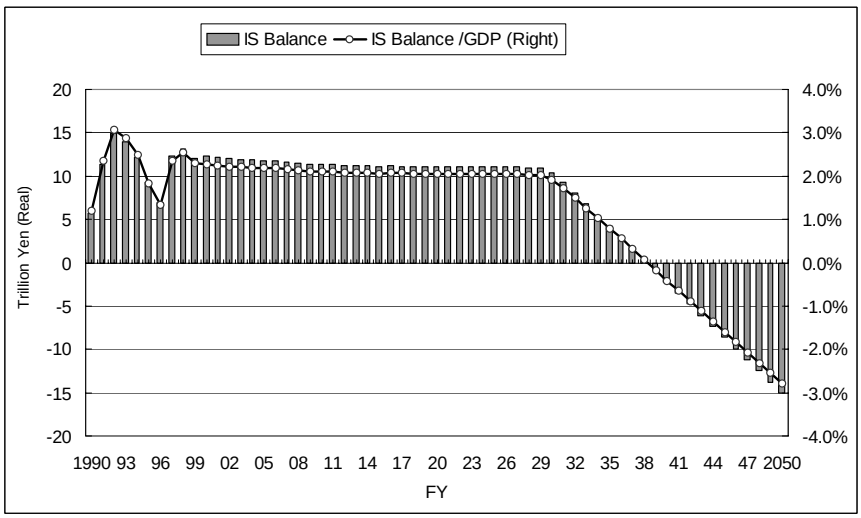
Note: Cases of constant corporation's IS after 2000.

1. Primary Balance Scenario

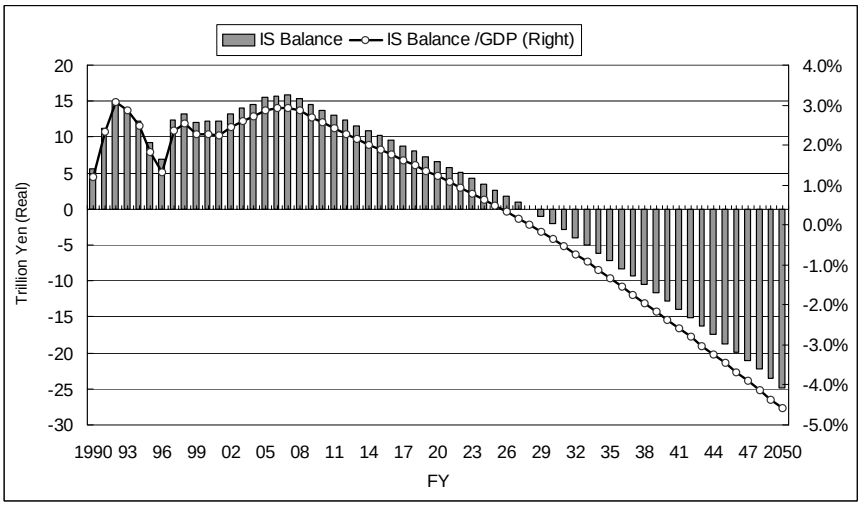
Case 1-1 Constant primary deficit, zero growth, constant interest rates



Note: Case A of the Corporations' IS which is negatively correlated to the governments' IS.



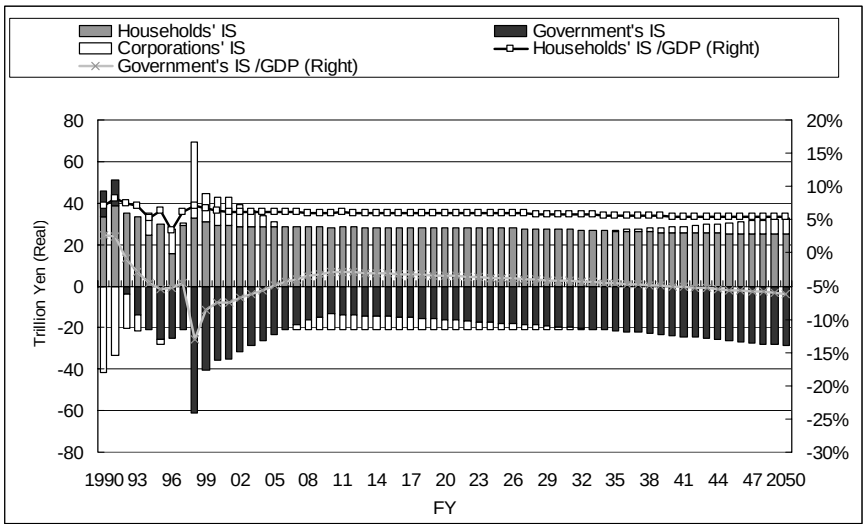
Note: Case A of the Corporations' IS.

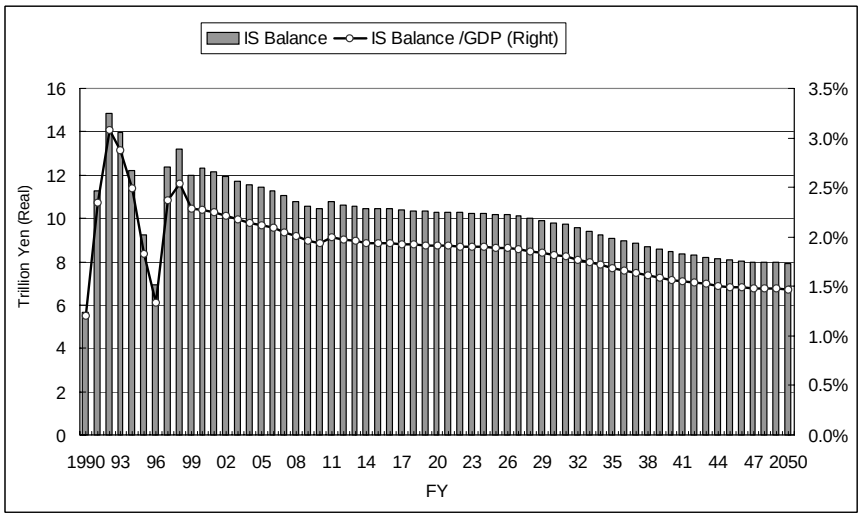


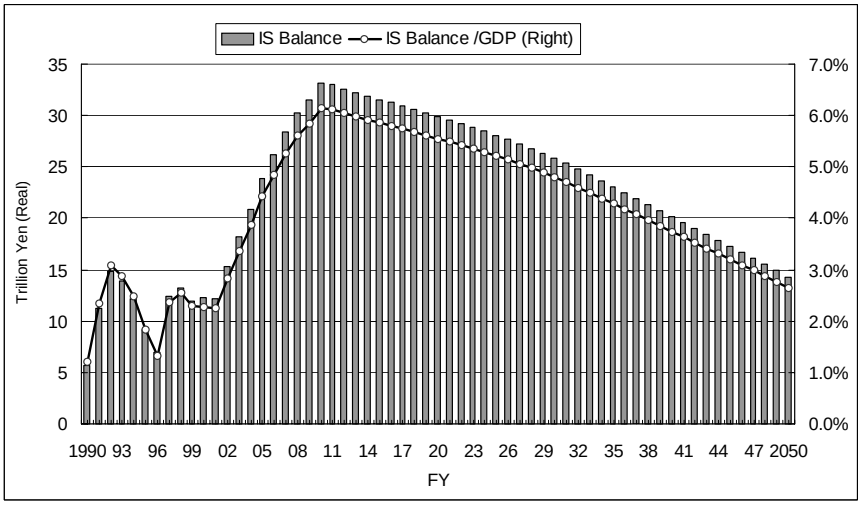
Note: Case B of the Corporations' IS which is constant after 2000.

Following figures shows the same cases in order.

Case 1-2 Primary balance in 2010, zero growth, constant interest rates

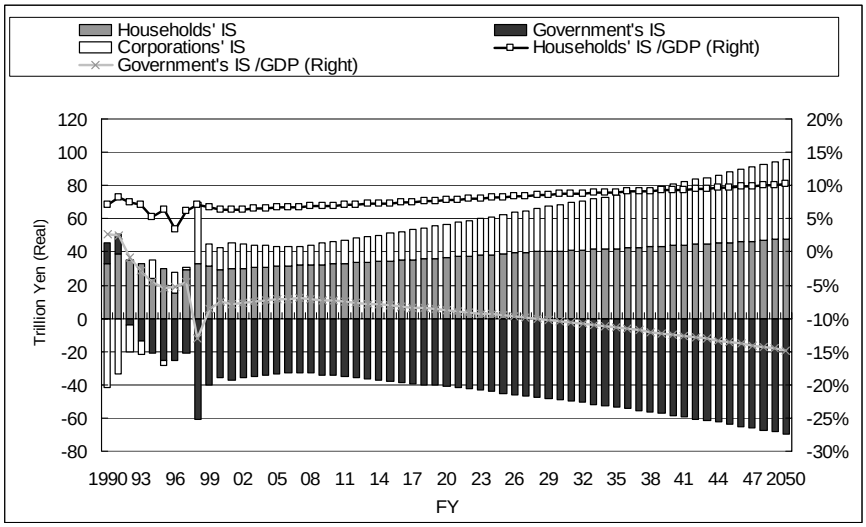


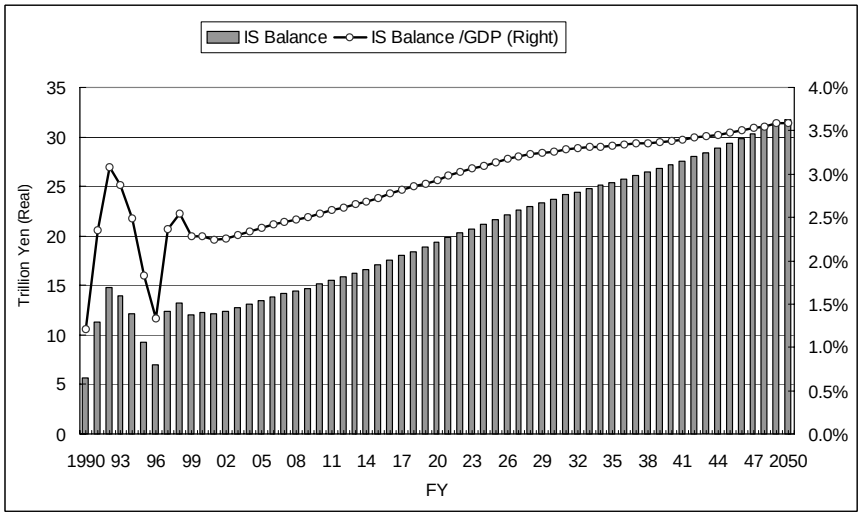


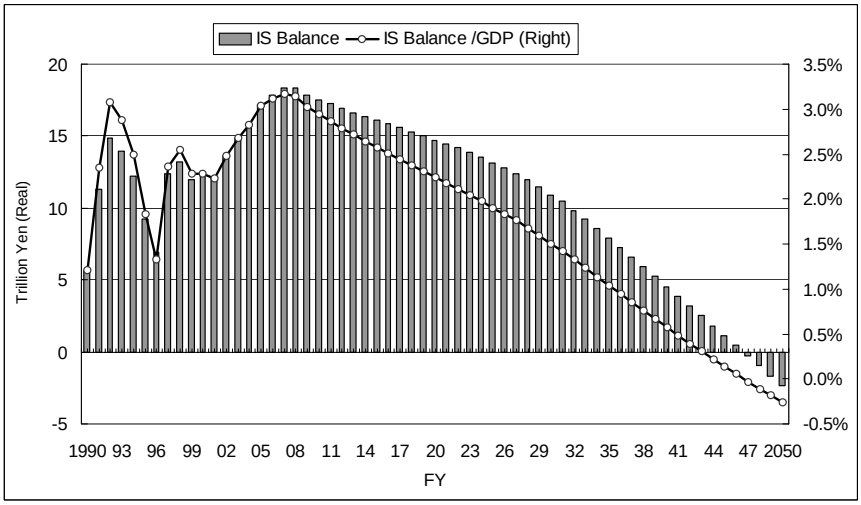


2. Real GDP Growth Rates

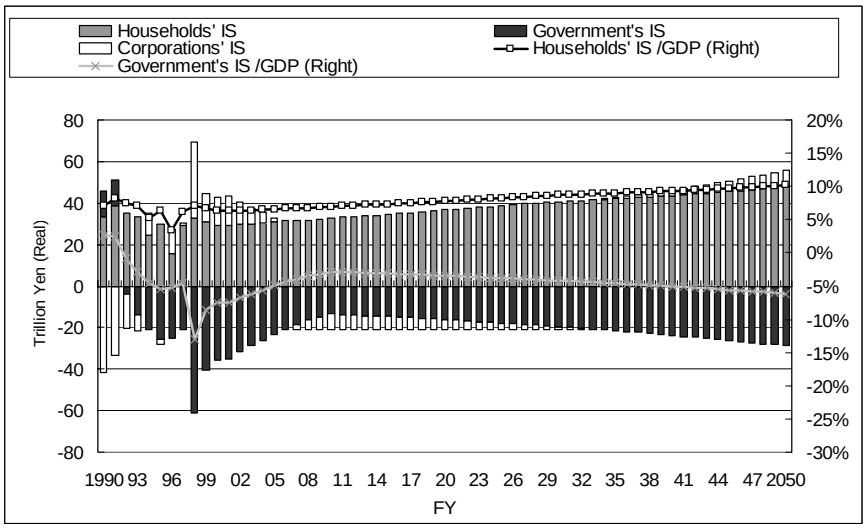
Case 2-1　1% real growth, constant primary balance, constant interest rates

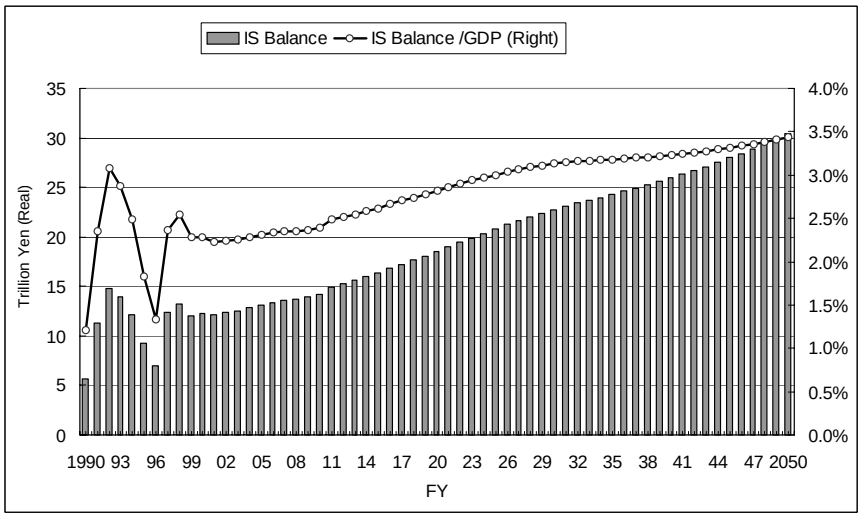


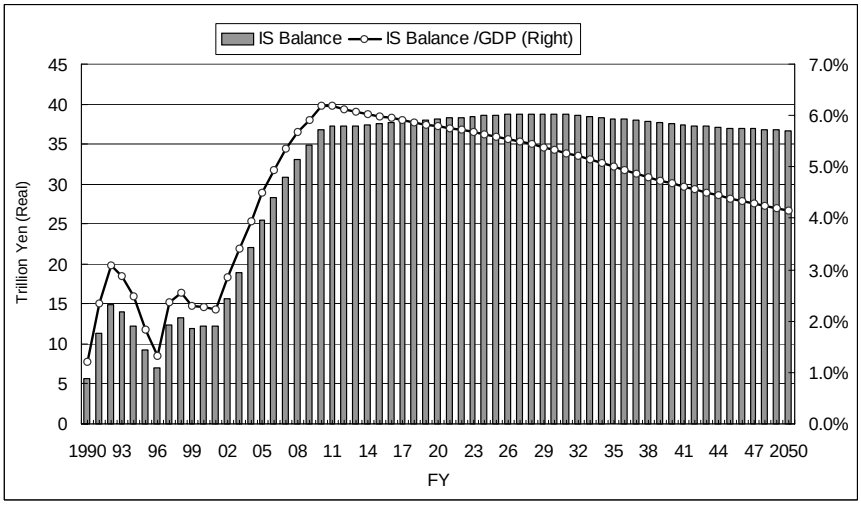




Case 2-2　1% real growth, primary balance in 2010, constant interest rates

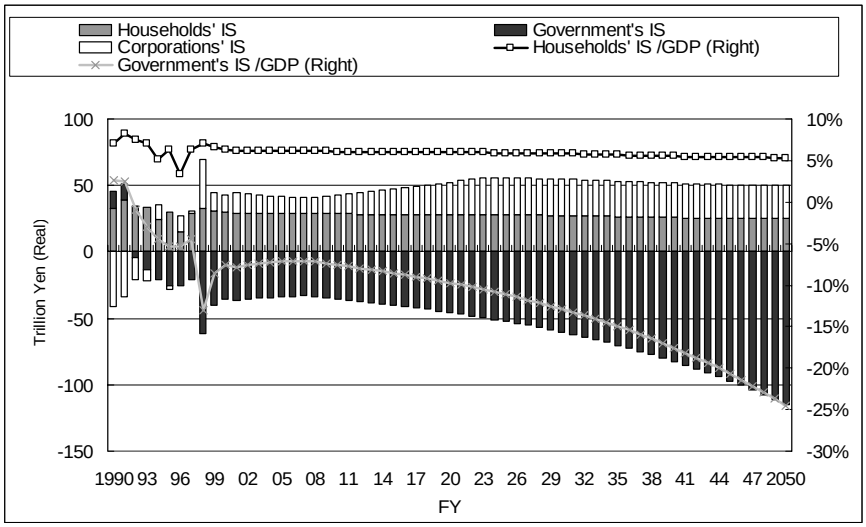


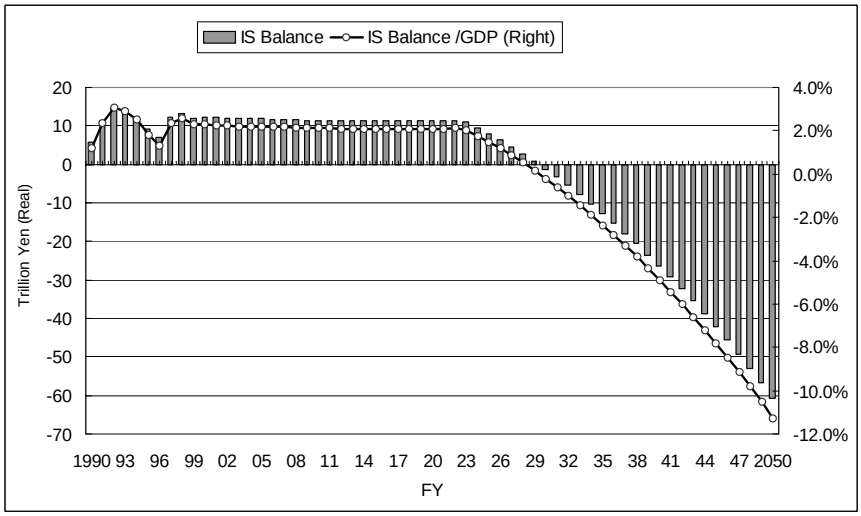


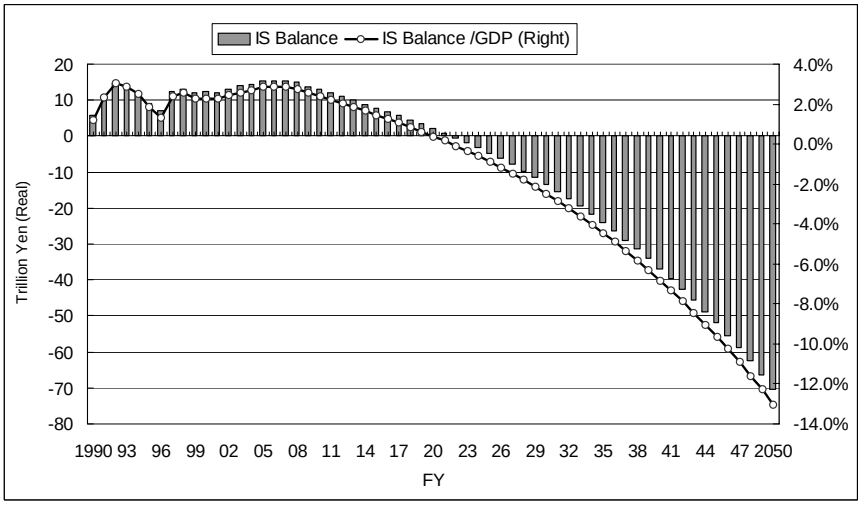


3. Interest Rates Increase

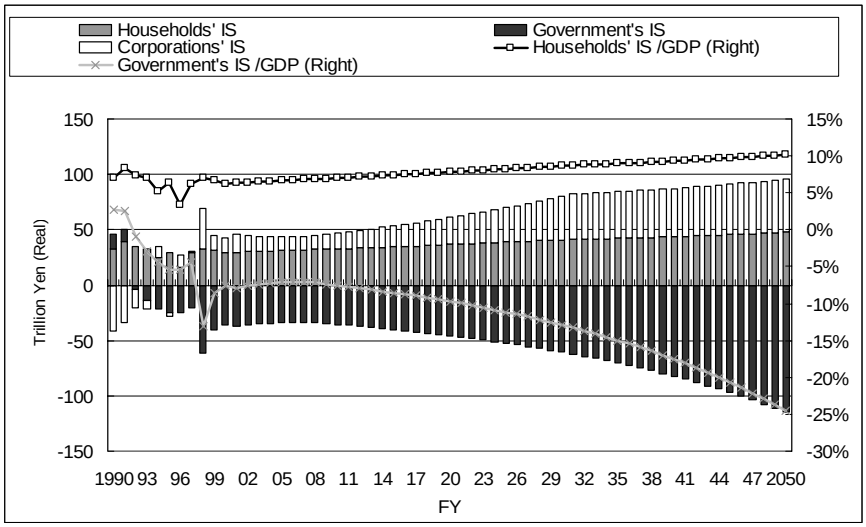
Case 3-1 Interest rates increase to 3% in 2050, constant primary deficits, zero growth

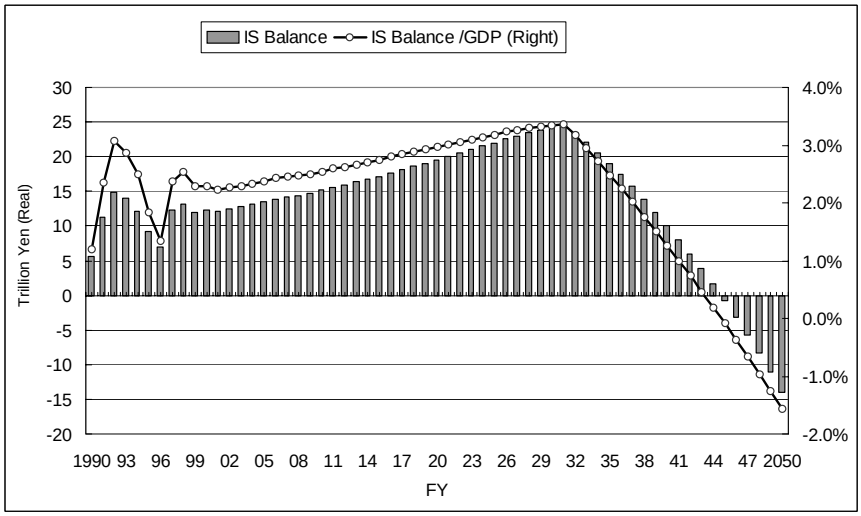


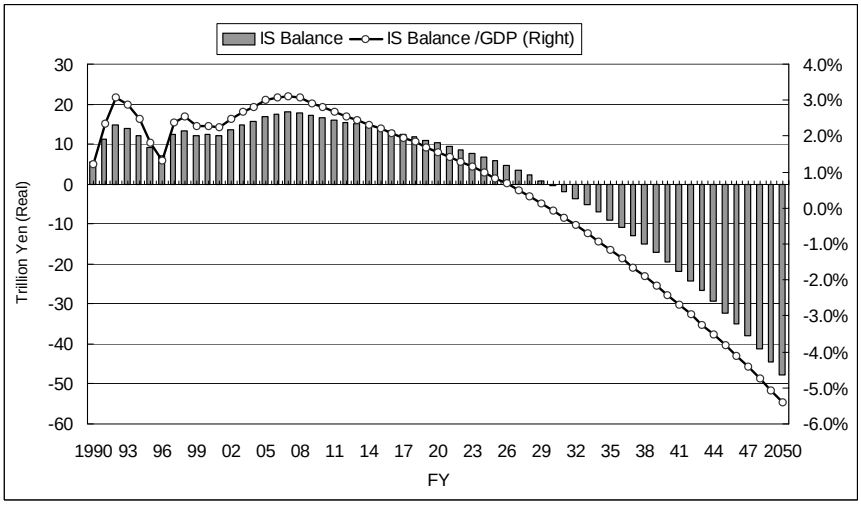




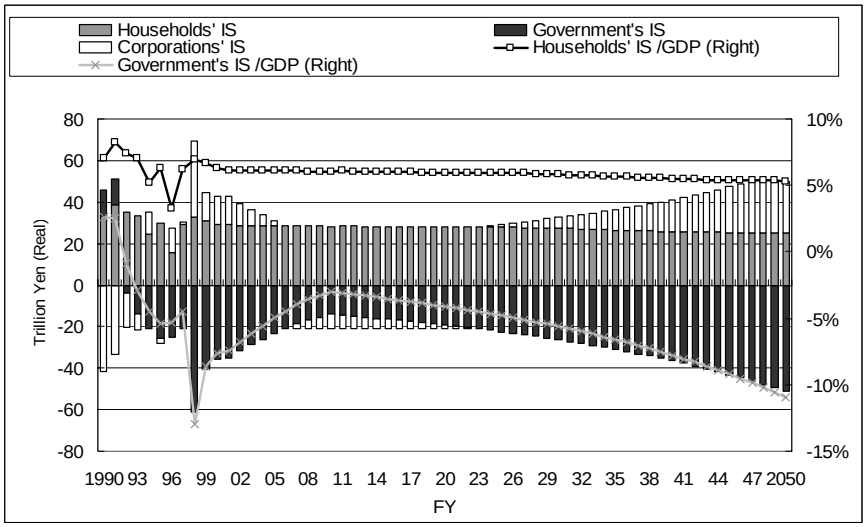
Case 3-2 Interest rates increase to 3% in 2050,
1% real growth rates, constant primary deficits

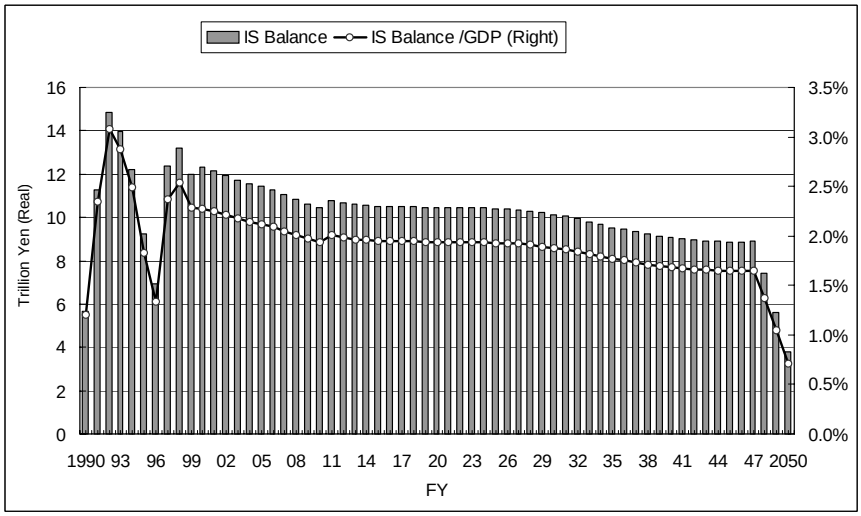


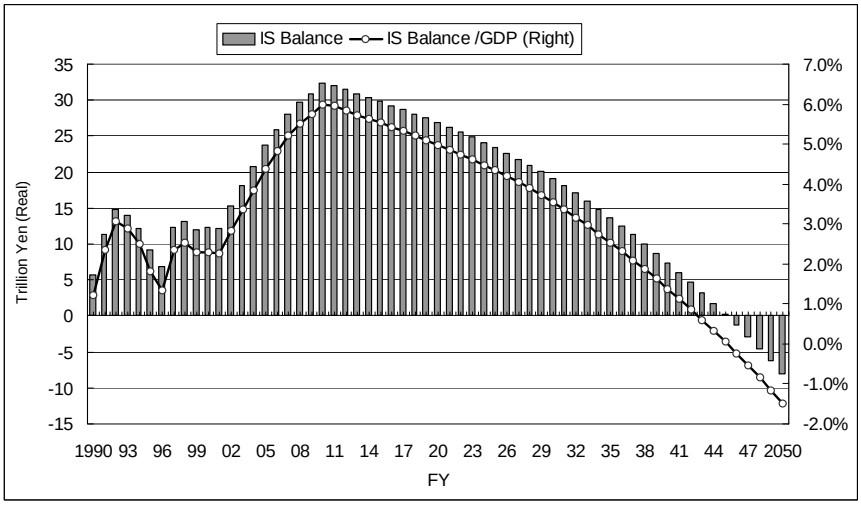




Case 3-3 Interest rates increase to 3% in 2050,
constant real growth rates, primary balance in 2010

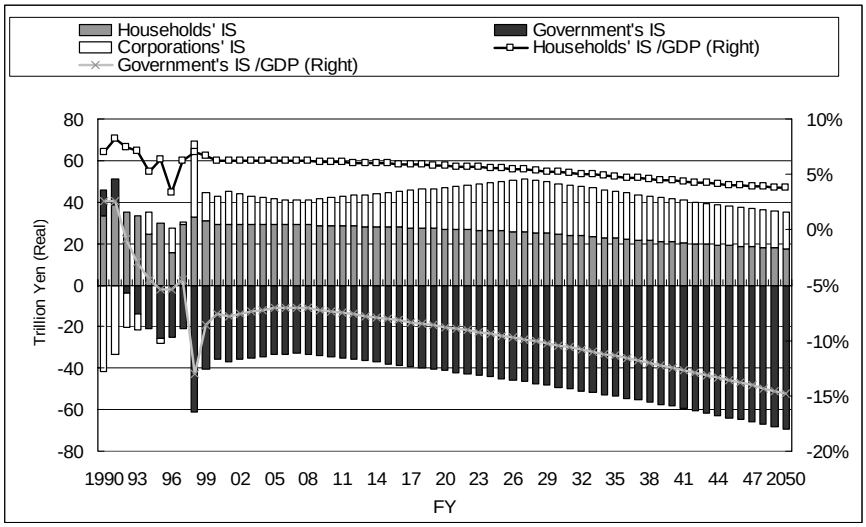


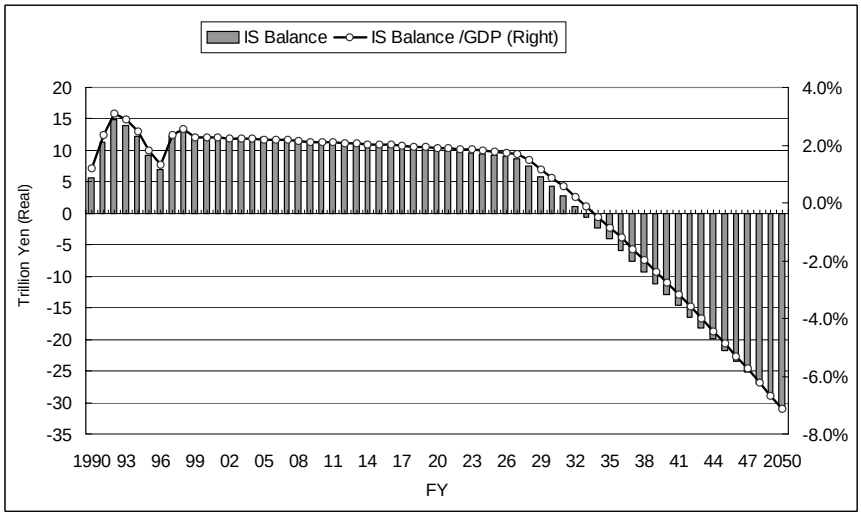


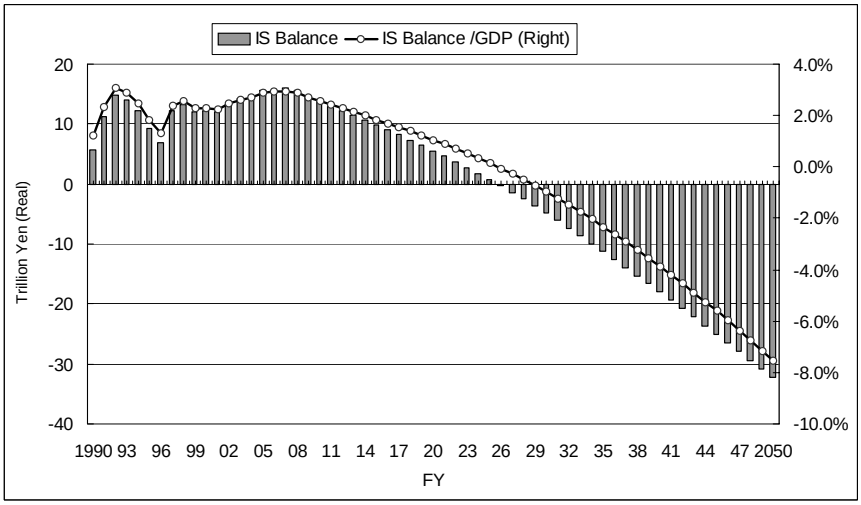


4. Constant real GDP per Capita Case

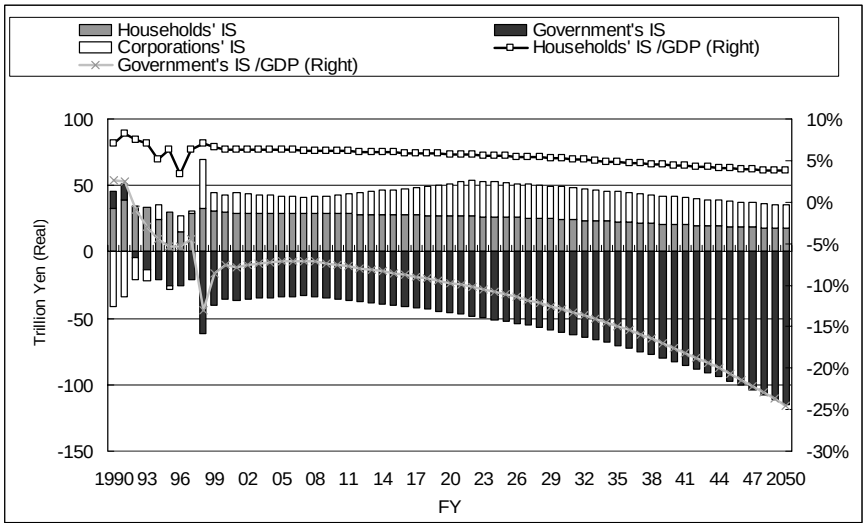
Case 4-1 Constant primary deficit, constant interest rates

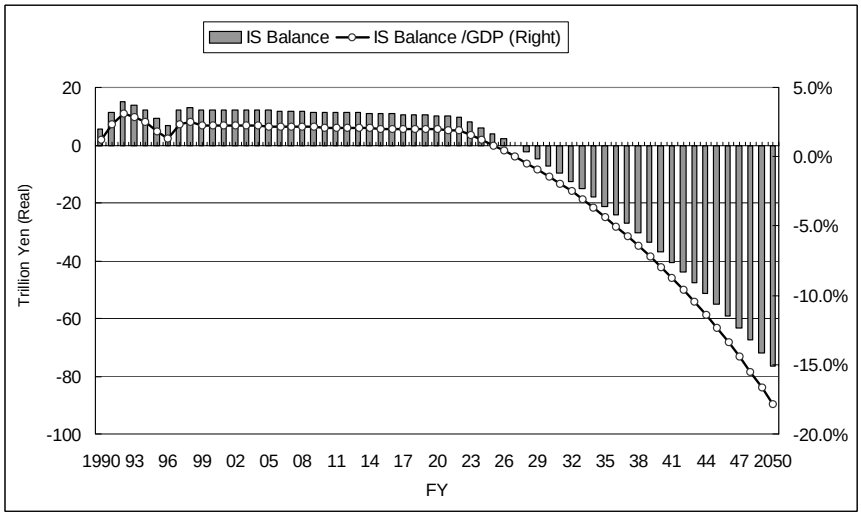


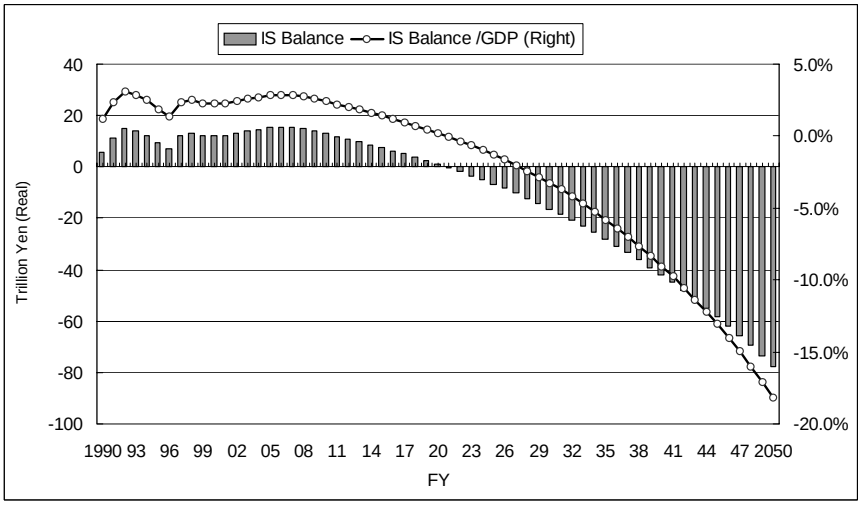




Case 4-2 Constant primary deficit, Interest rates increase to 3% in 2050







Case 4-3 Primary balance in 2010, constant interest rates