Macroeconomic Impacts of Aging in Japan

Takatoshi Ito and Masao Tsuri*

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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

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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 Three Statistical Data

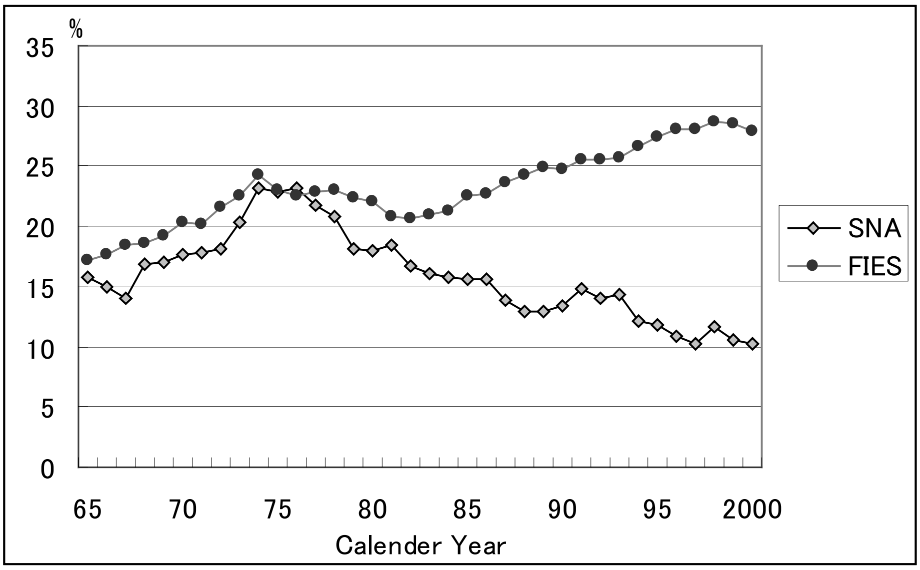
There are three different statistical data sources to infer household consumption-saving behavior. The three reports are as follows: (1) the Family Income and Expenditure Survey (FIES), the Ministry of Public Management, (2) the National Survey of Family Income and Expenditure (NSFIE), the Ministry of 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 show rather 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.

There are other differences between the NSFIE and FIES. One-person households are included in the NSFIE survey, but not in the FIES survey. 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 1 illustrates the saving rates of the FIES and SNA. SNA rates have been declining after 1975. On the other hand, the FIES rates have an upward trend after 1980. The reasons of such differences are that the NIES does not calculate the imputed values of house rents, social insurances, and one-person households. (see Ueda and Ohno (1993) in detail.)

Figure 1 Saving Rates, SNA and FIES



Note: The SNA saving rates before 1990 are that of SNA68, and 1990 and after are that of SNA 93. Saving rates are the ratio of saving over disposal income.

Since we cannot analyze the saving rates of the difference ages with SNA, we use the NSFIE which has an advantage of larger samples. The saving rates based on the NSFIE are estimated following Takayama et. al.(1989), Hayashi(1997), and Higo(2001). The basic definition is,

saving rates = (disposal income –living expenditure) / disposal income,

where,

disposal income = annual income – income tax

– social insurance – other non-living expenditure

The data of the income tax or 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 the bonus so that it is estimates as,

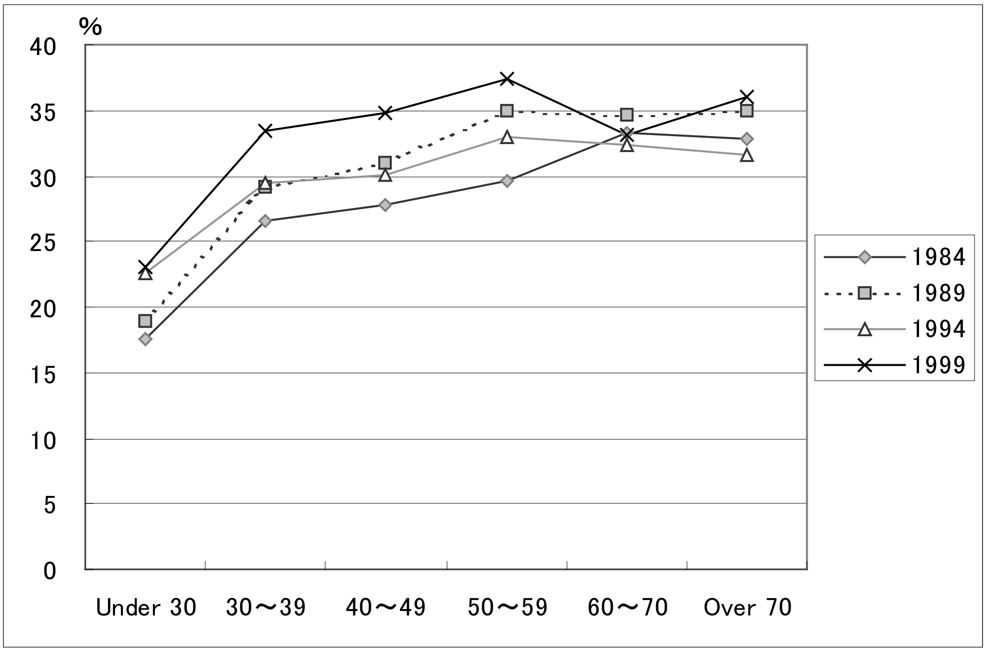
$$\textit{direct income tax} = (\textit{direct income tax(per month)}/\textit{income(per month)}) \times \textit{annual income}$$

The expenditure also needed to be adjusted, since that of the NSFIE is the value of average monthly expenditure only during three months from September to November. As for the one-person household, the data is the value of average monthly expenditure during two months of October and November. Since household expenditure usually shows seasonality, simply multiplying the monthly expenditure by twelve is not appropriate as estimated annual expenditure. To solve this problem, we multiply it by the factor estimated from the ten-year average weights of the three months (September, October, and November) from the FIES. The ten-year average is the average from 1991 to 2000 for NSFIE 1999; that from 1986 to 1995 for NSFIE 1994, and that from 1981 to 1990 for NSFIE 1989. The multipliers are usually more than 12.5 and less than 13, for example, that of the workers' expenditure is 12.79.

We have estimated the saving rates by different characteristics in 1984, 1989, 1994, and 1999: by age brackets—six age brackets, under 30, 30 to 39, 40 to 49, 50 to 59, 60 to 69, and 70 over or more; 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). Hence the number of the total estimated saving rates is 36. Note, the definition of workers household is the household of 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 results are shown in figures 2 to 4. Since the NSFIE captures the consumer behavior just in every five years, general trend is difficult to be extracted. The saving rates of the young (under 60) are higher than SNA or FIES, but those of the old are lower. Notably, the figures capture the different saving behavior of the old, depending on the types of households. Hence, we need to investigate the difference in income-expenditure relationship among the old by types of households.

Figure 2　Saving rates of two-or more household, NSFIE



Note: Rates of two or more households (workers and non-workers)

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

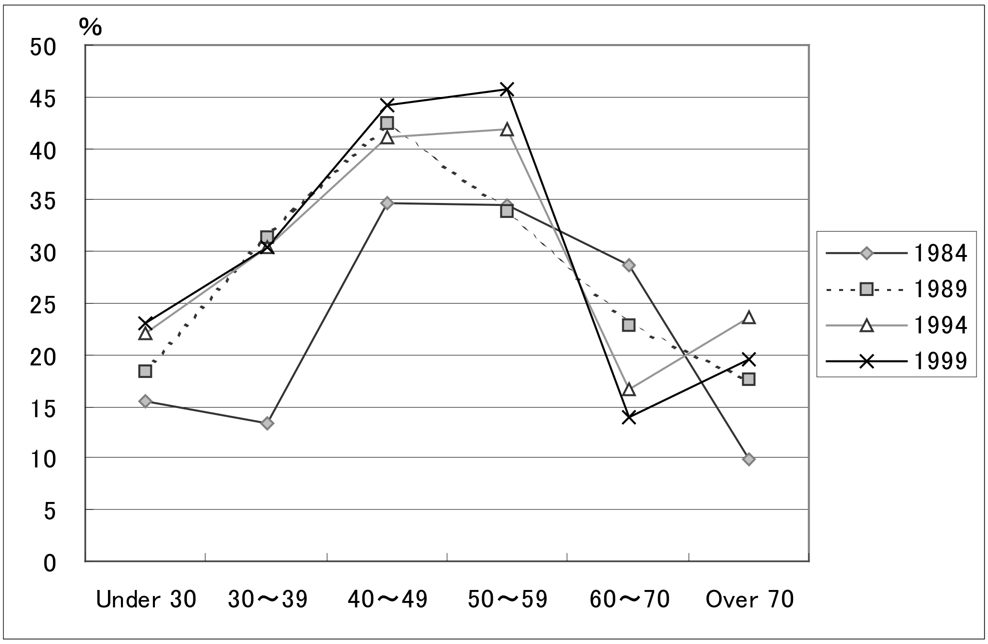
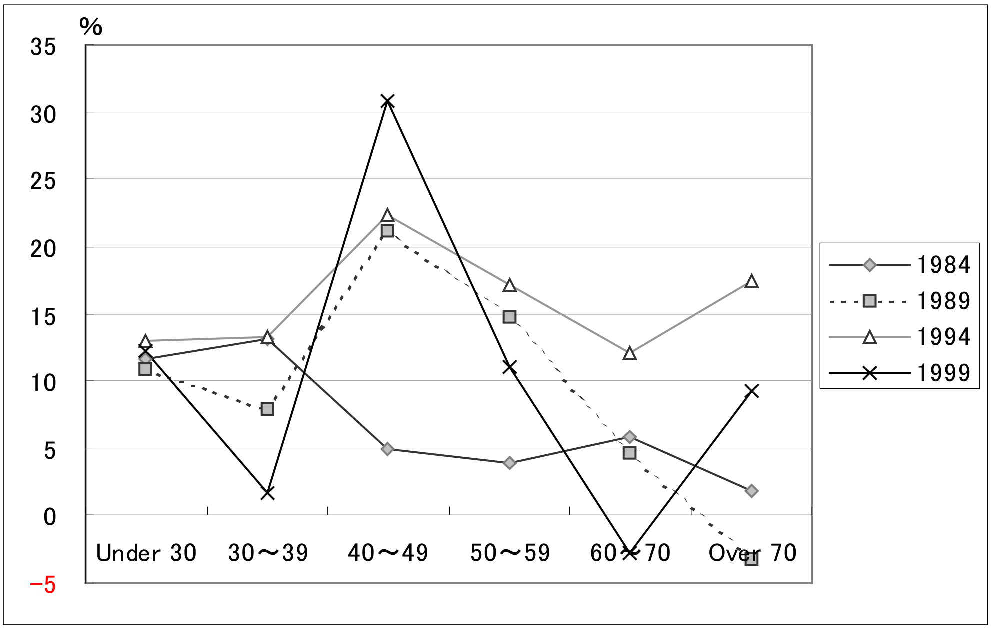


Figure 4 Saving rates of one-person household (female), NSFIE



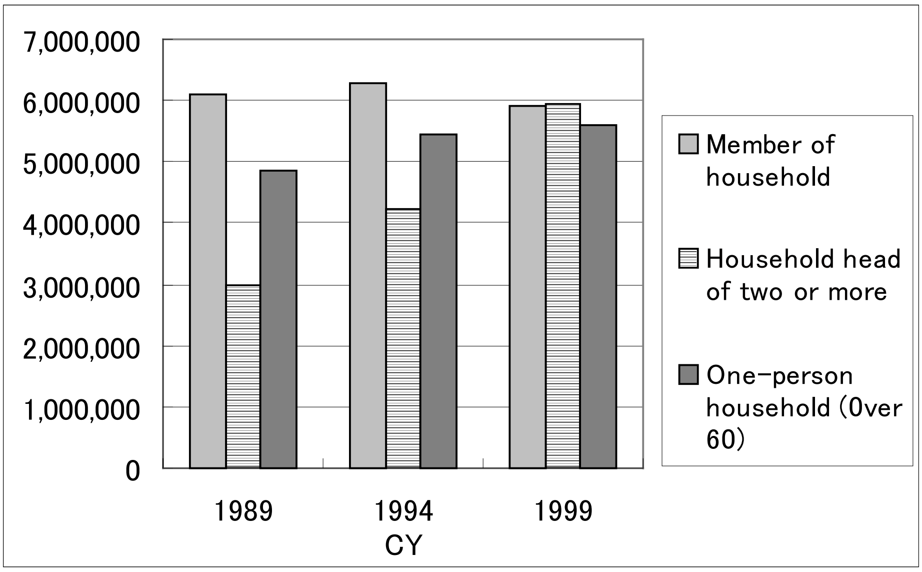
2.2 Saving Rate of the Retired

The life cycle theory (without bequest motive) predicts that the retired people will run down their asset, so that the 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 even higher than those who are younger. 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 head but a member of household. Each is divided into two categories, (1) the employed and (2) the 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 5 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 the accurate living expenditure of the older of household members is almost impossible from the NSFIE which has some data of the behavior of the older. Some researches, such as Hayashi(1986), and Yashiro and Maeda (1994) take this problem into account. They derive the old ages' income by taking the difference income or expenditure between households which have the old ages and which have not. We need to divide the household's living expenditure by some approximation.

The ratio of over 65 of household is available in 1989 NSFIE and after so that we derived simply the average income or expenditure per household (not per person) using the ratio of over 65.

First, we make an assumption on 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.

$$D_{it} = a_{it}\, y_t,$$

where, D is the average income of over 65 per household, y is average income of over 65 member, a is the over 65 ratio, the subscript t is time of periods and i is the index of brackets and households' types. This method can be justified because most of the older who are not the households heads are unemployed. Their source of income .is limited just to 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,

0.28 x 43 million yen = 12 million yen.

If we define C_i as the households' expenditure then a_iC_i is that of per household value. Then the average over 65 expenditure per household, E_i , is given as,

$$E_{it} = \frac{\sum_i a_{it} n_{it}\, a_{it} C_{it}}{\sum_i a_{it} n_{it}}.$$

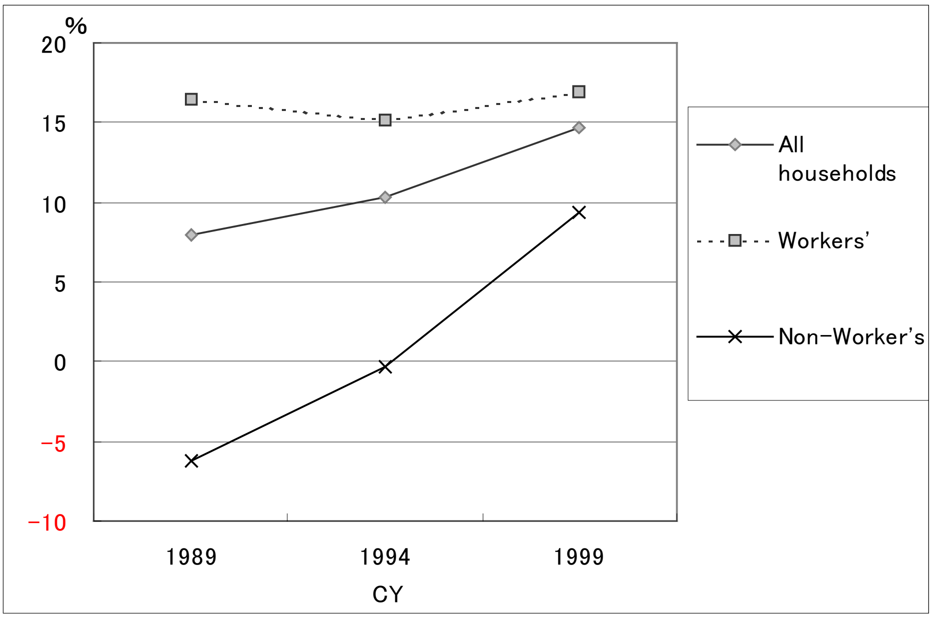
where n is the number of households of each brackets, and a_in_i is the total number of over 65 members in the bracket. Then, the average saving rates per household of over 65 members are given by,

$$s_{t}{}'_{65} = E_{it} \;/\; y_t,$$

This method of estimating the expenditure has some problems. The living costs may differ between the younger and the older, even if they live together. The older may need much less expenditure costs. However, the estimated expenditure of 1.27 million yen.in 1999 is not big so that we do not make any further adjustments.

Figure 6 shows the estimated saving rates of over 65 members of workers' and non-workers' household. Note the level of rates especially depends on the assumption of their income and expenditure. For example, if we do not multiply the pension by 1.25 then the rates become negative in many cases. The saving rates of workers' household are just above 15%, and stable throughout the years. This rate is much less than the first estimation of saving rates of the older. The saving rates of non-workers' household have an upward trend.

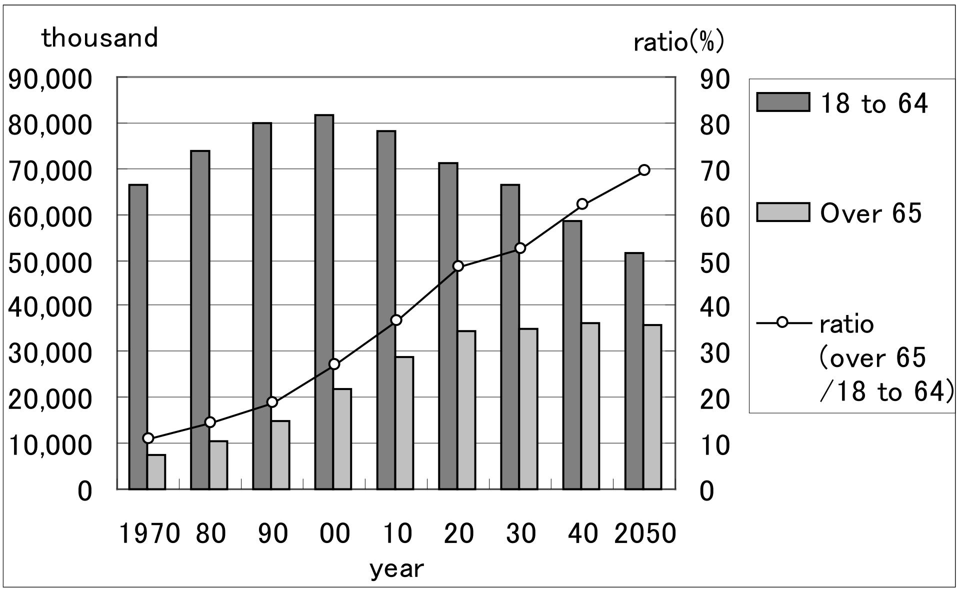
Figure 6 Saving rates of over 65 members of household



2.3. 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 according to the population aging. Figure 7 shows the ratio of the old age (over 65) over the young age (defined as the population of 18 to 64). As shown in the graph, the number of the young is declining since 2000, the number of the old age is almost double in 2020, and the ratio of the old to the young is 70% in 2050.

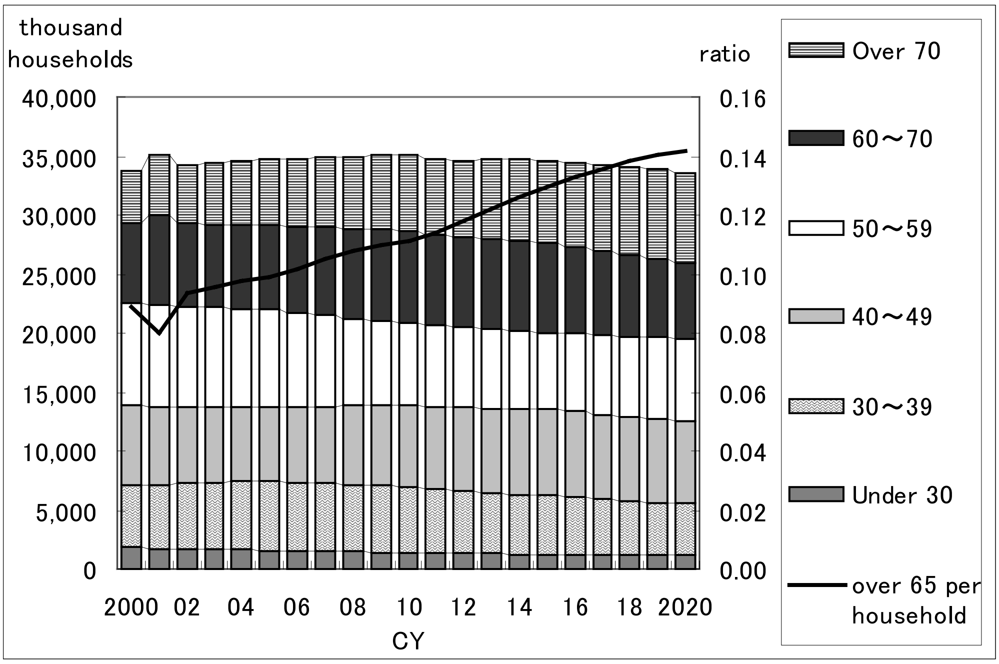
Figure 7 Number of population, and ratio of over 65



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.

Figure 8 shows the high variant projection of households estimated by National Institute of Population and Social Security Research. This projection is based on “Population Projections for Japan, January 1997”. We do not use the medium projection but the high variant projection because recent up dates of population projection (January, 2002) done by the same institute show higher ratio of the older, and the high variant projection of 1997 is almost same with the medium variant projection of 2002. Though the new households projection has not issued yet, it will also be adjusted to the more aging pattern.

Figure 8 Projection of households by age of household head



Source: National Institute of Population and Social Security Research (2000), high variant projection.

Note: Over 65 per house household the average ratio estimated as, （number of total over 65 years old number of 65 years heads household of one or more）/ (total population)

2.4. Simulation of the Household Saving Rate

As shown in the previous section, the population is likely to be aging so that it is important to find the impact of it to the savings. First, we need to adjust the saving rate, considering the behavior of the old age of household members. The method of estimating the rates of over 65 members of households has been already described up above. The adjusted saving rates are just weighted average of s'_{65} and the original saving rates.

The adjusted saving rates of households without over 65 member except over 65 bracket, s_i', can be given as

$$s_{it}' = (C_{it} - a_{it}E_{it}) / (W_{it} - D_{it}),$$

where all symbols are defined same as before.

The figure 9 to 12 compare the difference between the adjusted and not-adjusted saving rates of 1994 and 1999. As can be seen in figures, the adjusted saving rates of over 65 are significantly lower than the originals in all cases, though still positive.

Figure 9 Adjusted saving rates of workers household, 1999

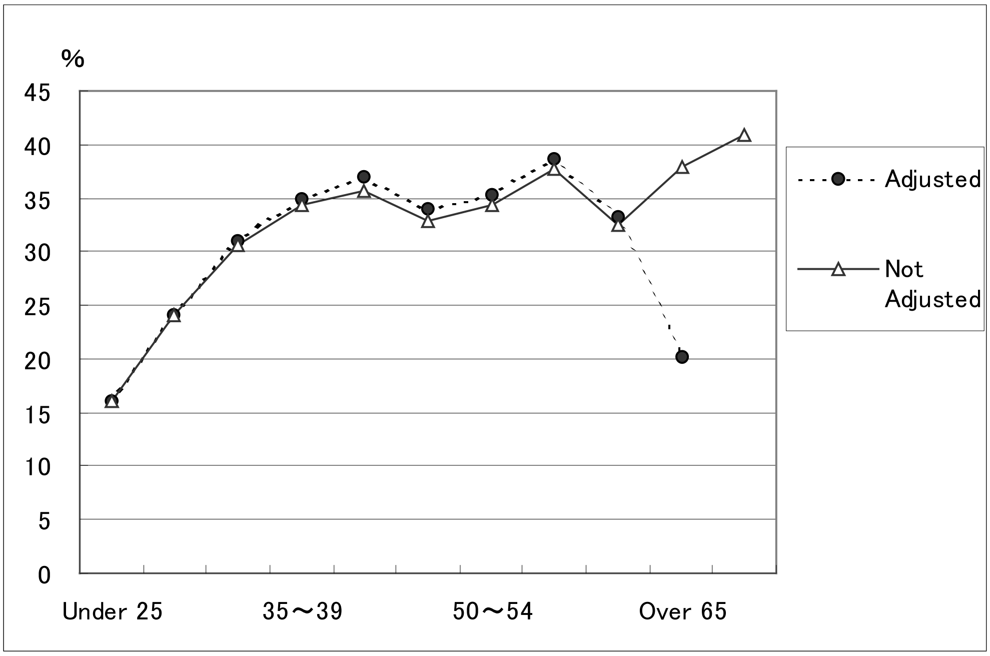


Figure 10 Adjusted saving rates of non-workers household, 1999

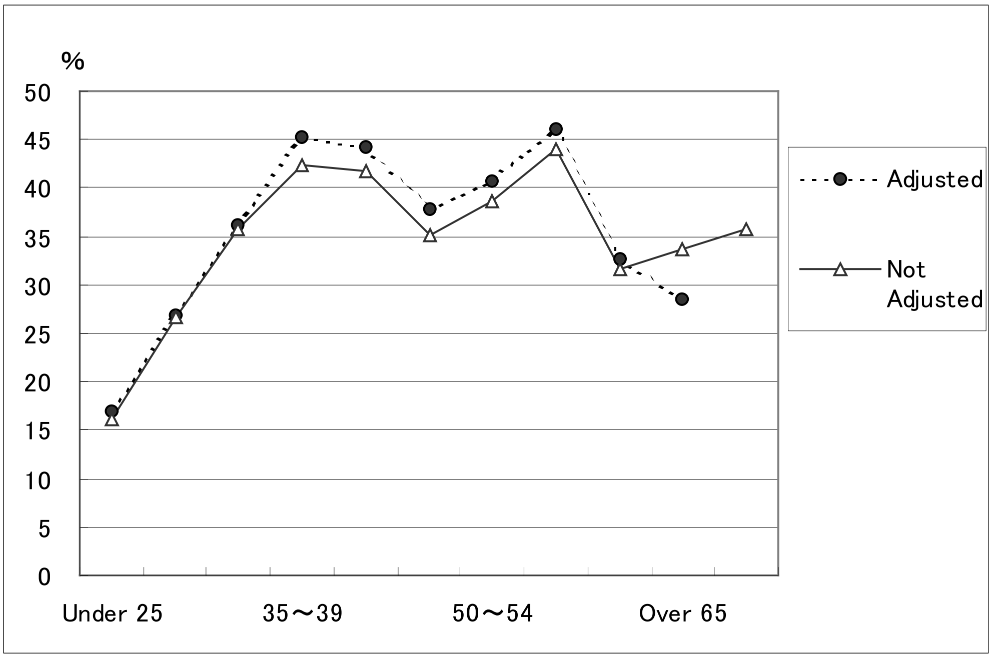


Figure 11 Adjusted saving rates of workers household, 1994

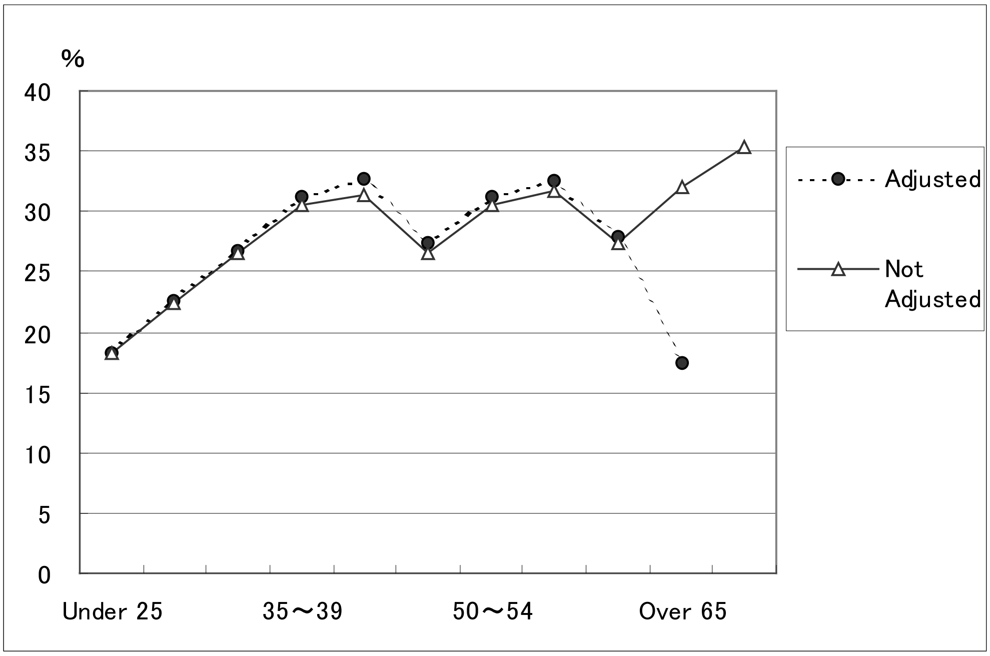
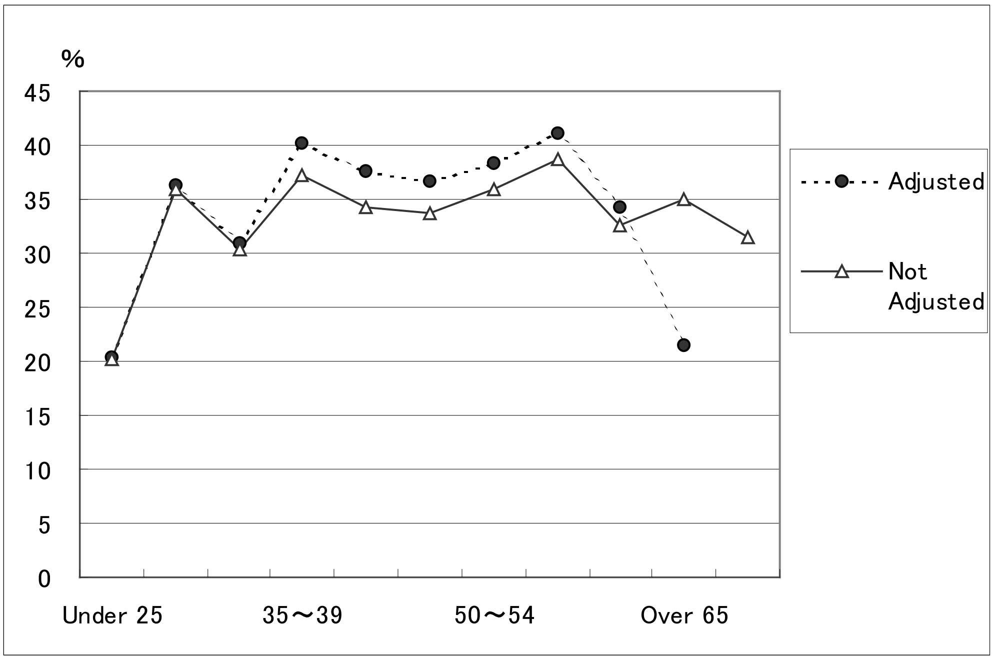


Figure 12 Adjusted saving rates of non-workers household, 1994



Next, we simulate the future saving rates considering the expected increases of the old age. The basic estimation is about the pure effects of aging. Many economic factors, such as government behavior, economic situation, and investment movements, may change the saving rates. However we simply assume other things to be equal to analyze the effects of aging alone. To add other things is ad hoc without appropriate general economic models. The average of 1999, 1994 and 1989 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 higher variant projection of the National Institute of Population and Social Security Research 2000. Here, we use the projection of not the population but the number households. The reason is that the saving rates are estimated from the households' income and expenditure so that to reallocate them separately to each member of households is difficult. In this sense, the result depends on the relation between population and the households. We use the projections of NIPSSR 2000 about the number of households, though we adjusted the saving rates of the older by population.

We have estimated the saving rates of workers and non-workers households as shown, but we make saving rates of their averages since future trend of workers or non-workers cannot be estimated. There are 6 age brackets. Each has one-mail, one-female, two or more types. In the simulation the saving rates of workers' and non-workers' are averaged by number weights of households. There are 18 different saving rates, and the number of each bracket is given.

$$s_t = \sum_i h_{it} s_{it} \ ,$$

where i is a factor from the sets of household brackets and types, and

$$h_i = \frac{n_i}{\sum_i n_i} \ ,$$

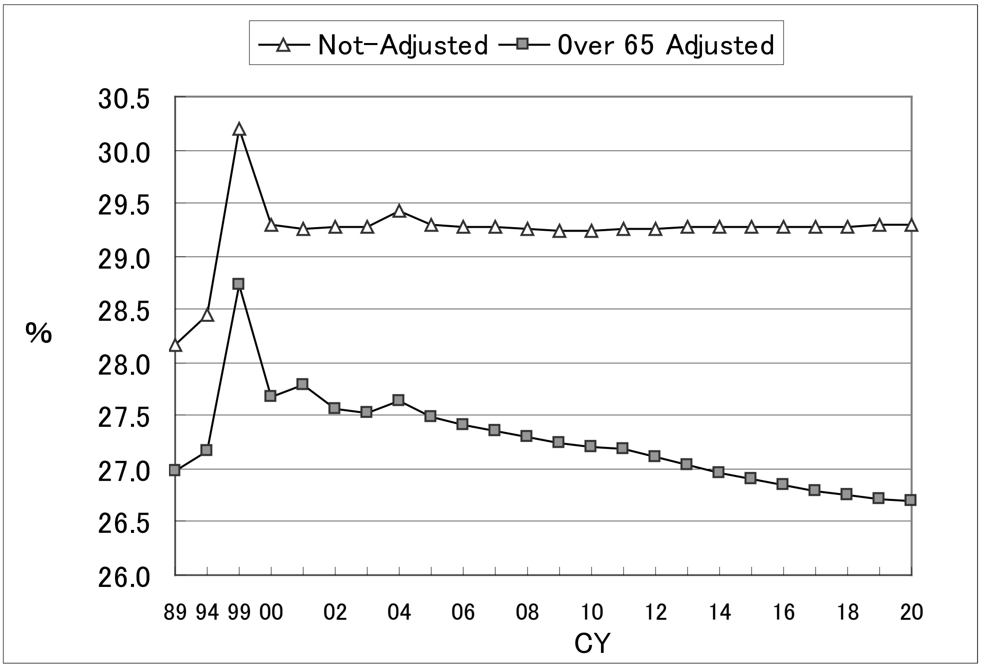
where n is the number of household of each bracket.

The average rates of all brackets and households' types are induced by weighted average again. However, additionally the behavior of over 65 members of households must be taken into consideration. Subtracting the number of over 65 heads households and one-person households from the total population of over 65, the number of over 65 members, , can be estimated. Then using these numbers of each year as weights over total population, we estimates the adjusted saving rates as,

$$s_t' = (1- \quad_t)\, s_t + \quad_t\, s_t{}'_{65}$$

where s' is the adjusted saving rates of all household, s is the not-adjusted saving rates , and s'_{65} is over 65 saving rates of household member. The estimated results are in the figure 13 and table 2.

Figure 13 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 survey data. Retired people in Japan seem to continue saving. If the future older people continue to save as their parents' generation, then the Japanese household saving rate may not be lowered too much. The excess asset will be bequeathed, intentionally or unintentionally. It is shown that in our best estimate, the household saving rate will decline from 28.72% in 1999(actual) to 27.20% in 2010, to 26.69% 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:

(Household saving —Household investment)

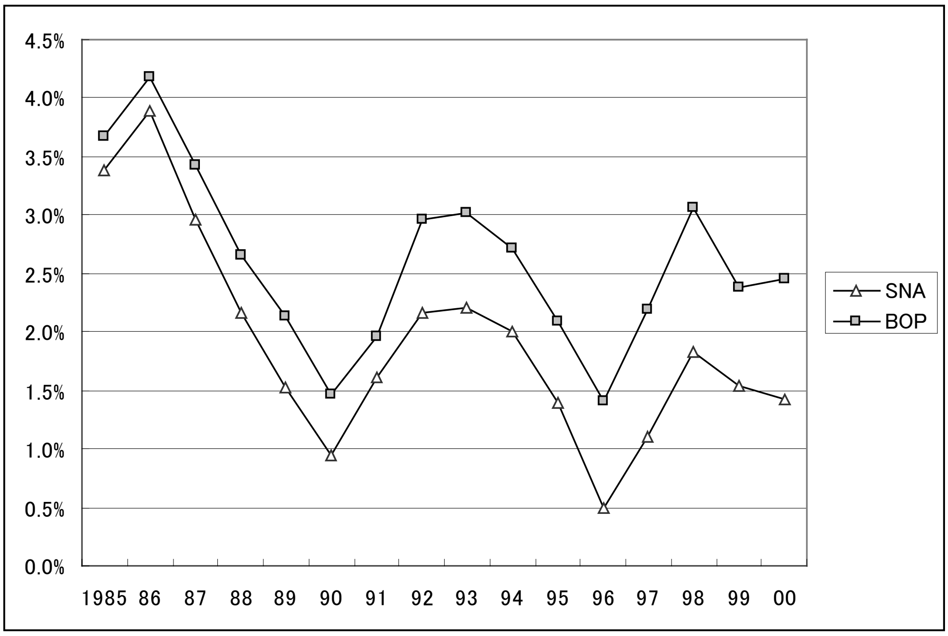
+ (Corporate saving —Corporate investment)

+ Government Sector surpluses = External Sector surpluses

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.

Figure 14 Current Account Balance (in ratio to GDP)

(the Balance of Payments, and the System of National Account)



Source: Bank of Japan, and SNA.

3.2. Simulation

We investigate the investment-saving balance with four possible scenarios. First, the base model is described. A household m maximizes the life-time utility given permanent incomes until the time of death *D*,

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

$$\text{s.t.} \quad a_{t+1} = (1+r_t)\, a_t + y_t - c_t - (\tau_t + z_t - z'_t)$$

where U_t is the life-time utility, u_t is the instantaneous utility, c_t is consumption, a_t is the wealth holding at the beginning of period t, a_0 is zero, y_t is income, τ is tax, z is the social security contribution, and z' transfer from government such as public pensions. The transversality condition is satisfied. First order conditions give

$$\frac{u'(c_{t-1})}{u'(c_t)} = \frac{1+r}{1+\rho}$$

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

Hence if we adopt the life cycle theory, a household will not leave any bequest to their child. However, such as uncertainty about the permanent income or implicit contracts between generations may give the older a reason to leave intended and/or unintended bequests. Since a household tends to receive lower income when it is younger or older, and higher 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 the possible Ricardian behavior. The assumption how a household treats taxes leads the different result of the household savings. As shown in the preceding analysis, we do not make a particular assumption, but show the possible range of saving rates.

Government corrects 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

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

The difference between expenditure and revenue shows the amount of bonds that has to be issued. The IS balance of the government sector is defined as

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

Other economic sectors, such as entrepreneurs also save, pay taxes, and invest.

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

$$Y_t \quad = D_{ht} + De_t + T_t = C_t + I_t + G_t + EX_t - IM_t$$

where D_{ht} is the households' disposal income, D_{et} is the entrepreneurial income, and T_t is government revenue. Since the ratio of D_{ht} to Y_t is stable, we assume it a constant, and assume also government tax rates to be constant. Then we can rewrite,

$$Y_t \;\; = \alpha\, Y_t + De_t + \beta\, \alpha\, Y_t$$

then,

$$De_t = (1\text{-}\alpha\text{-}\, \alpha\beta)\, Y_t.$$

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

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

$$Se_t = \varepsilon\, De_t = \varepsilon\, (1\text{-}\alpha\text{-}\, \alpha\beta)\, Y_t.$$

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

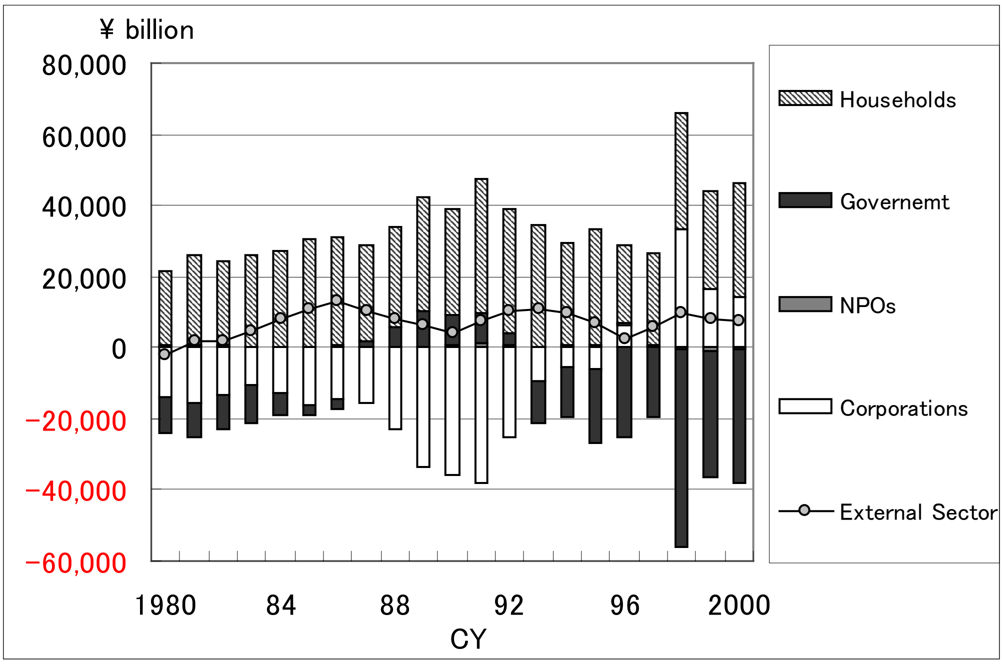
Total IS balance in macroeconomy is then given by

$$IS_t = (S_t\text{-}I_t) + (Se_t\text{-}Ie_t) + IS_g$$

$$= Y_t - C_t - I_t - G_t = EX_t\text{-}IM_t$$

The saving rates of the households and corporations sector 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.

Figure 15 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.

The most important factor in the overall IS balance is the government behavior. The government sector balance depends on the primary balance (expenditure without interest payments minus revenue without debt issues), and interest payments or outstanding debt. Figure 15 shows, the trends of the IS balance depends more on the corporate or government sector 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.

Next, we show the simulation under some cases. A model has been showed up above, and the definition is shown in Appendix.

Important notice is about the relation between household savings and government behavior. If government levies taxes harder, then household savings will decline due to the decrease of the disposal income. If government issues bond instead of taxes, then a household may increase savings expecting the future increase of tax burden. Since the degree of such effects depends on the exogenous government behavior, we just shows the households saving that is not considering 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 graphs.

(0) No population Aging

Let us start with a simulation that population aging will not occur in order to compare the population aging cases.

The first figure shows the aggregate saving and government IS balances. Since government behavior changes the household savings, both values are shown in the same figure. Second figure shows the total IS balances.

Figures shows, even if there is no population aging, the high level of government deficit may decrease the IS balance. The IS balance become negative in 2009 and ever after.

(1) Primary Balance Scenario

This is the scenario that the government sector try to reduce the primary deficit. This case assumes that the IS balances of household and corporate sectors are just changed according to government behaviors, and the government tries to reduce the primary deficit by increasing taxes or expenditure cut.

Case 1-1(constant deficit case), shows that if the government keeps the primary balance to be deficit at the same size with 2000, then the IS balance will be negative after 2009, because of the increase in the primary deficit and interest payments. The saving rates change slightly fundamentally. This means that without the change in government's behavior, it can decline drastically because of the interest payments of government bonds.

In the case 1-2 of tax increases, the IS balance is kept to be positive until 2016 though it shows decreasing trends. In this case the ratio of savings to GDP will be higher than the case of negative primary unbalance. As for the case 1-3 of expenditure cut, it shows almost same effects as the case 1-2.

(2) GDP growth scenario

As GDP increases, the income of household's increases and so does the tax revenue of the government. Note in this scenario that the gross saving increases, but so does gross investment, resulting in ambiguous change in the IS balance.

Case 2-1 is the scenario of 1% real GDP growth. In this case, the households' gross saving is increasing, though the ratio to GDP is not. So the IS balance depends on the investment. Government will receive more tax revenue so that the total IS balance will not be negative soon.

If the 2% real GDP growth without any assumptions on primary balance, or if 1% real GDP with achieving primary balance then the IS balance will be kept in positive as shown in case 2-2 and 2-3.

(3) Interest Rates Scenario

Until now we have assumed the constant interest rates of public bonds, but if the government outstanding debt is accumulated then the interest rates will most likely become higher.

Case 3-1 is the case that the interest rates increase by 0.1% every year. This simulation shows the reduction in IS balance in the case 1-1, but the degree of the reduction is larger. Case 3-2, comparable to case 2-3, shows the positive IS balance so that achieving the achieving primary balance can more than offset the negative effect of interest increases.

(4) Deflation Case

Case 4-1 is a deflation scenario. In this case even the gross saving is decreasing, and IS balance is also decreasing severely.

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 adjustment 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.

What we found was that any changes 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 not conceivable to predict the current accounts (external balance) turning negative due to aging through the channel of household saving, without any adjustment to the government budget deficits, 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

This appendix presents the method of IS balance simulation. In IS balance, private investment of each future year is almost unpredictable. On the other hand the saving can be guessed since the each brackets' saving rates are 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, and assumes that equilibrium is achieved so that GDP ,GDE and National Income are all equal. Constant rates of inflation are also given., thus nominal GDP is calculated from these two assumption.

Households' 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 distributed, the ratio of the compensation of employees are stable around 80% after 1990. So we give the compensation employees by multiplying the give GDP by 0.8. Then disposal income can be induced by subtracting taxes and social 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 of all are defined as Entrepreneurial Income,

Entrepreneurial Income=GDP - Compensation of Employees.

Though entrepreneurs' saving rates are no so stable as households', we assume the 95.18% of year 2000. Then the entrepreneurs' total saving is estimated.

Households' and entrepreneurs' investments are determined by the accelerator model, so that just depends on the growth rated of GDP.

Data of public finances are not those of calendar year, but of fiscal year beginning April 1st, but the adjustment is not easy so we use them as they are. 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)

x (outstanding government debt).

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 is 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 same amount as taxes paid by household, since taxes are assumed to be constant tax rates, revenue also depends on GDP.

Tax revenue = Workers' Income-$_1$ + additional tax

= Tax revenue-$_1$ +(current taxes-$_1$ – current taxes)

Then required amount of bond issue is the difference between revenue and expenditure, given as,

Public bonds issues = expenditure (includes debt-servicing costs) – revenue.

Outstanding debt is stock plus new issue minus redemption.

Primary balance in aspects of IS balance, can be defined as IS balance plus net interest payments. However, it is difficult to estimate precisely, we just get IS balance by assuming expenditure level, and by subtracting not net interest payments but gross payments.

Then all households savings and investments, IS balance of corporation, Is balance of Government are derived. One problem is that the estimated IS (after 2001) is not consistent to before 2000, because of rough estimation of debt-servicing costs. To solve this problem, we rescaled the 2001 value so as to be the same as the 2000 value. Real values are from GDP deflator.

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Table 1 Saving rates by groups, over 65 adjusted, all households

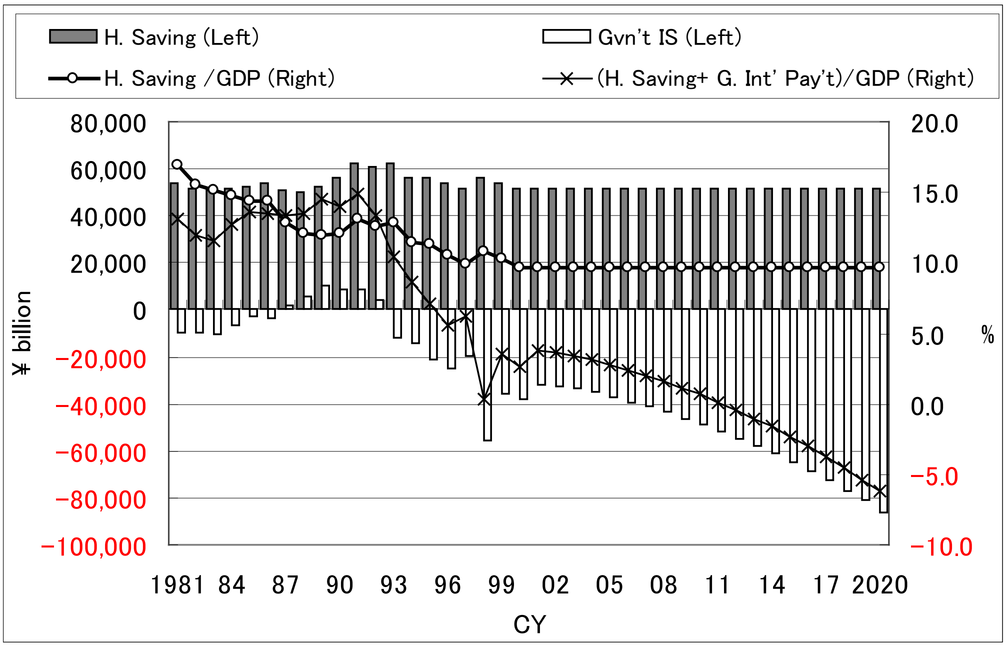
Year	1984	1989	1994	1999
Two or More Person				
Under 25	-	12.07	18.33	15.99
25～29	-	19.14	22.56	24.15
30～34	-	25.03	26.77	30.92
35～39	-	27.73	31.23	34.93
40～44	-	31.11	32.64	36.94
45～49	-	28.38	27.37	33.94
50～54	-	31.30	31.26	35.21
55～59	-	34.58	32.47	38.60
60～64	-	32.89	27.90	33.23
Over 65	-	18.17	17.38	20.24
One Person, Male				
Under 30	15.48	18.35	22.13	22.99
30～39	13.41	31.37	30.34	30.33
40～49	34.66	42.47	41.10	44.17
50～59	34.59	33.92	41.89	45.77
60～70	28.59	22.80	16.73	13.96
Over 70	9.80	17.58	23.66	19.61
One Person, Female				
Under 30	11.66	10.96	13.00	12.30
30～39	13.10	7.89	13.27	1.75
40～49	4.89	21.23	22.34	30.88
50～59	3.86	14.82	17.22	11.06
60～70	5.87	4.63	12.12	-2.78
Over 70	1.86	-3.25	17.47	9.33

Table 4 Simulated saving rates

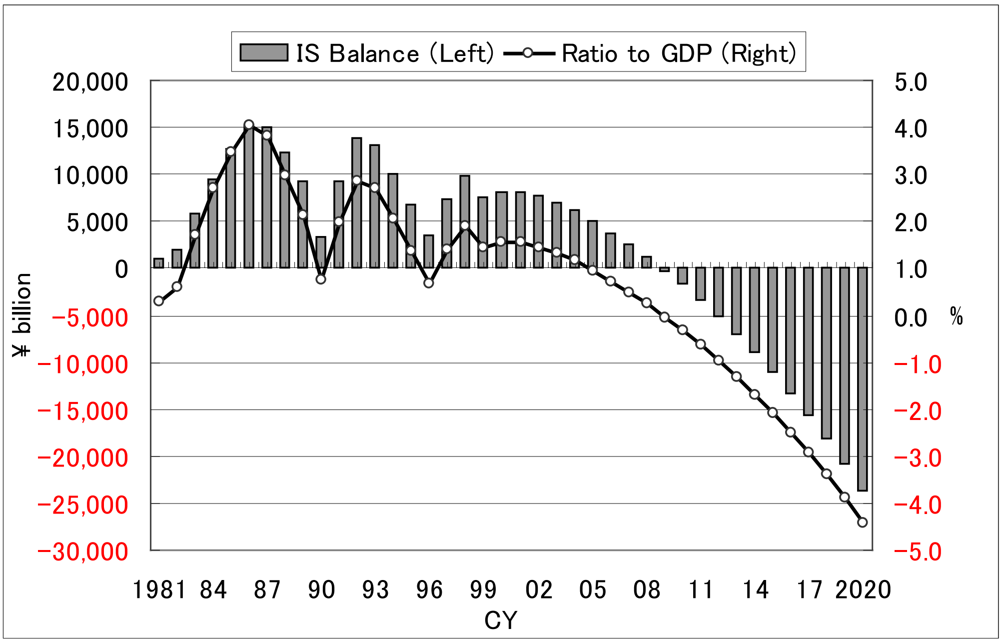
	not adjusted	adjusted
1984	25.373	
1989	28.162	26.987
1994	28.444	27.159
1999	30.191	28.724
2000	29.299	27.667
2001	29.251	27.790
2002	29.283	27.566
2003	29.282	27.530
2004	29.435	27.630
2005	29.297	27.479
2006	29.284	27.414
2007	29.270	27.349
2008	29.259	27.292
2009	29.247	27.236
2010	29.243	27.205
2011	29.261	27.179
2012	29.265	27.108
2013	29.267	27.033
2014	29.270	26.959
2015	29.280	26.901
2016	29.277	26.843
2017	29.277	26.793
2018	29.281	26.751
2019	29.287	26.718
2020	29.295	26.691

(0) No Population Aging

Households Real Saving and Saving Rates

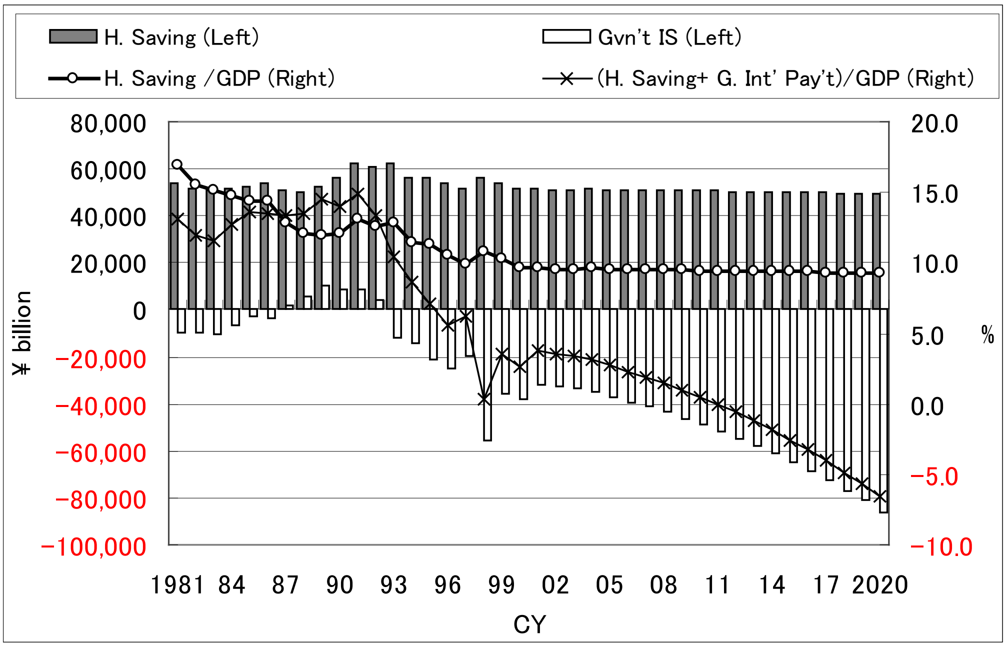


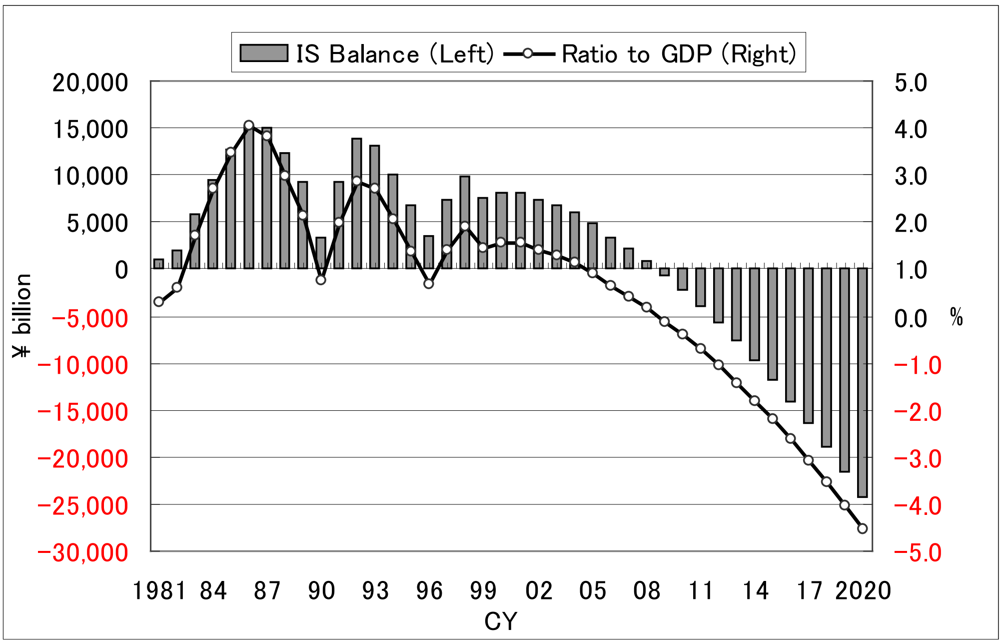
Real IS Balance and Rates



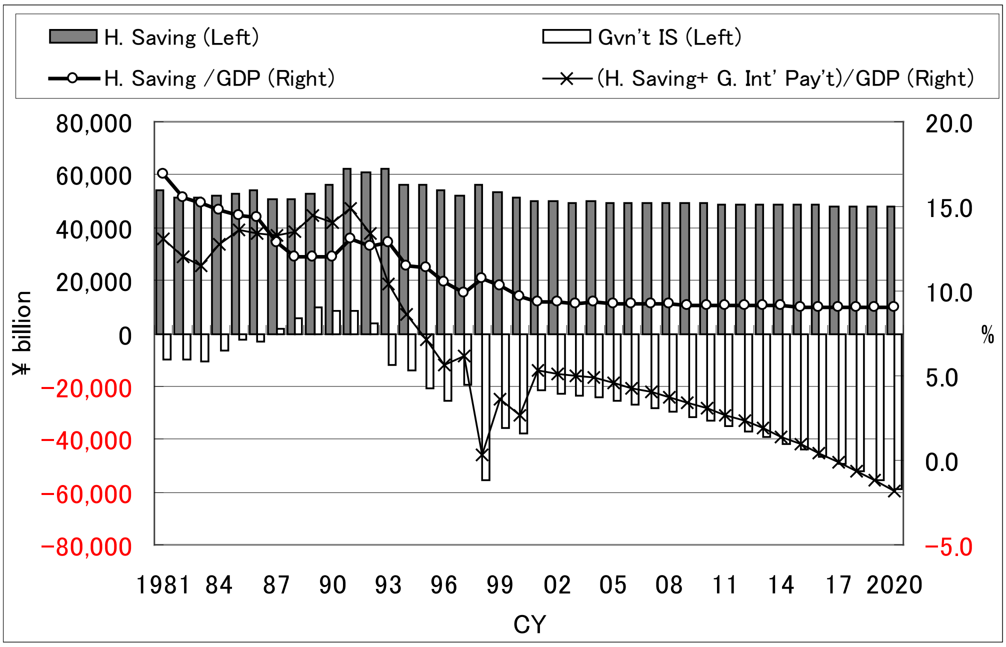
1. Primary Balance Scenario

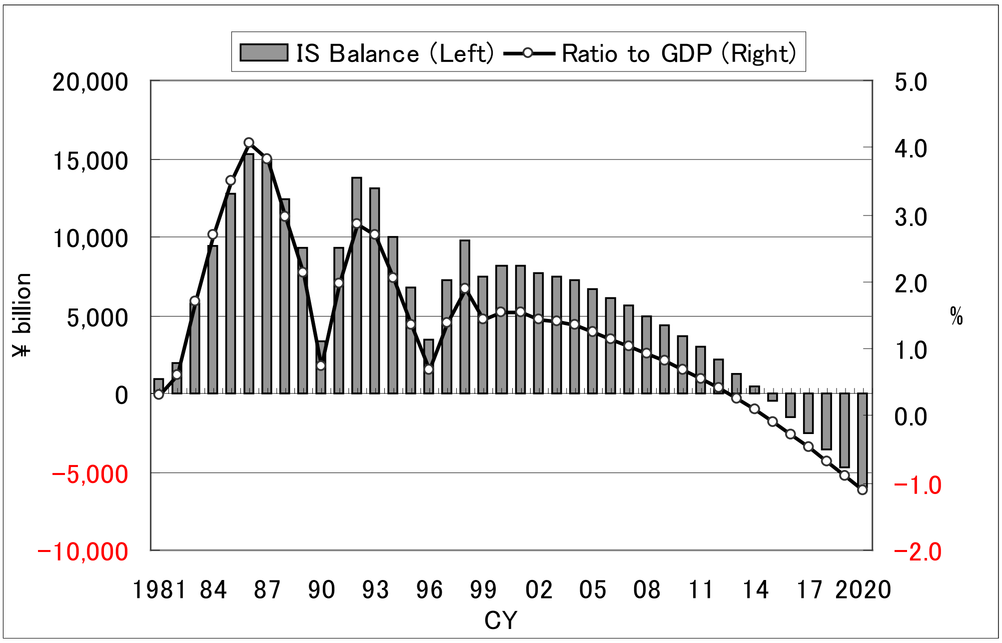
Case 1-1 Constant deficit after 2001 year



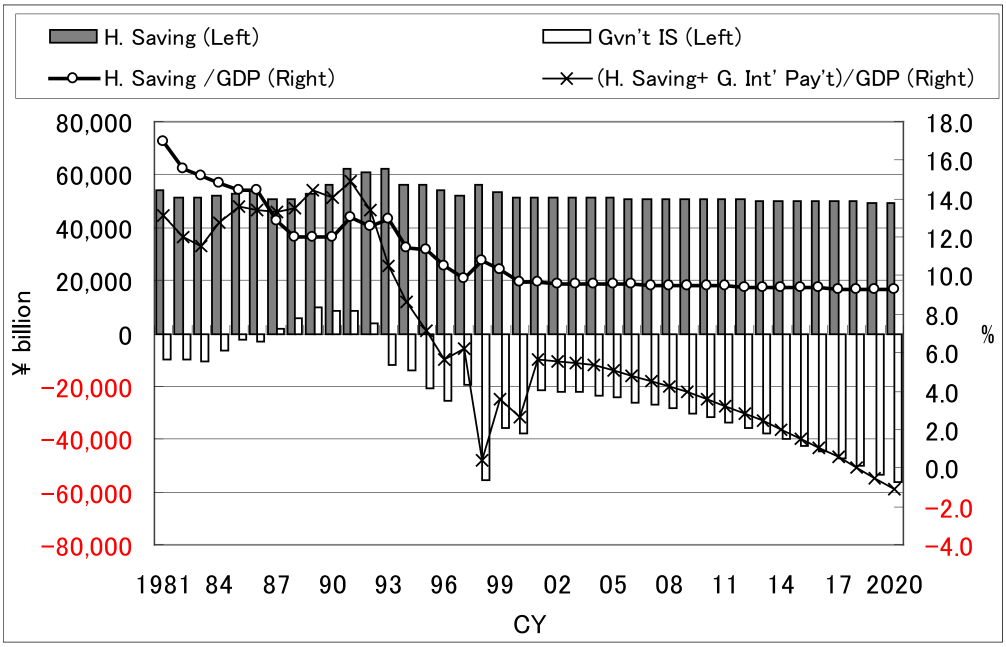


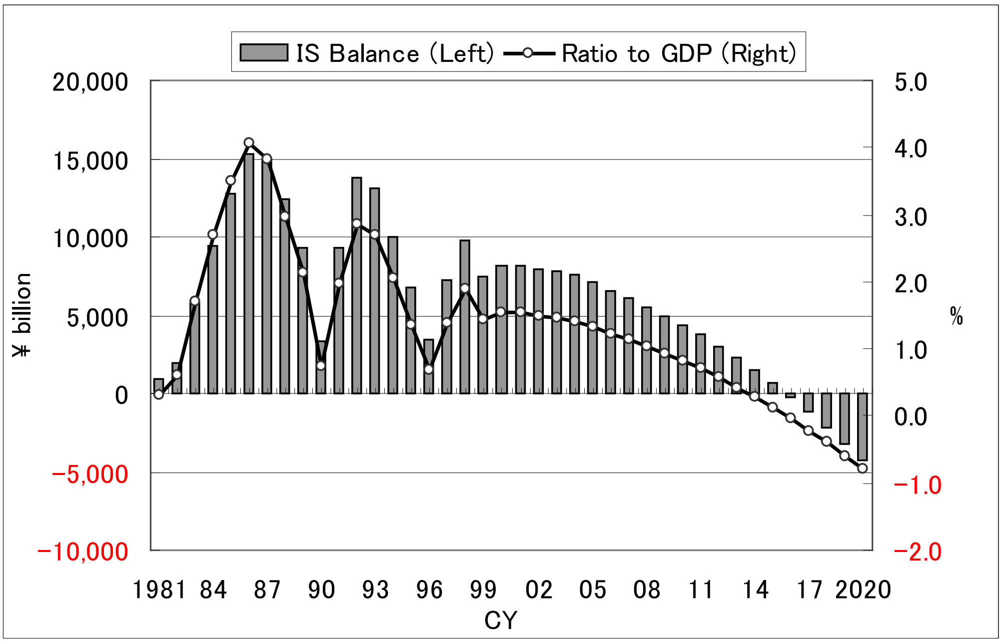
Case 1-2　Taxes increase every year by 10 trillion yen after 2001 to achieve primary balance





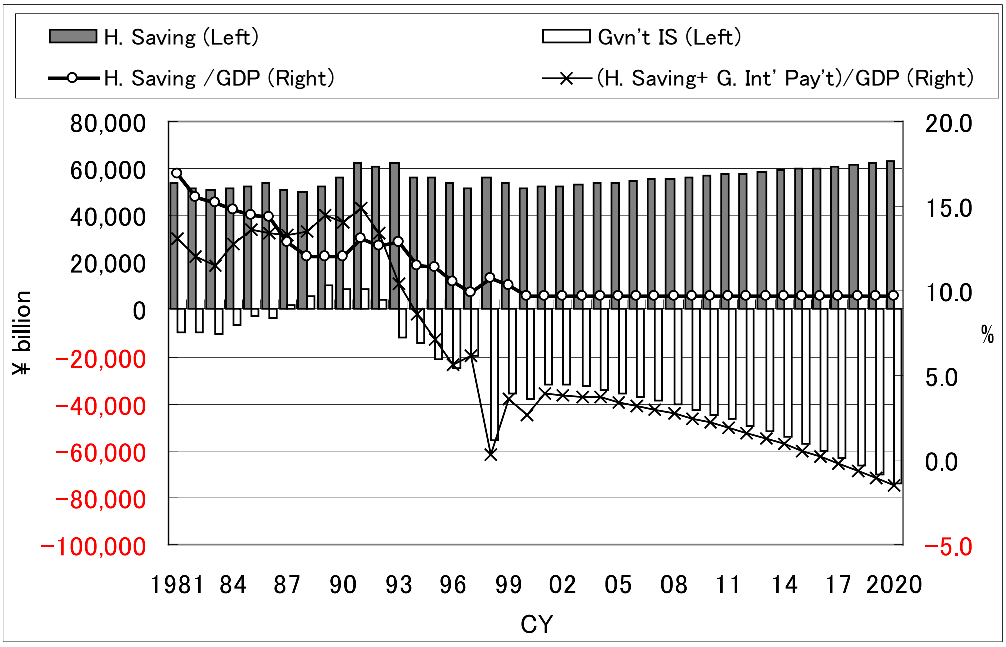
Case 1-3　Expenditure cut every year by 10 trillion yen after 2001

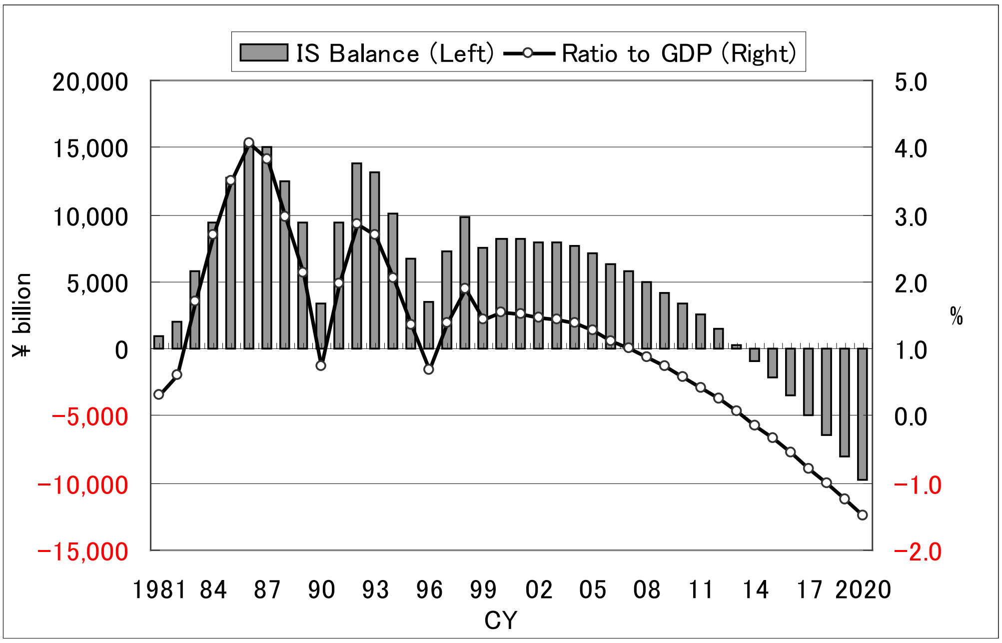




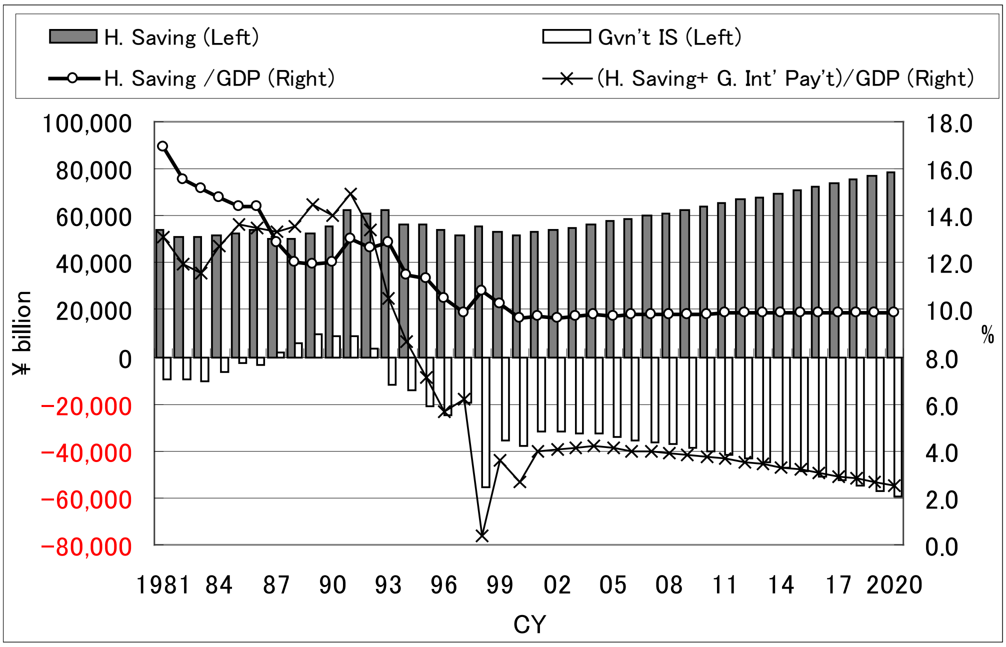
2. Real GDP Growth Rates

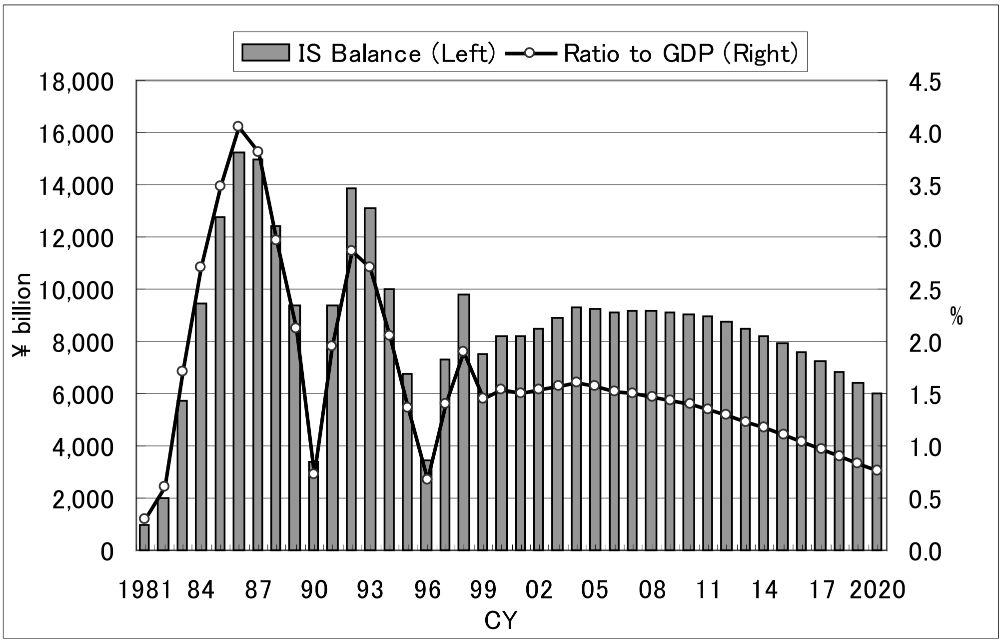
Case 2-1　1% Real Growth, Constant Primary Balance





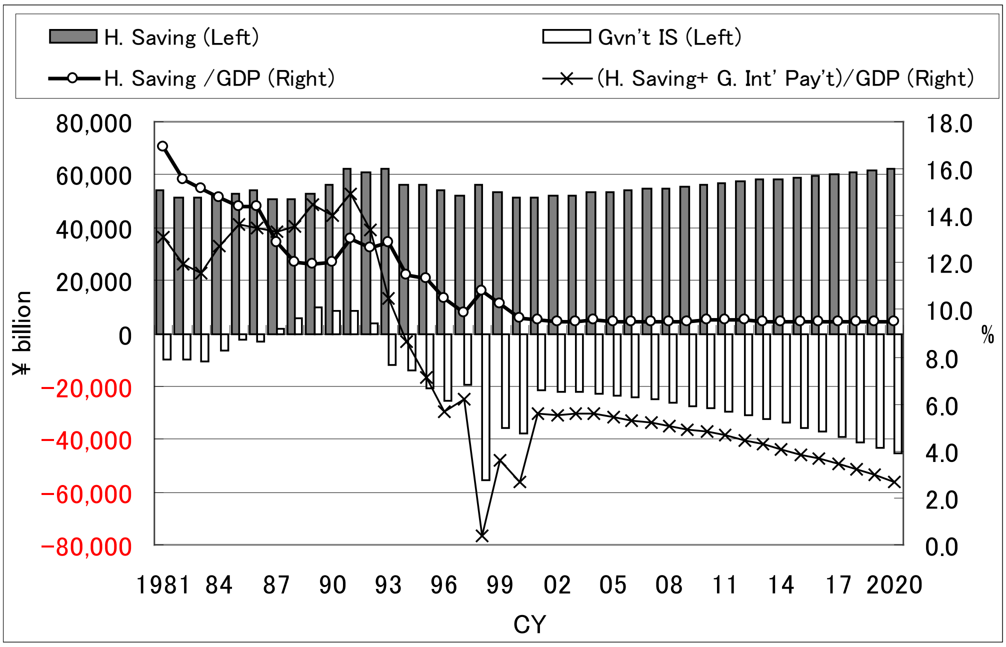
Case 2-2 2% Real Growth, Constant Primary Balance

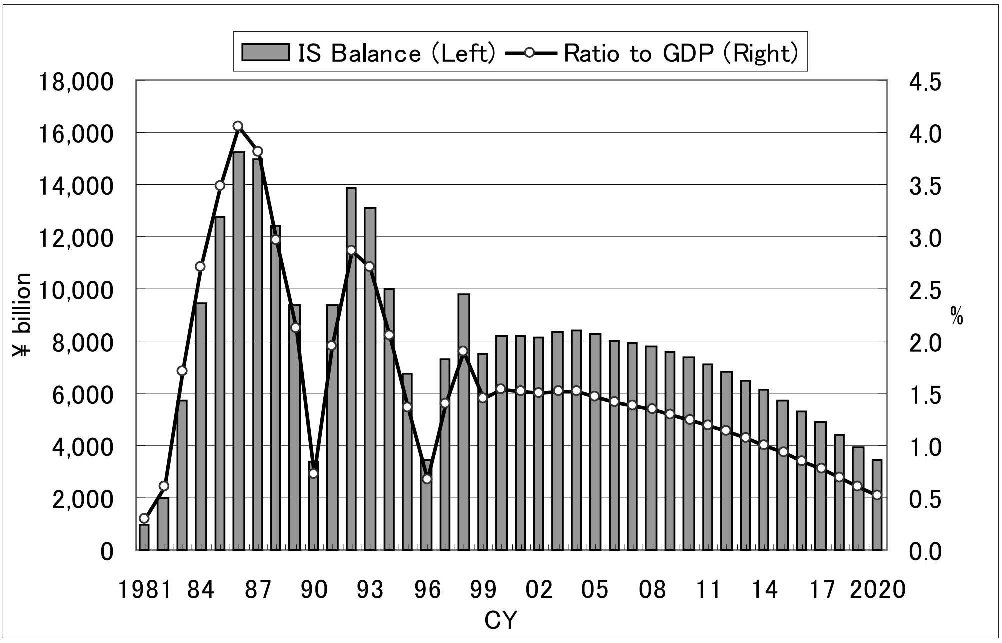




Case 2-3　1% Real Growth,

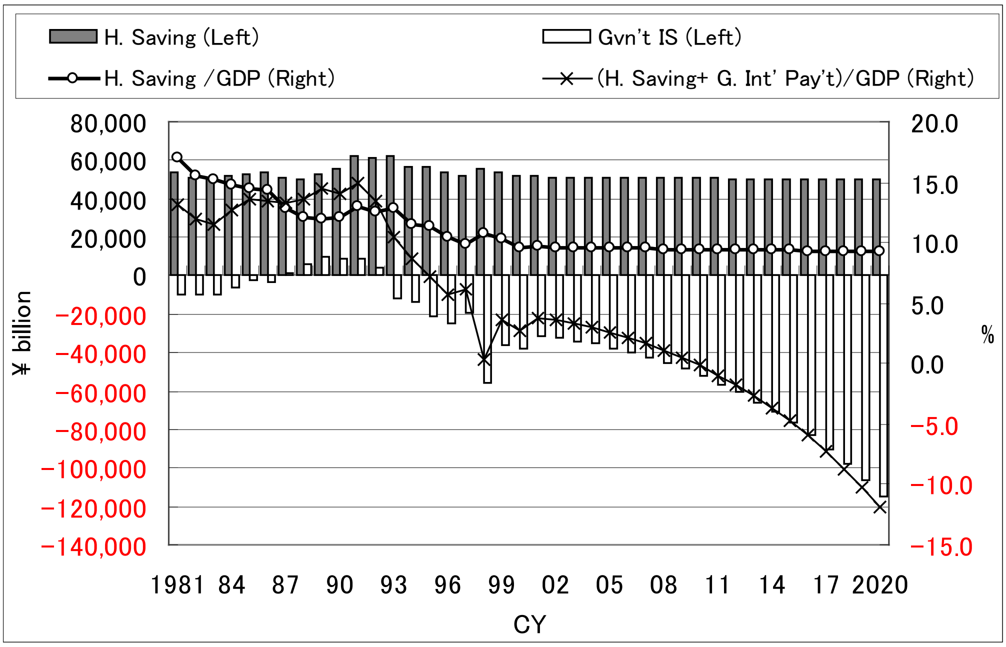
Tax increase and expenditure cut every year by 5 trillion yen (each)

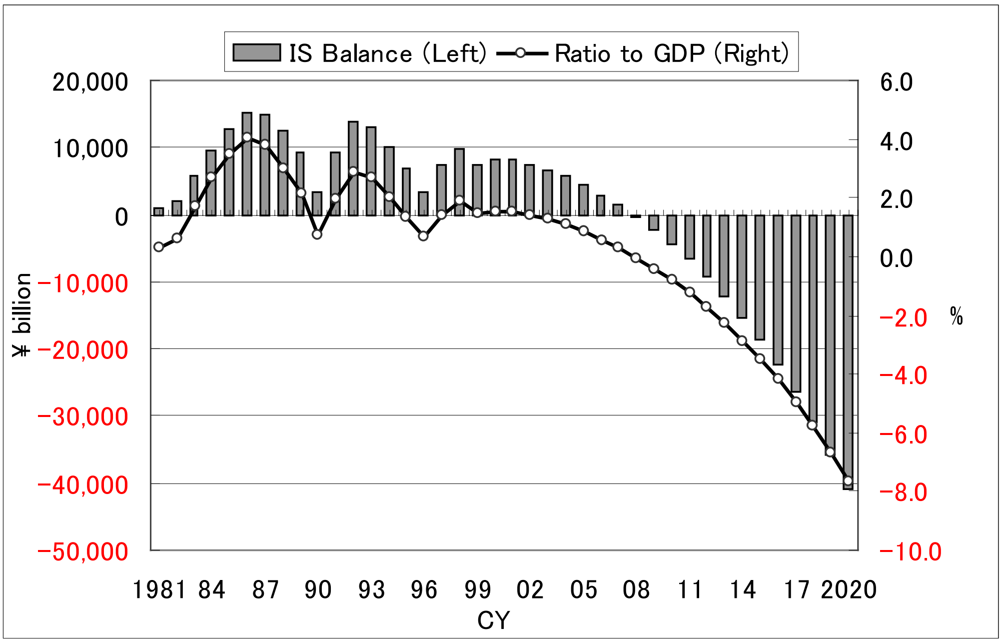




3. Interest Rates Increase

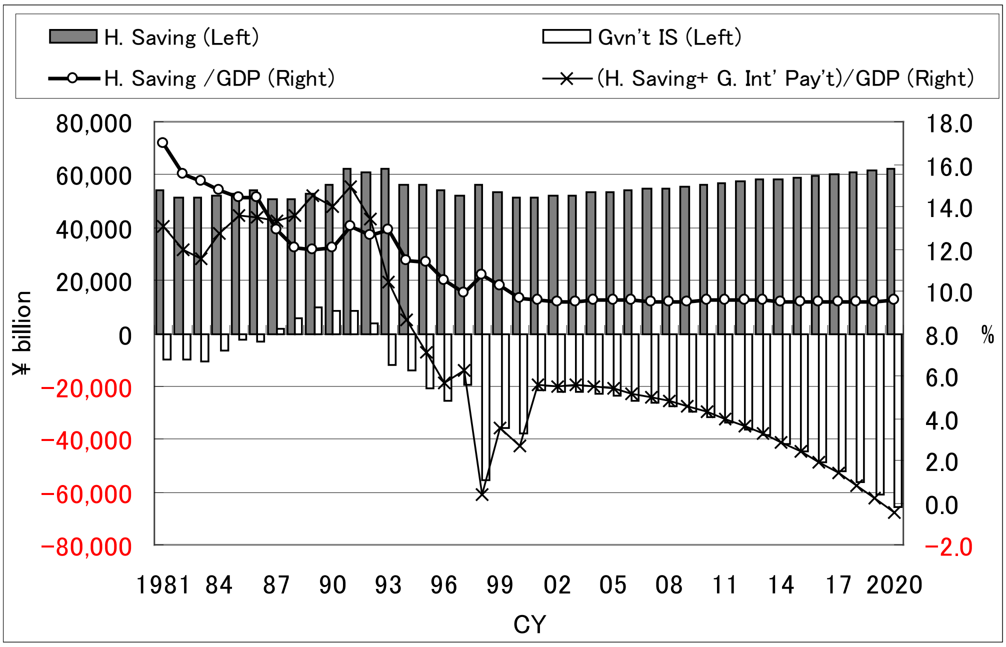
Case 3-1 Interest rates increase each year by 0.1%

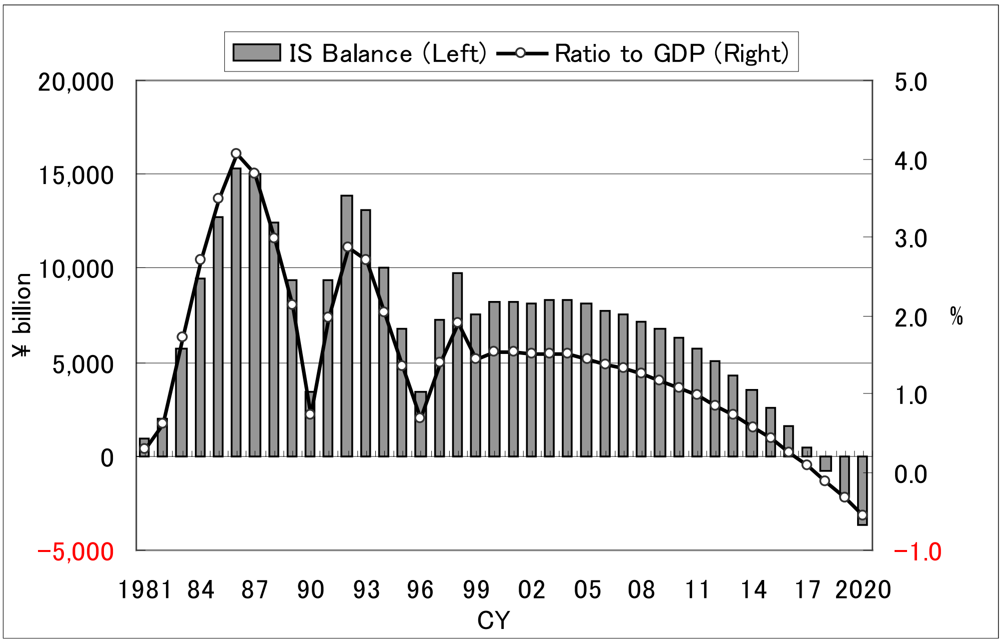




Case 3-2 Interest rates increase every year by 0.1%,

1% Real GDP growth rates, Tax increase and expenditure cut by 5 trillion yen (each)





4. Deflation Case

Case 4-1 Negative 1% Real GDP Growth and 1% Deflation