Bank of Japan Working Paper Series

Demographic Changes in Japan and their Macroeconomic Effects

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No.04-E-6
September 2003

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DEMOGRAPHIC CHANGES IN JAPAN AND THEIR MACROECONOMIC EFFECTS ♦

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September 2003

ABSTRACT

This paper examines the effects of demographic changes in Japan upon the social security system, labor market, household savings rate, and economic growth. The results are, firstly, to confirm, in the face of these demographic changes, (1) the increasing difficulty of maintaining the current social security system, (2) the decrease in the number of workers, and (3) the gradual decline of the household savings rate. Secondly, calculations based on a simple model show a reduction in the labor input and a slowdown in the accumulation of capital, indicating that the potential macroeconomic growth rate will also undergo a decline. Furthermore, in order to compensate for the decrease in the number of workers that accompanies such demographic changes, we include in the model some extreme conditions on rates of employment for the elderly and for women as well as on immigration and fertility rates. Even under such extreme conditions, it still proves difficult to completely neutralize the negative demographic effects on the potential growth rate.

JEL Classification: E17, E21, H55, J10, J21

Keywords: Demographic Changes, Social Security, Saving Rate, Labor Market, Growth Rate

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♦ In producing this paper, we have had the benefit of valuable comments from Shin-ichi Fukuda (Tokyo University), Yukinobu Kitamura (Hitotsubashi University), Takashi Oshio (Tokyo Gakugei University), and many of the staff of the Bank of Japan. We would like to offer them our most sincere thanks. Any remaining errors are those of the authors. The opinions expressed in this paper are the authors' own and do not represent the official position of the Bank of Japan or of the Research and Statistics Department.

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I INTRODUCTION

The declining fertility rate and the aging population are currently accelerating in Japan, and the total population itself is shortly expected to begin falling. It will be the first time in recent history for the population of an advanced economy to fall continuously.

Such demographic changes will have significant implications for the economy and the way the changes affect the economy is complex. In order to understand the economic effects of demographic changes precisely, a dynamic general equilibrium model is needed as shown in Auerbach and Kotlikoff (1987). Such models, however, involve mutual interactions among a number of variables, and this can make it even more difficult to focus on the effects of demographic changes alone. Realistically, most discussions have tended to adopt a simple framework to examine the relationship between demography and the economy[1].

At the same time, discussions of the declining fertility rate and aging population tend to involve a question of how to cope with them, which, however, invariably triggers some sort of value judgment. To take policy responses to the declining fertility rate as an example, there are those who believe that policy ought to be actively geared toward increasing the number of children, while there are others who consider this an issue of personal lifestyle choice and not an area to be debated lightly.

We choose, therefore, as simple methods as possible in analyzing the economic effects of demographic changes in order to avoid both the complexity and the issues beyond the realm of economics. Our approach is useful in capturing roughly when and what economic influences of demographic changes will be expected to emerge with total population imminently declining.

Since Japan's high growth period in the 1970s coincided with the entry of the postwar baby-boom generation into the labor market, there is already awareness of a certain connection between demography and economic activity in Japan. There is also a view that economic developments in the 1990s have been affected not only by cyclical factors but also by structural factors that include the effects of demographic changes. Today, the actual influence of the declining fertility rate and of the aging society on economic activity is being felt with increasing reality, and this trend is only likely to get stronger in future.

[1] Kato (2001) summarizes the treatment of population within economics.

Our aim in this paper is to focus only on the primary effects of demographic changes, and, by making some extreme assumptions, to obtain the broadest sense of when and to what extent demographic changes will influence the macroeconomy. Clearly the results obtained from such an approach are not definite and need to be treated with caution. However, at the current juncture, they provide us with a certain insight into what can be expected from demographic changes and we think such an insight is useful.

We focus on the three areas in which the influence of demographic changes is most eminently arising: the social security system, the labor market, and the balance between household consumption and saving. Current pension and medical insurance systems are founded on the implicit assumption that the number of young people is sufficient to support the aged population. As the age balance starts to collapse, the balance between contributions and benefits within the social security system is also destabilized. Similarly, as the population declines and becomes older, the number of workers also starts to fall. Within such environment, the household saving rate may also be affected and expected to decline as the weight of the dissaving elderly age groups increases. Of course there is no guarantee that people's behavior of 20 or 30 years ahead will be the same as it is now; indeed it would be more natural to assume some change. However, since it is highly problematic to forecast rationally what the change is likely to be, we assume that people's behavior within each age group remains, respectively, the same as at present in this paper, although we understand it represents an extreme simplification.

Having carried out the analysis for each of these three areas, we then make use of a simple model to look at the impact of demographic changes upon macroeconomic growth. Here again we simplify the analysis, focusing only on the primary effects of demographic changes and ignoring movements in a number of important parameters.

The paper is structured as follows. In Section Ⅱ we look at the outlook for demographic changes in Japan, based on the medium variant projection made in January 2002 by the National Institute of Population and Social Security Research (NIPSSR). Following this, we set out the influence of these demographic changes on the social security system in Section Ⅲ, the labor market in Section Ⅳ, and the balance between household consumption and saving in Section Ⅴ. In Section

VI we then take a look at the resultant effect on macroeconomic growth[2]. In addition, we also establish hypothetical conditions necessary to neutralize the effects of demographic changes, and we calculate what degree of counter shocks would have to be applied in order to alleviate the downward pressure on the economic growth rate. Section VII summarizes the conclusion of the paper.

II THE DEMOGRAPHIC OUTLOOK FOR JAPAN

II-1 OVERVIEW

According to the medium variant projections of "Population Projection for Japan" as of January 2002 issued by the NIPSSR[3], the total population is set to start falling in 2007, losing 20% over the next 50 years, and reaching half of its current level some 100 years from now (Chart 1, upper panel). At the same time, the proportion of the population made up of elderly people is set to increase rapidly by 2050, the reverse side of which is that the proportion of the young will undergo a gradual decline (Chart 1, lower panel).

Looking in more detail at the trend of declining fertility rates and population aging, we see that the so-called baby-boom generation and the baby-boom junior generation have acted in effect to accent this general trend (Chart 2). Baby-boom generation is those who were born from 1947 to 49 and the baby-boom junior generation is their children born from 1971 to 74.

Fixing our attention on these generations and looking at changes in population over time across different age groups, we see that the population of 0 to 19 years old fell significantly over the period between 1980 to 90 and recorded its largest yearly

[2] The macroeconomic growth rate will ultimately be affected by the widening fiscal deficit attributable to social security imbalance between contributions and benefits. Although this fiscal effect on growth rate is quite an important issue, it rather goes beyond the stated scope of this paper of only focusing on the primary effects of demographic changes. Therefore, we do not deal with the fiscal effect on the growth rate explicitly in this paper. Similarly the external balance, which is based on the current relationship with outside economies may also be affected by the demographic changes, however this is also an issue that we choose not to address in this paper.

[3] Unless otherwise stated, we use the medium variant projection as our baseline. Looking at past performance, actual figures for the total fertility rate are typically below these medium variant projections (Chart 5 below). Our stance to base the discussion in this paper upon the medium variant projections, however, rests on the facts that 1) the national pension systems and medical insurance systems are all constructed based on medium variant projections, and 2) using medium variant is easier to understand than alternatives.

fall since 1960 in 1993 when the baby-boom junior generation went out from the age group. According to the medium variant projections mentioned above, the rate of decline of the young population is anticipated not to reach those depths again (Chart 3).

Turning to the population of working age between 20 and 64, it began to fall from 1999 onward, reflecting the sudden decline in the fertility rate since 1980. From 2012, not only will the number of those reaching 20 continue to decrease, but the number of those turning 65 and going out of the working age group will also increase temporarily. Indeed over the whole subsequent forecast period, the rate of change in the population of working age is not expected to turn positive.

The population of the elderly 65 and over, on the other hand, continues to increase until the 2010s. After that, with the exception of the period during the 2030s when the baby-boom junior generation reaches 65, the elderly population is expected to remain roughly level, starting to decrease only after 2040.

Looking at the population projection up until 2025, we realize the rapid progression of societal aging as the baby-boom generation retires. In parallel with this, the population of working age continues to decline. Therefore, we keep discussing mainly the period until 2025 in Section Ⅲ to Ⅴ.

II-2 THE FERTILITY RATE

As mentioned above, the medium variant projection shows that the Japanese population will begin to decrease from 2007 onwards. Behind the projection are the declining crude birth rate and the rising crude death rate.

Looking first at movements of the total fertility rate[4] (Chart 4, upper panel), we find that the rate had already fallen beneath the level of 2.08 in 1974 after the baby-boom junior generation was born. The total fertility rate of 2.08 is the level necessary to sustain a given total population over the long term. Since then it has never recovered at all, dropping in 2002 to a level of 1.32. Second, turning to the crude death rate, we see that it is going to be rising gradually in line with the aging of the population, and that this trend is expected to continue (Chart 4, lower panel). In making population projections, NIPSSR had assumed that postponed childbirths might at some point reasonably be expected to materialize, even though mean age of

[4] See notes in Chart 4 for the definitions of the crude birth (death) rate and the total fertility rate.

women at first marriage and at first birth would steadily become older. However, as the actual fertility rate has displayed a continuing tendency to go under its projected value (Chart 5), the assumption is slightly modified in the January 2002 projection that the number of children the younger generation of women will bear over the course of their lives will never recover to the trend level extrapolated directly from the past. .

II-3 POPULATION OF OTHER COUNTRIES

As a reference, looking at the United Nations statistics describing population increase and the total fertility rates worldwide, we observe declining trends across every country and region (Chart 6). Together with some advanced European countries, the population in Japan is expected to decline earlier. Turning to the total fertility rates among advanced economies, Japan also finds itself in a relatively low group (Chart 7). Furthermore, when it comes to the speed at which the population is aging, Japan is the fastest, and looking at the prospect up until 2025, the ratio of the elderly to the working population in Japan becomes the highest.

III THE IMPACT OF DEMOGRAPHIC CHANGES ON THE SOCIAL SECURITY SYSTEM

In this section, we focus on the public social security systems composed of pensions, medical insurance, and nursing care insurance. The current pension system is structured in such a way that those eligible for pensions, mostly the elderly generation, are supported via income transfers from those paying contributions, mostly the working population. A change in the structure of the population, therefore, breaks the balance between contributions and benefits. Both medical and nursing care insurance systems also work in a similar way via intergenerational income transfers, and may similarly be characterized as systems in which the current working population supports the elderly generation.

In what follows we examine how the balance between contributions and benefits within these systems will be affected by demographic changes based on the Forecast of the Contributions and Benefits of Social Security released by Ministry of Health, Labour and Welfare in May 2002.

III-1 THE PENSION SYSTEM

The current public pension system in Japan consists of 70 million members paying contributions and 34 million who are receiving benefits (Chart 8). Looking at total pension payouts, we see that those in the Employees' Pension Insurance which covers mainly salaried employees account for more than half of the total, although members of the National Pension which covers mainly the self-employed make up about 60% of the number of those eligible for benefits (Chart 9). Turning to the amount of benefits received per person, those in the Employees' Pension Insurance and the Mutual Aid Pension which covers mainly government employees receive more than those in the National Pension, because a portion of their benefits is tied to their salary level. Looking across different kinds of pension payout, most payouts are made on the basis of old age, and about 10% is paid out in the form of survivors' pensions, with spouses and children receiving benefits after the death of the insured (Chart 10).

The current pension system is a pay-as-you-go (PAYG) system and assumes therefore a balanced population structure[5] (see Appendix 1). For this reason it becomes destabilized when demographic changes break the balance between those paying into the system and those receiving benefits. If we calculate the theoretical premium that the working population will be required to pay to meet the pension obligations of the retired generation, based on the actual and projected demographic changes in the working age and retired population with certain assumptions, we observe that the premium has risen sharply since the 1980s when the decline of the fertility rate and the aging became eminent, and that it is set to accelerate further after 2010 (Chart 11). Moreover, looking at the lifetime balances of pensions paid and received by an individual according to year of birth, we remark significant differences across generation (Chart 12). These observations indicate that it is

[5] Opposite to a PAYG system is a fully funded system where pension contributions made in one's working age is built up in financial assets and is going to be paid after retirement. In the fully funded system, benefits coincide with contributions at each individual level as long as it is run on a personal account basis, whereas in PAYG benefits meet contributions at each period within a whole economy. Based on this distinction, it is proper to say the Japanese current pension system is a PAYG. Nevertheless, some have argued that the Japanese pension system is a kind of funded system with the fact that the system owns pension assets: 137 trillion yen in the Employees' Pension Insurance and 10 trillion yen in the National Pension (Ministry of Health, Labour and Welfare (2002a)). It should also be noted, however, that the asset accumulation is nothing but a result of relatively high contribution compared with benefit in the early stage of the system and that benefits now exceed contributions. In this regard, it is more appropriate to recognize the current system as PAYG.

difficult to sustain the current pension system with considerable imbalances ahead.

For this reason the Ministry attempts to make some specific modifications: i) they will determine the level of benefit not by using per worker wage growth rate but by using a total wage growth rate, which reflects changes of the labor force population; and ii) they will review benefit payments not every five years when the Actuarial Valuation occurs as in the present system, but every year. In this way, the Ministry proposes reforming the system so that demographic changes are reflected in pension benefits more precisely[6].

III-2 THE MEDICAL INSURANCE SYSTEM

Medical insurance in Japan covers for all, so that everyone is an insured member of one system or other. Looking at medical care benefits across age groups, we see that almost half of the total is spent on patients 65 years old and over; it is also 65 years old and over who are especially costly when it comes to per capita medical expenses. Furthermore, turning to the growth rate of per capita medical expenses, expenses for the elderly have recently been rising at around 3% per annum, which is higher than the roughly 2% growth for medical expenses other than the elderly[7] (Chart 13). We may thus say that the medical insurance system is structured similar to the pension system, in the sense that the younger generation supports the elderly.

Demographic changes seem to be already making a certain contribution to the recent growth in medical expenses. Looking at the developments of the total medical expenses across age groups, we can see how population growth among the 65 years old and over has been pushing them upward (Chart 14).

III-3 THE NURSING CARE INSURANCE SYSTEM

The nursing care insurance system is a new system introduced in FY2000. Until then nursing care services had been offered directly by the administration. However, the old system proved unable to cope with both the growing demand for and

[6] Ministry of Health, Labour and Welfare (2002b)

[7] The growth rate of medical expenses for the elderly registered a large negative value in FY2000. This accompanied the introduction of the nursing care insurance system, and was the result of services that had previously been offered under the medical insurance system being paid for by the new nursing care insurance system.

diversification of nursing care. Therefore, it was decided that the system should be switched to the one providing nursing care services under a social insurance structure that was newly established specifically for this purpose. The total nursing care expenses reach 3.6 trillion yen in FY2000, the year of the system's inception, and 4.6 trillion yen in the following year (Chart 15).

Japanese citizens over the age of 40 make up the insured members of the nursing care system. They numbered 66 million in FY2001, of whom 43 million were aged 40 to 64, and 23 million were 65 and over. It is these participants in the system who pay the insurance premium.

Nursing care beneficiaries are those insured members of the system who are recognized as needing such nursing services. They are certified as nursing care beneficiaries. Looking at the breakdown of the certified nursing care beneficiaries across age groups, we see that these 65 years old and over make up 96% of the total in FY2001. Consequently, the nursing care insurance, like medical insurance, is structured in such a way that the working generation supports those retired.

III-4 THE OUTLOOK FOR THE PENSION AND MEDICAL INSURANCE

In May 2002, under the premise of forthcoming demographic changes, Ministry of Health, Labour and Welfare released its forecast of future developments in benefits and contributions within the social security system, including the pension, medical insurance, and nursing care insurance systems[8] (Chart 16). In this paper we reproduce these forecasts for pensions and medical insurance by supplementing certain assumptions, and then we examine how the contributions and benefits will perform towards 2025 under the premise that the demographic changes discussed in the previous section should materialize[9]. For details on the methodology here see

[8] The large black dots in Chart 16 are the forecast made by the Ministry. Note that nursing care is left out of the chart, and in what follows we make no attempt to reconstruct a future path for it. It is technically possible to estimate future prospects for nursing care, but only a short time has elapsed since its inception and the estimate is uncertain especially for the number of future certified nursing care beneficiaries. Thus we take the view that forecasting on the nursing care insurance system is problematic.

[9] The Ministry's May 2002 forecasts do not make completely explicit all the details of their assumptions, so that our reproduction in this paper is based on our own assessment of the appropriate assumptions. In addition, the Ministry is currently undertaking the Actuarial Valuation prerequisite for carrying out the pension reform in 2004, and is also proposing a mechanism that allows demographic changes to be reflected in benefits automatically every year (see III-1 above, and Appendix 1). We should therefore be aware that the assumptions on which the calculations

Appendix 2.

First we verify how demographic changes affect the Ministry's forecast for pensions and medical insurance[10]. Here, since there are only three forecast figures for 2005, 2010, and 2025, we make sure that the overall structure in our modelling is consistent with them, and then look at how changes in each of the assumptions affect levels of benefits and contributions within the system concerned.

PENSIONS

We set the numbers of insured members and beneficiaries of the pension system to be consistent with future demographic changes. We also index per capita pension benefits to the same inflation rate as is used in the Ministry's forecast[11]. The resultant estimates are basically in line with the Ministry's figures for contributions and benefits[12] (Chart 17).

In the absence of increases in pension insurance premiums, differences between benefits paid out and contributions demanded by the pension system will result in a heavier burden being placed on public finances in future. Under the current system, at least once every five years the Actuarial Valuation is carried out to determine the timing and the extent of any necessary rises in premiums in future[13]. However, if we include such premium increase among our initial assumptions, it becomes

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performed in this paper are based should be adjusted to the details of the final agreement in the 2004 pension reform and to the result of the Actuarial Valuation.

[10] We do not debate whether the Ministry's forecast on the levels of benefits and contributions are accurate. Instead, we check our own modelling up against the Ministry's forecast to see if it is consistent with the actual system in place.

[11] The inflation rate assumed in the forecast is 0.0% up until 2007 and 1.5% thereafter, while the rates of increase in nominal wages assumed for the same periods are 1.0% and 2.5% respectively.

[12] There are some technical reasons why our estimates will not perfectly match those of the Ministry's. i) Since we only have forecasts from the Ministry for 3 points in time, we interpolate the intervening periods making own assumptions on the annual growth rates over the periods. ii) We suppose that when premiums are raised they have effects for the whole fiscal year, whereas in reality increases in the premium are going into effect in October. iii) Our calculations drastically simplify age groups and pension system classifications.

[13] In this paper we make use of the schedule for premium increases laid out in the Ministry's "Impact of the New Population Estimates upon the Employees' Pension Insurance and the National Pension," released in May 2002. In the paper, the premium increases are tentatively adjusted from the previous 1999 Actuarial Valuation according to the new population estimates in January 2001, leaving other conditions unchanged.

difficult to capture the effects of demographic changes on pensions. Similarly, on the benefit side, the current age at which the insured becomes eligible to receive it is 65[14]. If, however, the age of eligibility were to be raised further, this would have the effect of lessening some of the burden placed on public finances in future.

The inflation rate and nominal wage growth rate at which the benefits will be adjusted are also factors that obscure the influence of demographic changes on pensions. The difference between contributions and benefits are highly sensitive to such assumptions in nominal terms. We should not, however, depend on any assumption on prices when we make forecast in real terms. For this reason, in calculating future contributions below, we employ the real wage growth rate and assess the pension balance at FY2002 price. The rate of real wage increase in the Ministry's forecast is 1%, obtained by subtracting the inflation rate from the nominal wage growth rate.

In what follows, we first confirm how the pension balance – the difference between contributions and benefits – will develop when we apply the scheduled increase of pension premium. The case is referred to as the case of "premium rates are raised". We then consider how the balance would be affected in the following three cases. i) Case 1: premiums are not raised, where all other conditions, such as levels of pension benefits and the age of eligibility for benefits, are kept the same as under the current system. ii) Case 2: premiums are left at current levels, but the age of eligibility for benefits is raised in stages from 65 to 70. iii) Case 3: premiums are left at current levels, but the population of working age between 20 and 64 is made to increase so as to keep constant the proportion of the population 65 years old and over. The taxable income here is total employee compensation including bonuses, drawn from the "Monthly Labour Survey" compiled by Ministry of Health, Labour and Welfare. The main results are summarized as follows.

1) In the rising premium case, contributions and benefits are almost balanced. There emerges hardly any difference between them. On the other hand, when we keep the premium fixed in Case 1, the difference expands to about 20 trillion yen by around 2020 (Chart 18).
2) Raising the age of eligibility for benefits in Case 2 prevents the emergence

[14] To be precise, the age of eligibility is currently in the process of being gradually raised from 60 to 65, which, for men, continues until the completion in FY2025.

of much of a difference until the latter half of the 2010s (Chart 19).

3) When we keep the proportion of the population over 65 fixed (Case 3), not only does the negative gap between contributions and benefits shrinks, but in fact the balance turns positive (Chart 20).

From these results we conclude that, given forthcoming demographic changes, the balance between benefits and contributions under the current pension system will inevitably crumble, and that, in order to keep the pension sustainable, either the system will need to be modified, or we will have to put up with an increase in the burden placed upon public finances.

MEDICAL INSURANCE

Turning next to medical insurance, we look at the population estimate by age groups and make use of the corresponding figures for per capita medical costs to calculate total benefits for each age group. The estimates that we obtain are basically consistent with the forecast of Ministry of Health, Labour and Welfare (Chart 21). Since medical insurance is run as a PAYG system, the Ministry's forecast considers the burden of medical costs should be financed within the same fiscal year as the costs are incurred. Intrinsically, therefore, there emerges no gap between contributions and benefits. In such a set up, if the amount of benefits expands, the corollary is that the amount of contributions must also expand. Consequently, the issue of the size of the future burden that will emerge as a result of demographic changes must be addressed in terms of changes in insurance premiums.

Here, we look at how the difference between contributions and benefits changes for the following three cases. i) Case 1: premium rates are fixed at current levels, and per capita medical expenses, both for the elderly and for the others, are assumed to continue to grow at their actual average rates over the recent periods. ii) Case 2: premium rates are fixed at current levels, but the growth in medical expenses for the elderly is reduced and set in line with that for the others. iii) Case 3: premium rates are raised in such a way that contributions are kept in line with benefits, and per capita medical expenses, both for the elderly and for the others, are assumed to continue to grow at their actual average rates over the recent periods. The taxable income used here is total employee compensation including bonuses, drawn from "Monthly Labour Survey". The main results are summarized as follows (Chart 22).

1) In Case 1, in which premium rates do not change, a difference of just under -22 trillion yen emerges between contributions and benefits by 2025.

2) When we hold premium rates constant but restrict the growth of medical expenses for the elderly, as in Case 2, the difference that emerges by 2025 slightly shrinks from the Case 1 but still as much as -13 trillion yen.

3) In Case 3, where we raise premium rates, we see that, in order to keep contributions in line with benefits, premium rates would be required to rise by about 60%, from just over 7% at present to just over 11% in 2025.

What these results tell us is that, with per capita medical expenses for the elderly growing relatively rapidly, the burden on the medical insurance system is set to rise. Moreover, even if we bring the medical expense growth for the elderly down to that for the younger, demographic changes, specifically the expansion of the elderly population, still make this burden increase.

IV THE IMPACT OF DEMOGRAPHIC CHANGES ON LABOR MARKETS

We turn in this section to the influence of demographic changes on labor markets. In order to perceive the demographic impact on labor market, we first draw an age pyramid depicting the population of those in employment, by fixing the rates of employment across age groups at their levels in the year 2000. It shows there will be significant changes in the labor supply (Chart 23). By making impacts upon labor markets in this way, these demographic changes will also act to constrain the labor input and will thus affect the economic growth rate over the medium and longer terms. In what follows we will look in turn at the impact of demographic changes on the numbers of those in employment, self-employed and family workers, working hours, and wages.

IV-1 MAIN FEATURES OF LABOR MARKETS

NUMBER OF THOSE IN EMPLOYMENT

First of all, looking at movements to date in rates of employment across age groups, the rate of employment for workers 60 years old and over is extremely low

compared with that for workers of prime employment age, i.e., in the latter half of 20s to their 50s. At the same time, rates of employment for women describe an M-shape, as a period at which the rate of employment is lower corresponds to the ages of marriage and childbirth (Chart 24).

Turning to changes over time in the overall rate of employment, we decomposed them into a demographic change factor, i.e., the part that varies with changes in the relative weights of different age groups and other factors, i.e., the part corresponding to changes arising mainly as a result of economic fluctuations. We see, as a result, that movements observed in the overall rate are mainly determined by the latter factor (Chart 25). Recently, however, the former factor may be beginning to exert a downward influence upon the overall rate of employment.

When we look at how the numbers of those in employment have changed across different age groups (Chart 26), we find that it has been the baby-boom generation that has marked the peaks, both for men and women.

NUMBER OF THOSE IN SELF-EMPLOYED AND FAMILY WORKERS

We focus next on the movement over time in the number of the self-employed and family workers. The number of these people has been displaying a downward trend (Chart 27), which is attributed to the fact that a larger number of the aged self-employed and family workers have been closing their businesses. It is also clear that a share of the aged self-employed and family workers among total employment is higher because, unlike employees, there is no mandatory retirement age for self-employed and family workers.

NUMBER OF THOSE IN EMPLOYMENT ACROSS INDUSTRIES

Looking at the numbers of those in employment across different industries (Chart 28), the employment has been consistently increasing only in the service industry. The number in agriculture and forestry, which make up the vast part of those in self-employed and family workers, has been trending downward, while the numbers in manufacturing and construction have also been falling recently.

HOURS WORKED

For total hours worked per worker, a full-time male worker tends to work shorter

hours as he gets older[15], whereas a full-time female worker does not (Charts 29 and 30). The hours worked by part-time workers increase with age until they reach 60, but there is no significant difference in the hours worked across age groups[16] (Chart 31).

WAGE PROFILE

Looking at the wage profile, which describes wage difference across age groups, we see that there is a marked difference in wage levels depending on age group for full-time male workers in both manufacturing and non-manufacturing (Chart 32). Unless the shape of this wage profile undergoes a significant transformation, demographic changes will make average wages higher[17]. For female full-time workers and part-time workers, on the other hand, the differences in wage levels across age groups are not so remarkable (Charts 33 and 34).

When we examine the combined wage profile for full-time and part-time workers, we observe a gradual leveling out of the wage profile for workers between the latter half of 30s and 50s, reflecting the increasing proportion of part-time workers in recent years (Chart 35).

IV-2 THE OUTLOOK FOR THE FUTURE

With the above observations, we now take a look at the outlook for the future. The assumption here is that wage levels and rates of employment that we have looked at across gender and age groups will remain at their recent levels in the future. Superimposing the demographic changes expected for different gender and age groups upon this, we can get a view of how the numbers of those in employment,

[15] For regular working hours, we observe the opposite tendency i.e., rising along with age, especially for full-time male workers in manufacturing. This may perhaps be explained by the fact that there is a higher proportion of older workers in small scale enterprises where regular working hours are longer.

[16] In analyzing both working hours and the wage profile below, we make use of the Basic Survey of Wage Structure. The statistics contain substantial volatility for employees under the age of 19 where the sample is thin, so we omit the impact on this age group.

[17] A closer examination, however, reveals that wages have been gradually hitting their peak at older age groups. This phenomenon has been broadly accompanying the aging of the baby-boom generation. Whether the trend will continue, as the baby-boom generation reaches 60 and further, is an open question.

hours worked and wage levels will develop hereafter[18]. The outlook for the future takes on the following shape.

(1) Employment rates are significantly affected by the factors such as economic fluctuations. However, apart from them and taking only the influence of demographic changes, the increase in the number of the elderly, among whom the rates of employment are relatively low, is likely to cause overall rates of employment to decline gradually. At the same time, the total number of those in employment will fall, as the total population is also set to decline, (Chart 36).

(2) Turning to the numbers of the self-employed and family workers, we could expect them to increase in line with the rise in the number of the elderly, supposing that the ratios of the numbers of this employment category to those of total employment were to remain unchanged across age groups at recent levels. It is perhaps more natural, however, to take the viewpoint that, since it is not easy to start up a business in one's later years, the number of those in self-employed and family workers will in fact decrease. Recalling that the numbers of the self-employed and family workers start to decrease in net terms after age 45 for men, and age 40 for women (Chart 27 above), we may reasonably assume that the numbers in this employment category will not increase for people in these age groups and older. If we adopt this idea, the result is that the numbers of self-employed and family workers will indeed decrease. Moreover, since the pace of decline within this employment category exceeds that within the overall number in employment, the ratio of the self-employed and family workers to the overall number in employment will also fall. It is also worth mentioning here that, subtracting the self-employed and family workers from the overall number in employment, we can expect a slow decline in the number of those in employment as well (Chart 37).

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[18] More specifically, we calculate the number of those in employment, hours worked, and wage costs at the macro level as Σ (the most recent values of each variables for every gender/age category × the population of the respective gender/age category). Needless to say, the treatment represents a crucial assumption. For example, in the case where the number of employees is expected to decline, which we will discuss below, measures such as extending the age of mandatory retirement will be taken. It will clearly alter the number of elderly people who are in employment. However, rational forecasting of the extent to which the rates of employment and wage levels within given gender and age categories will alter in response to demographic changes is not feasible in practice. As was mentioned in Section Ⅰ above, it is important to consider these issues, but there is no guarantee of finding a solution that will prove convincing to everyone. It is for this reason that, while remaining fully aware of the lack of rigor, we adopt the very simple assumption explained above in carrying out our estimations.

(3) For working hours, as already mentioned, we do not observe a large difference across age groups. As a result, even when we take demographic changes into account, the impact upon hours worked per worker may be considered small, and all in all, total hours worked are set to follow the gentle decline of the number of employees (Chart 38).

(4) With regard to average wages, they will be expected to decline, as the baby-boom generation currently residing in the highest wage age group will withdraw from the labor market. However, with the population of the young, which costs relatively little in wage terms, decreasing in line with the declining fertility rate, there is also pressure acting in the opposite direction to push wages up. Looking at the net effect, we see that average wages for full-time male workers will maintain a slight rising trend until 2020, although from 2012, when the baby-boom junior generation reaches its high-earning at their 40s, average wages will increase temporarily sharper[19] (Chart 39, upper panel). When we include part-time workers, however, we see the increase in the proportion of part-time workers acting to suppress the rise in wages[20] (Chart 35 above, lower panel). Turning to total wages, i.e., wage per worker × the number of employees, the rise in a wage per worker is more than compensated for by the fall in the number of employees and as a result total wages are expected to decline (Chart 39, lower panel).

Thus, considering the impact of demographic changes upon the labor market, we can make the following basic suppositions regarding the future shape of the labor market: a) the overall number of those in employment will decline; b) there will be no significant change in hours worked per worker; c) average wages will rise slightly for the immediate future; d) total wages, following the number of employees, will decline.

V THE IMPACT OF DEMOGRAPHIC CHANGES ON THE HOUSEHOLD SAVING RATE

We turn our attention next to the influence of demographic changes on households'

[19] Although firms' concern over labor costs encompasses not only wages but also retirement bonuses, we take no account of the retirement bonus costs.

[20] Since the proportion of elderly part-time workers is large, the increase in the number of elderly workers is itself pushes up the proportion of part-time workers in the population as a whole.

consumption and saving behavior[21]. Since household saving is the underlying source for capital accumulation, it also affects the economic growth as a whole through business fixed investment. In this section we make use of the Family Income and Expenditure Survey (FIES) to look at the major features of the household saving rate, hereafter referred to simply as 'the saving rate' unless otherwise specified, across household head at different ages. Next, since the discussion relates to the growth rate of the economy as a whole, we outline the relationship between the saving rate obtained from the FIES and that obtained from the System of National Accounts (SNA). Having done so, we are able to examine how demographic changes will impact upon the SNA saving rate.

V-1 THE FIES SAVING RATE

The overall FIES saving rate has been declining since 1999, although up until then it had been on a rising trend (Chart 40). We can decompose the movement in the saving rate into a factor capturing the influence of changes in the age distribution of household head, i.e., the demographic change factor, and a factor capturing the influence of economic fluctuations, i.e., the other factors. The overall movement seems to be governed by the latter factors[22] (Chart 40, lower panel).

Our observations regarding movements in the saving rate across household head of different age groups may be summarized as follows:

(1) Saving rates in the households of the elderly, especially in recent years, have been falling in comparison to those in households of the employment age (Chart 41). The elderly people here have positive saving rates, although basic lifecycle models indicate they may be negative because of dissaving. The possible reason is that the elderly people here are still in work, not yet withdraw from the labor market, and consequently may not be engaged in dissaving yet.

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[21] There has been a lot of literature on the influence of population aging upon the saving rate. However, with both views, that saving rate will rise and that it will fall, there is no clear conclusion on this issue (see Cutler et al. (1990), Miyata (1992)).

[22] As in Section IV above, when we talk here about the demographic change factor, we are referring to the direct impact of demographic changes upon the saving rate. The effects such as the households feel uncertain about their future pensions and therefore raise their rates of saving may broadly be included under the heading of demographic change factors but they are treated as 'other causes' in our analysis.

(2) Saving rates of every age group have until now been rising. For example, the saving rate in their 30's of the current generation is higher than that of their 20 years older generation when they were in the same age group (Charts 42 and 43).

Although saving rates of the same age group have been trending upwards, there also has been a rise in the proportion of the elderly in the total population, whose rate of saving is relatively low, and this has acted to curb the overall pace of increase in the saving rate to some extent[23].

V-2 THE FIES AND THE SNA SAVING RATES

As we have already seen, the FIES saving rate was basically on a rising trend up until the end of the 1990s. This, however, contrasts with the saving rate in the SNA (revised base, excluding imputed rent), which trended downward (Chart 44 (1)). Since the two saving rates are defined differently, it is expected for discrepancies to emerge between them. However, it is difficult to explain to what extent the discrepancy emerges purely because of definitional differences[24].

For this reason, we assume for simplicity that the differences between the two rates arise because of differences in coverage, and we consider, together with the saving rates of the employed household head that we get from the FIES, another two saving rates, namely, the saving rate for elderly households not in work, and that for the remaining households which we can take almost as the self-employed[25].

We should note that the FIES covers only households with two or more members and does not include single-member households. The level and direction of changes in the saving rate for single-member households, however, roughly resemble those of the SNA saving rate as was seen in Chart 44. Therefore, it seems that the single-member household saving rate may not be a disturbing factor and we do not

[23] See Chart 47 for changes in the age distribution of household head.

[24] With regards to definitional differences, there is an example such as the fact that remittances and gifts are included among expense items in the FIES, whereas they are listed under transfer payments in the SNA. However, none of the research to date has been completely successful in resolving the differences between the two saving rates only by adjusting the difference of the definition.

[25] Ishikawa and Yajima (2001) show that, when a weighted average is taken of the saving rates for the employed household head and households not in work, the resulting saving rate follows a basically horizontal path.

consider it explicitly here[26].

While the saving rate for elderly households not in work is available as a separate aggregate from FIES (Chart 44 (2)), there is no saving rate of the remaining households[27]. Assuming that the SNA saving rate may be perfectly decomposed into the rates for the employed households, elderly households not in work, and the remaining households, and that the saving rate of the remaining households may approximate to that of the self-employed, we can calculate the saving rate of the remaining households by using weight of each household.

Looking at the movement in the saving rate for the remaining households derived in this way (Chart 44(3)), it has declined since the 1990s and became negative in the latter half of the 1990s onward. To account for the saving rate of self-employed households in work becoming negative, we may consider the following possible explanations.

(1) According to the Unincorporated Enterprise Survey, operating profits of the self-employed firms[28] declined continuously across all sectors during the 1990s (Chart 45). These economic environments surrounding small enterprises may be considered consistent with falling saving rates.

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[26] The number of single-member households was about 13 million as of year 2000, making up 30% of the total number of households. Moreover, according to the estimates of future numbers of households carried out by the NIPSSR, single-member households are expected to make up a gradually increasing proportion of this total. In addition, about one in every three single-member households is expected to have head 65 years old and over by 2020. As a result, the impact of demographic changes upon the saving rate may in fact become larger for single-member households. However, the statistics for the aggregate saving rate for single-member households are based on a small sample, and the statistical errors become large when we subdivide this further into different age categories. It is for this reason that we discuss simply by assuming that changes in the saving rate for single-member households are not a disturbing factor in the overall picture here.

[27] The treatment of household head type in the FIES may be summarized in the following diagram, where the italics indicate where aggregated saving rates are available.

<table>
<tr><th></th><th>The employed</th><th>Those not in work</th><th>Self-employed</th></tr>
<tr><td>The elderly</td><td rowspan="2">The employed households</td><td>Elderly households not in work</td><td rowspan="2"></td></tr>
<tr><td>Other age groups</td><td colspan="2">The remaining households (mainly self-employed)</td></tr>
</table>

[28] We make use of operating profits as a proxy of the income of the self-employed. It may well be more appropriate to use cash flow or net profits but such data are not available.

(2) Looking at the age composition of self-employed head of households, the proportion of the elderly is high (Chart 46). Since the saving rates of elderly households who are not in work are negative, it is conceivable that the saving rate of self-employed households may also be negative even if they are still working.

Having made the observations above, we may now proceed our discussion with the supposition that the SNA saving rate could be perfectly decomposed into the respective saving rates for the employed households, elderly households not in work, and the remaining households.

V-3 THE FUTURE DEVELOPMENTS OF THE SAVING RATE

In light of the preceding analysis, we look at the impact of demographic changes upon the saving rate. Our assumption here, as in the previous section, is that saving rates across different age groups remain unchanged at their most recently recorded levels. We examine the direct impact which demographic changes will have on the overall saving rate via population changes within each age group. Of course, when we consider the underlying rising trend in saving rates across different age groups illustrated in Charts 42 and 43, these saving rates may be likely to change. However, we simply assume that they remain unchanged at their most recently recorded levels, because rational forecasting of the direction and the extent of such change can hardly be made.

For the employed households, we first take the shares of household head within each age group, i.e., dividing the number of household head by the total population in the same age group. We then assume that such ratios remain unchanged in the future and estimate the number of households by taking into account the changes in population within each age group. Chart 47 shows the distributions of household head and the population. Turning next to elderly households not in work and to the remaining households, we basically treat them in the same way as the employed households above. However, as for the remaining households, which we take as roughly equivalent to the self-employed, we assume that they are unable to start up new businesses any more after the age of 45, as we observe in Section Ⅳ. By arranging this way, the proportions of the employed households, elderly households not in work, and the remaining households will change in accordance with demographic developments (Chart 48).

In order to forecast the movements in the saving rate that would accompany future demographic changes, we aggregate all saving rates in different age groups. Then we see that the saving rate for the employed households is set to follow a slow decline after 2006 (Chart 49, upper panel). When we add elderly households not in work and the remaining households and look at the movements of the SNA saving rate, the pace of decline accelerates somewhat between 2006 and 2010 and it becomes moderate thereafter[29] (Chart 49, lower panel). In the section that follows we turn to the influence upon macroeconomic growth of this decline in the saving rate and of the decrease in the number of those in employment discussed in the previous section.

VI THE IMPACT OF DEMOGRAPHIC CHANGES UPON MACROECONOMIC GROWTH

We have investigated so far what sort of influence demographic changes will have upon the social security system, the labor market, and the saving rate, making some extreme assumptions for the sake of simplicity. In this section we turn, in light of these investigations, to the impact upon macroeconomic growth.

VI-1 A SIMPLE MODEL

The impact of demographic changes upon the social security system is transmitted, via changes in the fiscal balance, to the behavior of households and firms. As was mentioned in Section Ⅱ, we do not consider such behavioral changes here for the sake of simplicity. Likewise, when there are changes in household saving, these may cause parallel changes in the external balance. However, developments in the rest of the world are not within our scope either. Price changes have an obviously large impact on household and firm behavior. But again a rational forecast of price developments, which may induce such behavioral change, is difficult to conduct for the entire period of our long-term estimation which focuses solely on the impact of demographic changes. Therefore, we also omit future price developments.

Under the admittedly extremely restrictive conditions described above and starting off from a simple macroeconomic supply function, we are able to draw out

[29] This moderate pace of decline in the saving rate is consistent also with the analysis in Nakajima

the essential features of how demographic changes will influence upon economic growth.

We begin by setting up the following simultaneous equations, in which the endogenous variables are real output and real capital stock.

$$Y_t = A_t (L_t H_t)^{\theta} (O_t K_{t-1})^{1-\theta} \qquad (6\text{-}1)$$

$$K_t = (1-\delta) K_{t-1} + s_t Y_t \qquad (6\text{-}2)$$

Here, Y is real output, A is total factor productivity, L is the number of those in employment, H is hours worked, O is capacity utilization rate, K is real capital stock at the end of the period, and s is the ratio between real capital spending and real output (see Appendix 3). In addition, θ is labor share, which we set to 0.71 following Bank of Japan Research and Statistics Department (2003), and δ is capital depreciation rate, which we set to 4.8% in line with its most recent value.

Fitting the actual data to the equation (6-1), we are able to decompose the actual real output growth rate into each factor (Charts 50 and 51). Looking at the most recent periods, we see that the contribution of the capital stock and the total factor productivity factors fell from the levels observed at the beginning of the 1990s. The contribution of factors such as reductions in hours worked and numbers of those in employment as well as the decline in the capacity utilization rate also exerted downward pressure on the macroeconomic growth. This observation shows that the demographic developments may have acted negatively upon the recent sluggish economy to some extent.

VI-2 ESTABLISHING A BASELINE

In order to examine the impact of demographic changes, we establish a baseline case first in which there are no demographic changes and then to compare this with a case which takes account of demographic changes.

In the baseline case, the variables considered exogenous are the number of those in employment L_t, the capacity utilization rate O_t, and the ratio between real capital spending and real output s_t. They are all assumed to remain unchanged in future

(2002).

at their most recent levels[30] (Chart 52). Total factor productivity A_t is assumed to rise at an annual rate of 0.5% in future, which is its average rate of increase over the past 10 years. It in fact moves broadly in line with economic fluctuations, when looking at its path in the past. The case taking demographic changes into account is also assumed to have the same rate of increase in total factor productivity as the baseline case.

When the baseline case is constructed in this way, economic growth springs from improvements in total factor productivity and increases in the capital stock (Chart 53, lower panel).

VI-3 ECONOMIC GROWTH REFLECTING DEMOGRAPHIC CHANGES

For the case that reflects demographic changes (hereafter the "the case with demographic changes"), we make use of our results in Section Ⅳ for future figures of the number of those in employment L_t and hours worked H_t, and of those in Section Ⅴ for future figures of the ratio between real capital spending and real output s_t[31]. We assume, as in the baseline case, that the capacity utilization rate O_t remains unchanged at its current level. Meanwhile we assume the influence of demographic changes on the social security system, dealt with in Section Ⅲ, appears in disposal income $Y_{d,}$ which is used when calculating the future path of s_t (for detail see Appendix 4).

When we reflect demographic changes in this way, the macroeconomic growth rate declines slowly, becoming negative as we enter the 2020s (Chart 53, lower panel). The reasons for macroeconomic growth turning negative are: i) the decrease in the number of those in employment; and in addition ii) the decline in capital accumulation caused by the fall in the saving rate and the decrease in the number of those in employment[32].

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[30] Strictly speaking it is not that we directly consider s to be fixed, rather that we take the household saving rate (s_2 in Appendix 3) to be fixed, and also that we assume disposable income Y_d and Y grow at the same rates. The result is that s becomes fixed as well. It should be reiterated, as was mentioned above, that we do not take price changes into account.

[31] Having obtained the path of the household saving rate s_2 from Section Ⅴ, we use it to derive s in line with the way explained in Appendix 3.

[32] The decrease in the number of those in employment contributes to the decline in capital accumulation because it causes the rate of growth of Y to fall. Note that Y is included in the second

Given the simplicity of our assumption that a number of the variables other than those representing demographic changes remain fixed at current levels in future, careful interpretation is required of the estimation on the level of the economic growth rate. We therefore compare these figures with the baseline case, which is calculated using the same set of simple assumptions (Chart 54). This comparison reveals not only that the downward pressure upon growth, exerted by the decrease in the number of those in employment, will be maintained consistently in future, but also that the impact of the decline in capital accumulation will become intense during the 2010s. The downward pressure on economic growth will be broadly of an order of 1% point after the middle of the 2010s. This process will be attended by stagnation in the growth rate of labor productivity, i.e., output per person in employment, with the gap between the baseline case and the case with demographic changes reaching a level of around 0.5% point by the latter half of the 2010s.

With the future economic growth rate being pushed down by demographic changes in this way, it is conceivable that the growth rate on which the future outlook of the social security system relies in Section III may fall even further. We would like to go back to this point later.

VI-4 NEUTRALIZING THE EFFECTS OF DEMOGRAPHIC CHANGES

Our estimation suggests that the macroeconomic growth rate will be pushed down by future demographic changes. However, there remains the question of whether some sort of counter shocks might enable us to prevent the decline in the growth rate. Conceptually, shocks that would compensate for the decrease in the number of those in employment that is accompanying a declining fertility rate and an aging population might include: a) a rise in rates of employment, especially among women and the elderly, b) an increase in the number of those in employment via immigration, and c) a rise in the fertility rate. Thinking about the feasibility of these shocks demands caution on various fronts, given the characteristics of the shocks in question. However, we set aside the issues of feasibility and simply look at the extent to which such counter shocks succeed in neutralizing the effects of demographic changes, because we are concerned here only with investigating the intensity of the future impact of demographic changes.

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term on the right-hand side of equation (6-2).

First of all we turn our attention to the extent of the actual shock which we may reasonably anticipate from each of the three possibilities introduced above.

(1) Comparing the rate of employment in Japan with those observed in Europe and the U.S., we see that for men the rate in Japan is already at a rather high level on the whole (Chart 55). For women, however, the rate of employment is low especially for those in their 30s, and there may be room for increases.

(2) Turning next to immigration, it remains on a small scale in Japan when compared with other advanced countries (Chart 56).

(3) With regard to the fertility rate, it has been on a declining trend since the latter half of the 1980s in Japan. In other advanced countries, on the other hand, there are examples such as Sweden, where the fertility rate has enjoyed a period during which it rose considerably, and France, where it has been climbing little by little in recent years (Chart 57). Looking at the situation in countries such as France and Sweden, we see that in both countries the policies which offer support for bearing and raising children have been adopted, and they may well have contributed somewhat to the rise in the fertility rates[33] (Charts 58,59, and 60).

Having made these observations, we may now go on to discuss below the effectiveness of these three hypothetical counter shocks in neutralizing the impact of demographic changes on the economic growth rate.

[33] In Sweden, as we saw in chart 55, a high rate of female employment is well established, and there exists a scheme for maternity leave whereby benefits, which are linked to the level of wages just prior to childbirth, are payable in installments over a long period of time. With the upturn in the employment environment for women and the increasing advantage of this scheme during the second half of the 1980s, the number of couples making use of the scheme to have children is said to have risen (Tsuya (1996)). In France too, since 1994, when parents with employment experience became eligible for parent allowance on the birth of their second child (previously eligibility had come with the third child), there seems to have been a recovery in the fertility rate. What both of these countries have in common is a close relationship between female participation in the labor market and allowances for maternity leave. It cannot, however, be denied that, as in Sweden since 1990, there is a tendency for the fertility rate to decline along with economic recession. For recent trends in the Swedish fertility rate and the factors behind them, refer to Hoem (2000), Björklund (2002), and Andersson et al. (2001). On the details of the scheme in France, the National Institute of Population and Social Security Research (2000) and Kojima (1996) are informative.

VI-5 THE OUTLOOK ASSUMING THAT THE NUMBER OF THOSE IN EMPLOYMENT REMAINS CONSTANT[34]

We make the following suppositions regarding the hypothetical shocks to prevent demographic changes from inducing a fall in the growth rate.

(a) Employment rates rise so that there should be no unemployment among men of employment age, so that employment rates should rise to the levels equivalent to those in the U.S. among women, and so that all of the elderly people who wish to work should be able to find jobs[35].

(b) The scale of immigration reaches up to the average of countries in the EU15 (by 0.22% of the population each year). The escalation in scale takes place constantly over the ten years starting from 2005.

(c) The total fertility rate recovers to the level that almost puts an end to population decline, namely two children for every woman over the course of 20 years starting from 2005.

To avoid misunderstanding, we repeat that we will not discuss here the rights or wrongs of applying such counter shocks. We are making no value judgments as to whether or not such shocks are desirable. This is no more than a hypothetical experiment in which we aim to measure the extent of the impact of future demographic changes by examining the effects upon economic growth in case we impose the hypothetical conditions (a) – (c) above.

Looking first at the case when all of these shocks are immediately materialized[36], we see that the number of those in employment, now 63 million, rises at once to 72 million, and that over the long term it is feasible to maintain about 69 million people

[34] So far, we have looked at the outlook up until around 2025. Our discussion is now carried out for an extended time frame running up to 2050, since we put extreme suppositions which cannot be fulfilled within a shorter period of time.

[35] To get numbers of those wishing to work, we add together the figures for those in work and for those who are out of work but desire a job, taken from "Employment Status Survey" compiled by Ministry of Public Management, Home Affairs, Posts and Telecommunications.

[36] What we mean by "immediately" here is that (a) employment rates rise to the maximum level from now, (b) immigration rates start to rise from 2005 to the maximum level without taking ten years, and (c) the fertility rates start to rise from 2005 to the maximum level without taking 20 years. In Charts 61-63 this case of immediate materialization is referred to as the "maximum case".

in employment (Chart 61)[37]. However, the idea that the number of those in employment might suddenly rise by 9 million is patently unrealistic. Therefore, we think instead the case where conditions (b) and (c) above are achieved first, and then condition (a) is introduced in a relaxed way so that the number of those in employment should always be kept constant. This we refer to as the "neutralizing case" (Charts 62 and 63).

In this neutralizing case, we manage to neutralize a significant part of the decline in the growth rate induced by demographic changes (Charts 64 and 65). However, putting it another way round, what it means is that, even when we impose highly extreme conditions of the neutralizing case, we are still unable to prevent the decline in the growth rate that accompanies demographic changes completely. Although in the neutralizing case the extent of the fall in the saving rate is less than that in the case with demographic changes, there is still a gradual decline and this acts to weaken growth springing from increases in the capital stock (Charts 66 and 67).

It is worth mentioning also that, even if we don't impose the extreme conditions of the neutralizing case, allowing total factor productivity to rise more than previously assumed, i.e., 0.5% annually, would enable the decline in the growth rate to be averted. Looking at the difference in future growth prospects between the neutralizing and the demographic change cases (Chart 65 (3) above), we see that if the growth of total factor productivity is to rise by one percentage point in around the year 2030, it will have much the same effect as the counter shocks that we have been discussing.

VI-6 IMPACT ON THE PENSION SYSTEM

Let us look now at how the neutralizing case above would affect the balance between contributions and benefits within the pension system. As already mentioned, the economic growth rate in Ministry of Health, Labour and Welfare's forecast, which we also used in our calculations of the future balance in the social security system, may not incorporate sufficiently the declines in the growth rate

[37] As for the cases where we impose each of our three hypothetical conditions separately, the results are as illustrated in Chart 61 (2). For the cases where we raise the rate of employment and accelerate immigration respectively, the number of those in employment can be maintained for a while, but in the end the effects start to wear off. By contrast, the effects of a recovery in the fertility rate are sustained over the longer term.

associated with demographic changes. Here, therefore, we apply the forecasts of future economic growth rate in the case with demographic changes obtained in the subsection Ⅳ-3 to our calculations of the future balance within the pension system. We discover that in fact a larger gap will emerge between contributions and benefits (Chart 68), but in the neutralizing case, this gap improves significantly. This is not only because the higher rate of employment acts to suppress the amount of pension benefits being paid, but also because increased immigration and the rise in the fertility rate cause the population of those in employment to increase and this improves the capacity to meet the burden of pensions[38].

Ⅵ-7 The Effect upon the Economy of an Increase in the Public Burden

We turn, finally, to an examination of the influence on the economy of an increased public burden. In Section Ⅲ and Ⅳ-6, we saw that demographic changes will have considerable impacts on the social security system, and that the gap between pension benefits and contributions may not be completely closed, even allowing for some neutralizing counter shocks. To sustain the pension and medical insurance systems in the future, therefore, the public burden may have to be increased. Consequently, in considering the path of economic growth discussed in Ⅳ-3 and Ⅳ-5 above, we should bear in mind an issue which we have not yet given explicit attention, namely the influence of a rise in the public burden on the economy.

Our interest here is in the impact of a higher public burden on the household saving rate and the labor supply. It is not immediately clear, for either the saving rate or the labor supply, whether the influence of a higher public burden would be positive or negative. Looking at the saving rate, for example, a rise in the public burden would require households to deal with a reduction in their disposable income, and this could cause saving rates to be lowered from the current level across all age groups. On the other hand, thinking that they might no longer be able to rely on the social security system in their old age, younger generations could conceivably raise their rates of saving. Similarly for the labor supply, assuming that the increased

[38] In this regard, immigrants will become eligible to receive pension benefits in the end. Since the immigrants to be accepted into the economy are assumed here to be in the 15-49 year old age group, this eligibility will not become an issue until, at the earliest, 2021 onwards. By that time, the recovery in the fertility rate will also have begun to raise the number of population who are young to pay the pension contributions.

public burden weighs upon labor income, people may think that their income doesn't increase much even if they work, and so rates of employment could decline from their current levels, i.e., a substitution effect between consumption and leisure. Alternatively, since an increased public burden causes incomes to fall, people may feel that they need to work more in order to maintain their current income levels, i.e., an income effect.

Making use of OECD data from 1960 to 2000, we carry out a panel data analysis for the G7 countries, obtaining the result that a rise in the public burden has a significant negative effect on the saving rate (Chart 69). The result may be taken to imply that, between the two putative effects of a rise in the public burden, namely i) households confronted with reduced income decrease their saving and ii) the younger generation increase its saving in response to a higher public burden, it is the former effect which dominates. Of course this result will not necessarily continue to hold true in future but we should be aware of the possibility that the saving rate, and hence the economic growth rate, may fall even further than was suggested earlier in this section. The situation is not, however, so clear for the labor supply, where the coefficients are not significant in either positive or negative, and the impact of a rise in the public burden remains uncertain[39] (Chart 70).

VII CONCLUSION

Our aim in this paper is to analyze the influence of forthcoming demographic changes on the economy in Japan from several different perspectives. The analysis here is not carried out in a general equilibrium framework. Instead, somewhat simple assumptions are made concerning transmissions of the influence. Having said that, however, the analysis allows us to obtain a first approximation of when and how impending demographic changes will affect the economy.

To state the results of the analysis in short, macroeconomic growth is likely to fall with the contraction of the labor input and the slowdown of capital accumulation. In addition, maintaining the current structure of the social security system, which premises a balanced population, is going to become very difficult to be maintained

[39] The results here accord with those of Furukawa, Takagawa, and Uemura (2000), which also looks at the relationship between the increase of the public burden and the supply of labor and concludes that the coefficients are not significant.

as demographic changes materialize. We also considered some counter shocks which might be able to avert the decrease in the numbers of those in employment and so neutralize the effects of demographic changes on economic growth. However, even with such hypothetical shocks, complete neutralization of the effects proved difficult.

In the estimation carried out in this paper, the paths of a number of variables are assumed to remain constant in the future. Since these variables may in fact be considered subject to changes, the picture of future economic growth may well be different as well. For example, as was seen in Section Ⅳ, it is possible that, with the increase of the public burden, the saving rate will fall and economic growth will drop still further. A conceivable result is the emergence of a vicious circle, with the public burden increasing higher and the saving rate falling still further down. On the other hand, it may be the case that an increase in the saving rate of a younger generation concerned about their future could prevent growth from falling to some extent which is suggested in our simulations. These issues will no doubt be investigated more fully in future surveys and researches.

Finally we must reiterate that it is well beyond the intended scope of this paper to discuss the feasibility of the hypothetical counter shocks, which are posited merely as a means of measuring the downward pressure on growth exerted by demographic changes. Meanwhile, the time when the impact of demographic changes will become even more readily apparent is not that far away. Faced with a declining fertility rate and an aging and decreasing population, there is a pressing need for further research into the vital questions of what sort of growth Japan should be aiming at, and what it should do to achieve it.

APPENDIX 1: PAY-AS-YOU-GO AND FULLY FUNDED PENSION SYSTEMS[40]

As is well known, there are two types in financing pension systems: pay-as-you-go (PAYG) systems and fully funded systems. PAYG is the system that requires the burden of paying for the retired generation's benefits to be borne by the generation currently in work, which means that the benefits and contributions in the pension system is required to be balanced for each given point in time. The other one, fully funded, is the system in which the burden of pension for retirement is paid for by withdrawing from the saving reserves that each generation built up themselves during the time that it was working. In the latter case, balance in the pension system is achieved separately for each generation over its lifecycle.

The impact of demographic changes is very different depending on which of these two systems is in place. In what follows we explain these differences in more detail, before going on to review how the revision of the population forecast has been institutionally reflected in the current pension system.

The system currently in place in Japan is a PAYG system, and it is upon such a system that demographic changes impact most severely. As is easily seen in the equations below, since balance must be achieved between pension benefits and contributions every year, it is inevitable for premiums to rise if the number of the retired increases more than the number of those currently in work (N1/N2↑).

$W_2 \times \alpha \times \mathrm{N}_2 = \mathrm{b}_1 \times \mathrm{N}_1$ or re-writing this,

$$\alpha = \frac{b_1 \times N_1}{W_2 \times N_2}$$

W_2 : average wage per worker in the current working generation
α : Employees' Pension Insurance premium
b_1 : pension benefits per capita of the retired generation
N_1 : number of those currently retired
N_2 : number of those currently in work

[40] There are detailed explanations of the differences in economic characteristics between a PAYG and a fully funded system in Oshio (2001), and of the problems that attend the shift from a PAYG to a fully funded system in Oshio (2001) and the Forum for Policy Innovation (2001).

However, this is not true in the fully funded system. Let us think of a simple world in which there are just two periods, a period of working and a period of retirement, during which each generation invests the income it earns when working at interest rate r and then uses up these savings after retirement. Then we can write down the following balancing condition for each generation.

$$W_1 \times \beta \times (1+r) \times N_1 = b_1 \times N_1 \qquad \text{or re - writing this,}$$

$$\beta = \frac{b_1}{W_1 \times (1+r)}$$

W_1 : average wage per worker of the retired generation when it was in work
β : Employees' Pension Insurance premium
b_1 : pension benefits per capita of the retired generation
r : interest rate
N_1 : number of those retired

Since there is no term in this equation describing the balance between the number of those currently in work and the number of those retired, a change in the overall population composition within the economy has no effect on pension premiums. On the other hand, a fall in the interest rate requires a compensating rise in premiums.

What the above discussion suggests is that the economy will never be completely free from the influence of demographic changes as long as the PAYG system remains in place. Therefore, in order to respond to demographic changes, we must employ either of the following three measures: i) raise premiums, ii) lower pension benefits, or iii) adopt a fully funded pension system.

We now turn to look at how the revision of the population forecast has been reflected to date in the existing system. Specifically, when the Actuarial Valuation is carried out, which occurs at least once every five years, demographic changes, along with changes in any of the other conditions upon which the system is premised, such as the rate of wage increase, the inflation rate, and the employment structure, are dealt with through alterations in the pension premium. In terms of our treatment above, this corresponds to the option i). In the current system, while the inflation rate can be reflected every year, demographic changes cannot. We have to

wait as long as five years until the next Actuarial Valuation completes. Moreover, even if the working population declines, there is no automatic reduction mechanism in benefits. Changes made are limited only to discretionary items, such as multiplier in determining pension benefits, so that their impacts have to be absorbed entirely via changes in premiums.

In the FY2004 pension reform, it has been proposed that pension benefits should be annually and automatically adjusted according to the sum of the rate of the wage increase per capita, the rate of decline in the number people insured in the public pension system, minus the rate at which life expectancy is prolonged. Under the current PAYG system, this can be interpreted as a way of adopting the option ii) above, employing an automatic mechanism for pension benefits to be reduced.

APPENDIX 2: FORECASTING LEVELS OF CONTRIBUTIONS AND BENEFITS WITHIN THE PENSION AND MEDICAL INSURANCE SYSTEMS

1. MAJOR PREMISES

- Estimation periods are from FY2003 to 2025 in Section Ⅲ, and from FY2003 to 2050 in Section Ⅵ.
- Unless otherwise indicated, we adopt the assumptions used by Ministry of Health, Labour and Welfare in their May 2002 forecasts.
- We assume that there are no changes in prices, and that real wages rise at an annual rate of 1%.
- For the period from FY2026 to 2050, for which there are no forecasts by the Ministry, we assume the FY2025 premises to remain in place.

2. FRAMEWORK

(1) PENSION CONTRIBUTIONS

- The term 'the insured' includes the following categories:
  Type Ⅰ: the self employed, farmers, and students.
  Type Ⅱ: private sector employees and public service employees.
  Type Ⅲ: spouses of the Type Ⅱ members.
- The future number of the insured is determined by the population aged 20 to 64 at each period.
- Per capita premiums vary depending on the insured member's category type, with the following amounts being levied every year:
  Type Ⅰ: 13,300 yen monthly × 12 months.
  Type Ⅱ: total remuneration taken from the Monthly Labour Survey × the premium rate for the Employees' Pension Insurance as representative.
  Type Ⅲ: 0 yen.
- For rises in premiums, we follow the schedule set out in the "Impact of new Population Estimates upon the Finances of the Employees' Pension Insurance and the National Pension," in May 2002.
- Increases in total remuneration are calculated using the rate of increase in real wages.
- The government's contribution to the basic pension is taken to be 1/3.

(2) PENSION BENEFITS

- Pensioners are divided into those in the National Pension, the Employees' Pension Insurance, the Mutual Aid Pension, and the Welfare Pension.
- Future numbers of pensioners are determined based on the population aged 65 and over who are not in work[41].

(3) MEDICAL INSURANCE CONTRIBUTIONS

- We assume the entire medical expenses are paid by the working age population even though in reality some elderly people are paying their medical expenses through premiums.
- Thus we have: Total expenses = per capita remuneration taken from the Monthly Labour Survey × the population of those aged 20-64 × premium.

(4) MEDICAL BENEFITS

- Per capita medical expenses across different age groups are treated as changing in line with the forecasts of Ministry of Health, Labour and Welfare[42].
- Total medical expenses are obtained simply by the product of the population and per capita medical expenses.
- Co-payments, i.e. the portion that patients pay themselves when they are treated are deducted from total medical expenses. We assume the proportion of individual expenses is assumed to remain constant in the future.

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[41] In fact, the age of eligibility for receiving a pension is in the process of being raised gradually from 60 to 65. This process is scheduled to be completed, for men, in FY2025. As a result, currently there exist people aged between 60 and 64 who are receiving pensions. We assume the rate of employment for those aged 65 and over is kept constant from FY2002 onward in Section III. We assume it is raised so that all those elderly people who wish to work be able to find jobs in Section VI.

[42] According to the Ministry's forecasts, per capita medical expenses across age groups are expected to rise by 3.2% annually for elderly medical expenses, and by 2.1% for the young based on the actual figures for the last 5 years. These rates are broadly in line with the long-term trends since the mid 1980s (Chart 13). However, several reforms have been implemented in recent years, such as the medical insurance system reform in 1997 and the introduction of the nursing care insurance system in 2000, which have succeeded in bringing medical expenses down at least for a while. Taking these recent events into consideration, our assumptions for future growth in medical expenses may be regared somewhat biased upside.

3. CASES CONSIDERED

(1) PENSIONS

- Rising premium case: premium rates are raised in steps, based on the schedule in the "Impact of New Population Estimates upon the Finances of the Employees' Pension Insurance and the National Pension," in May 2002.
- Case 1: premium rates remain level in relation to total remuneration.
- Case 2: the age of pension eligibility is raised up to 70, one year older at a time, with rises occurring every third year, starting from 2005 and finishing in 2017. Premium rates remain level.
- Case 3: the population of working age, namely those aged 20-64, is increased so as to keep the proportion of the population aged 65 and over constant in future. Premiums remain level.

(2) MEDICAL INSURANCE

- Case 1: the premium rate remains level in relation to total remuneration, i.e. 7.1% at their FY2002 level. The Ministry of Health, Labour and Welfare forecasts are used for per capita increase of medical expenses, which are their averages over recent periods, i.e. +3.2% for expenses for the elderly, +2.1% for expenses for the young.
- Case 2: the premium rate remain level, but per capita medical expenses for the elderly are set to increase at the same rate as per capita medical expenses for the young.
- Case 3: the rate of increase in per capital medical expenses is the same as in case 1, however the premium rate is raised in such a way that no gap emerges between benefits and contributions.

APPENDIX 3: SAVING AS THE SOURCE OF FUNDS FOR CAPITAL ACCUMULATION

The saving rate in Section V is basically the household saving rate, given as "(disposable income - consumption) / disposable income". However, when we discuss the macroeconomic growth rate, we consider saving in a whole economy and therefore need to use the concept of saving as the source for capital accumulation. In carrying out our estimations, we understand the relationship between these different concepts of saving as follows.

To begin with, we can write down an expression for the end-of-period capital stock K as follows: $K = (1-\delta)K_{-1} + I = (1-\delta)K_{-1} + sY$, where the suffix "-1" indicates a lag of one period. Here δ is the capital depreciation rate, I is capital spending, Y is output, and s describes the ratio between capital spending and output which is a function of household saving.

We then define s, s_1, and s_2 as follows:

$$s \equiv I / Y$$
$$s_1 \equiv 1 - C / Y$$
$$s_2 \equiv 1 - C / Y_d$$

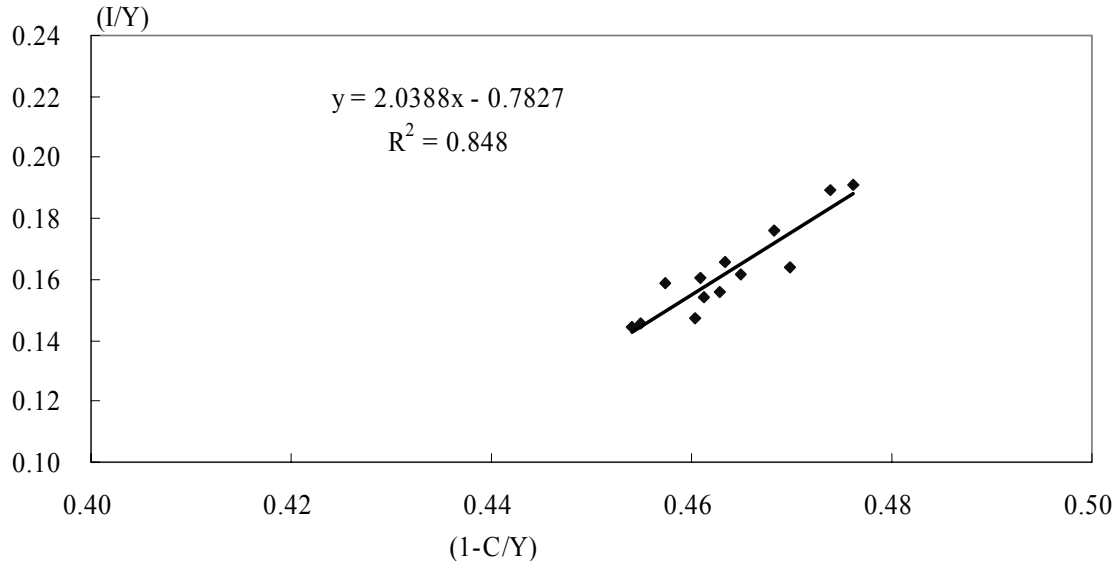
Here, C is households' final consumption expenditure and Y_d is households' disposable income. s_1 is the saving rate when "output = consumption + saving," and s_2 is the household saving rate. Changes in prices are not considered here. We can then write down the following relationship between s_1 and s_2:

$$s_1 = 1 - \frac{Y_d}{Y}(1 - s_2)$$

Our ultimate concern is on *s*, however, as is seen in the chart below, there is an empirically observed linear relationship between s and s_1, and we assume it holds here. This assumption is equivalent to ignoring changes in IS balances arising both from the transactions with the rest of the world and with the government sector.

In this way we are able to derive the ratio between capital spending and output, *s*, from the household saving rate, s_2.

(Reference) Comparison between $s=1/Y$ and $s_1=1-C/Y$



APPENDIX 4: INCORPORATING THE EFFECTS OF THE PENSION SYSTEM ON ECONOMIC GROWTH

Here we incorporate the effects of demographic changes on the social security system, covered in Section III, in a way that disposable income of households Y_d reflects changes of pension benefits.

To begin with, we decompose disposable income Y_d as follows:

Y_d = baseline disposable income + the amount that pension benefits differ from the baseline case

"Baseline disposable income" is regarded to increase in proportion to economic growth. For "the amount that pension benefits differ from the baseline case", we use our forecasts on pension benefits in Section III. In this regard, pension benefits depart from their baseline value when demographic changes cause shifts in the number of elderly people not in work.

In Section III, we described how increases in pensions would cause household contributions to rise. This would reduce individual households' disposable income, and might therefore also influence the path of household saving rates, probably in the direction towards a reduction in household saving. However, in order to keep the discussion simple, we assume an environment in which the rate of household contribution is fixed, and any shortfalls are paid by the government through issuing government bonds. The expansion of the fiscal deficit may well have some further influence on household saving, but, as we have already mentioned, the effect of widening fiscal deficit upon saving is left out here.

These settings allow us to separate disposable income into a part that moves in proportion to economic growth, and the other that is determined via demographic changes. Our forecast employs this Y_d and also s derived from the way explained in Appendix 3.

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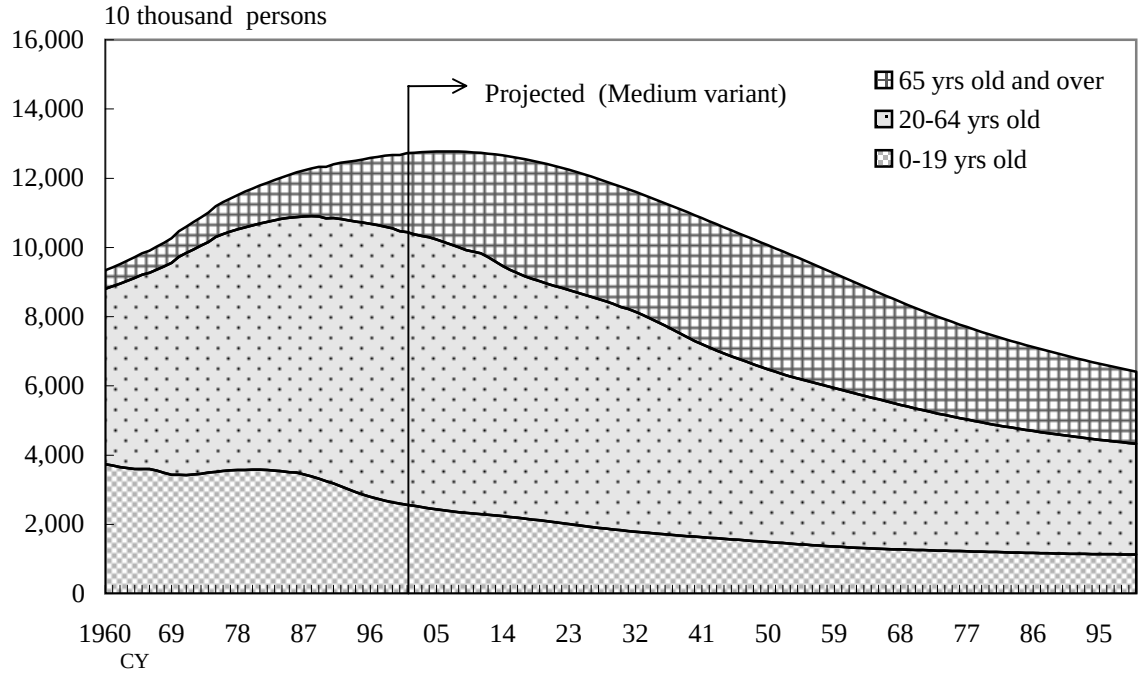
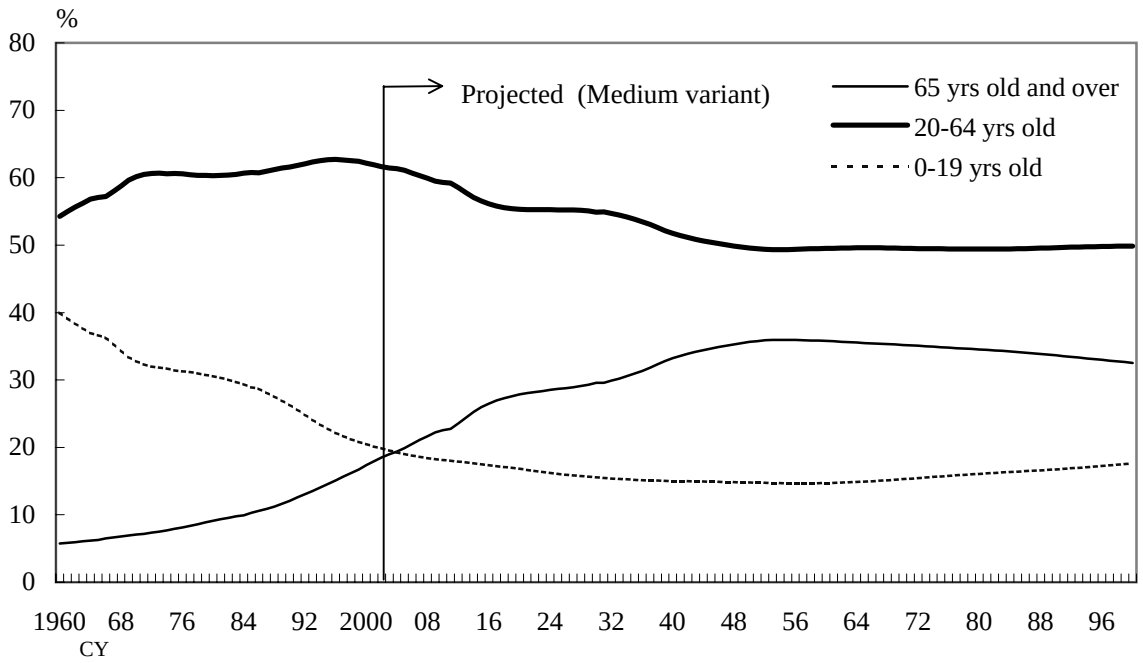
Chart 1

Population Projections for Japan

(1) Trends in the number of the major age composition



(2) Trends in the percentage of the major age composition of the total population

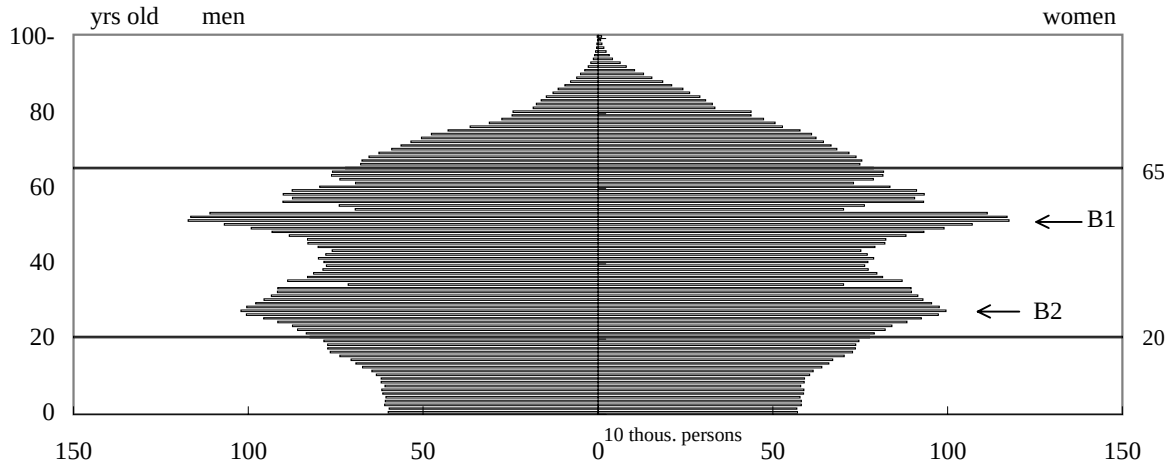


Sources: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Population Estimates";
National Institute of Population and Social Security Research, "Population Projection for Japan"

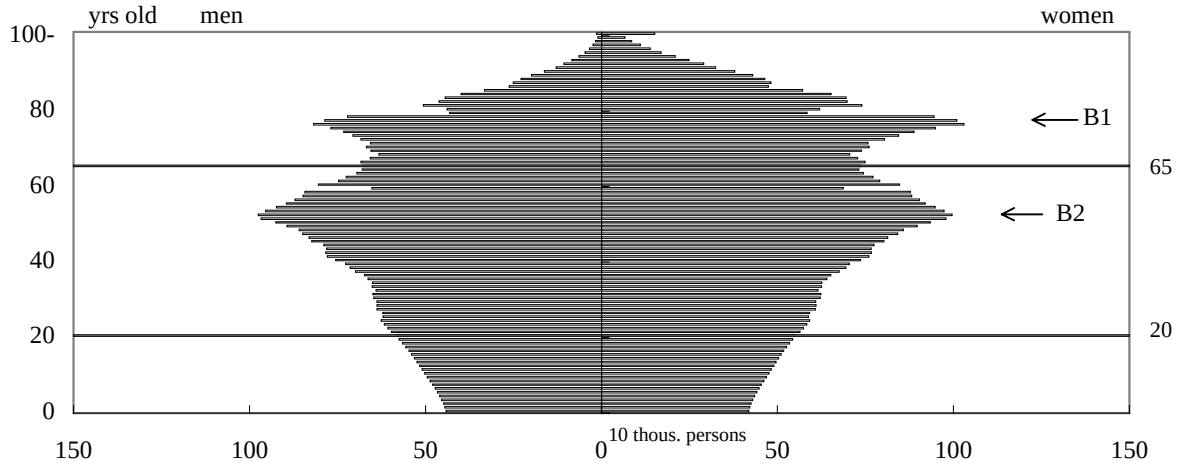
Chart 2

Population Pyramid

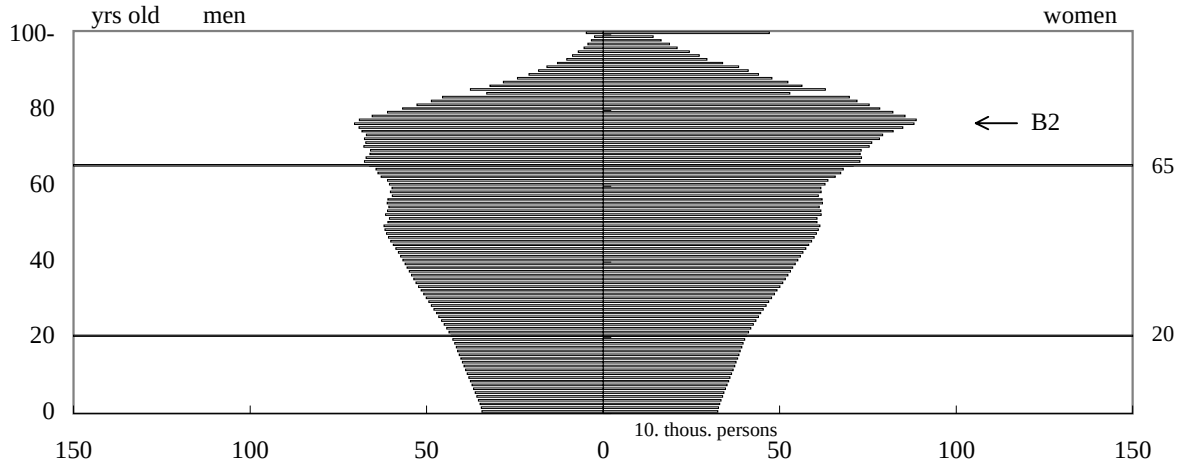
(1) Year 2000



(2) Year 2025



(3) Year 2050



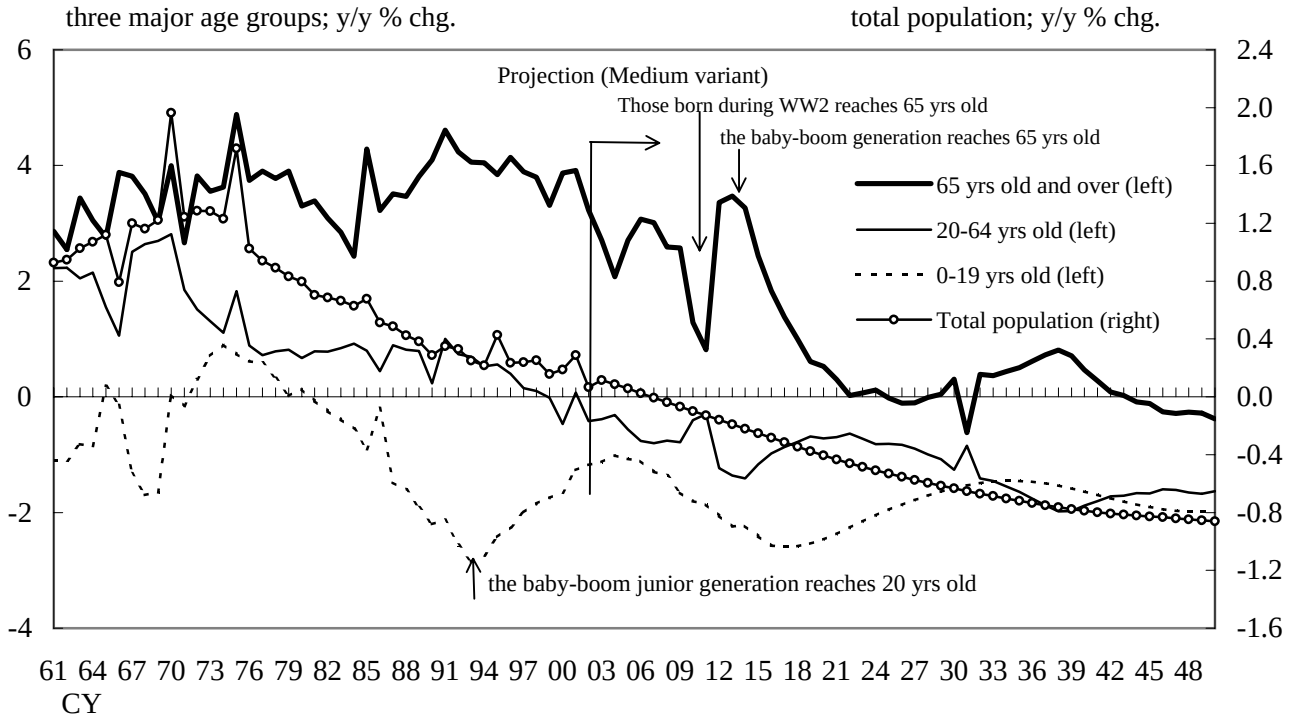
Note: B1 = the baby-boom generation born in 1947 to 49;
B2 = the baby-boom junior generation born in 1971 to 74.

Source: National Institute of Population and Social Security Research, "Population Projection for Japan."

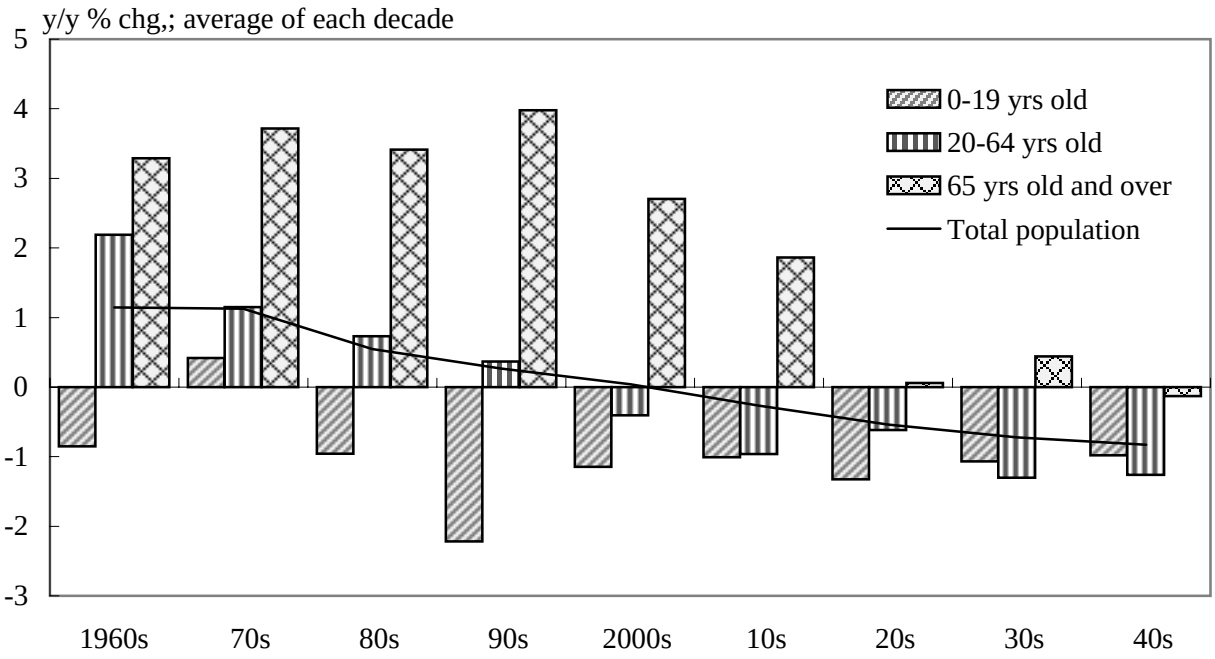
Chart 3

Developments in Population by Age

(1) Year-on-year changes in population of three major age groups



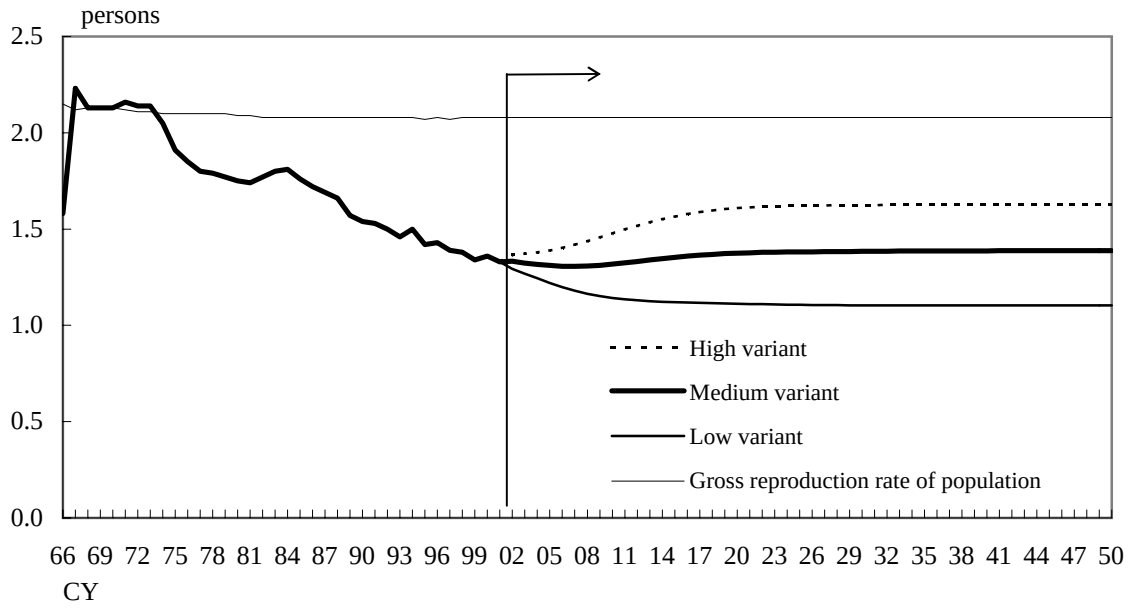
(2) Year-on-year changes in population of three major age groups by decade



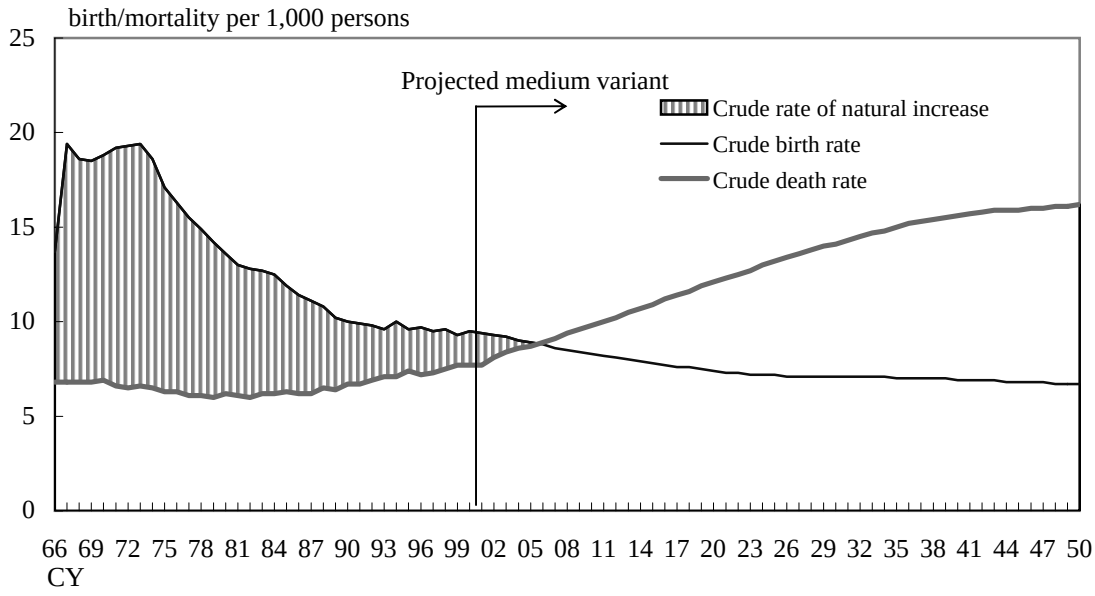
Sources: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Population Estimates";
National Institute of Population and Social Security Research, "Population Projection for Japan"

Fertility and Death Rates

(1) Total fertility rate



(2) Crude birth rate and crude death rate



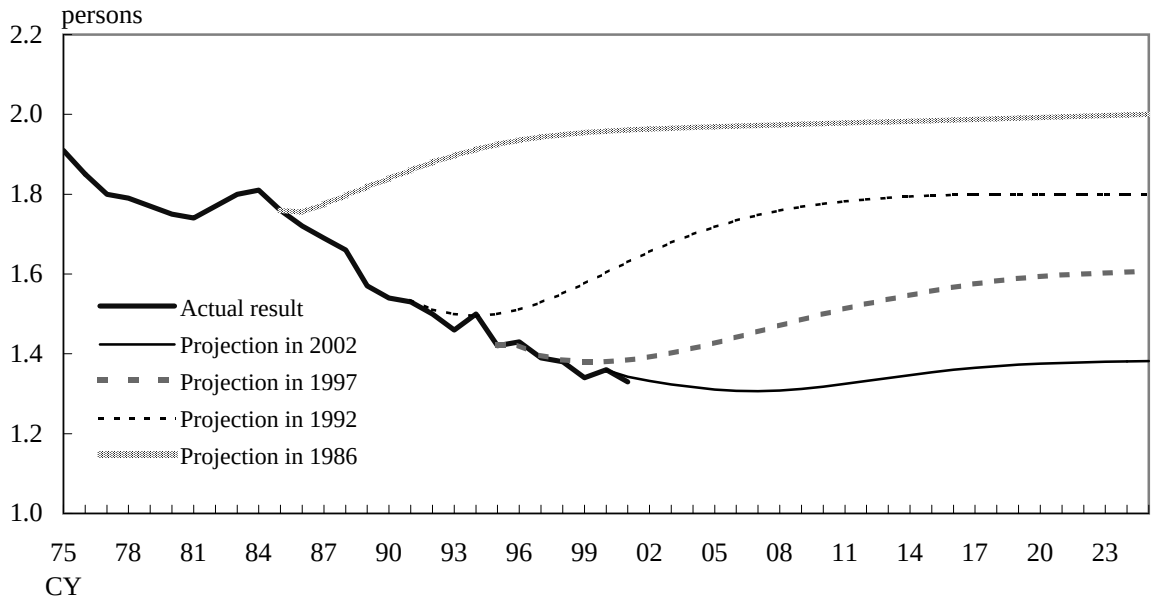
Notes: 1. Total fertility rate is the sum of an age-specific fertility rate of women between 15-49 years old observed during a certain year. It is the average number of births assumed in a woman's lifetime based on the given age-specific fertility rate.
2. Gross reproduction rate of population is the total fertility rate needed to maintain the current population. Here, it is indicated as level from 2000.
3. Crude birth (death) rate is the number of births (deaths) per 1,000 persons.

Sources: Ministry of Health, Labour and Welfare, "Vital Statistics"; National Institute of Population and Social Security Research, "Population Projection for Japan."

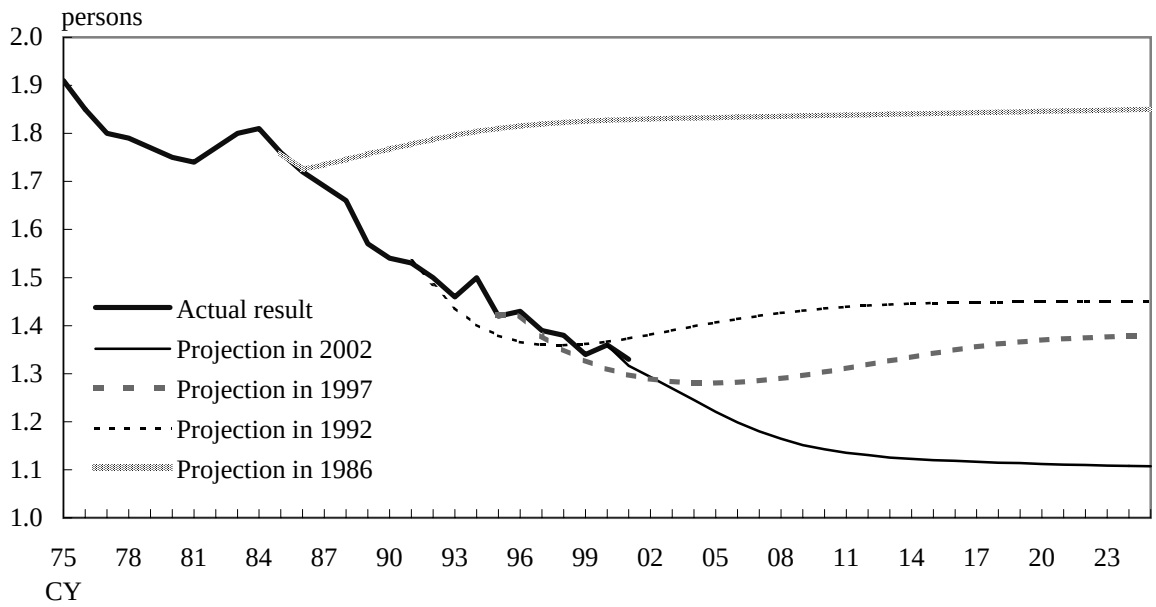
Chart 5

Past Population Projections: Total Fertility Rates

(1) Medium variant projection



(2) Low variant projection

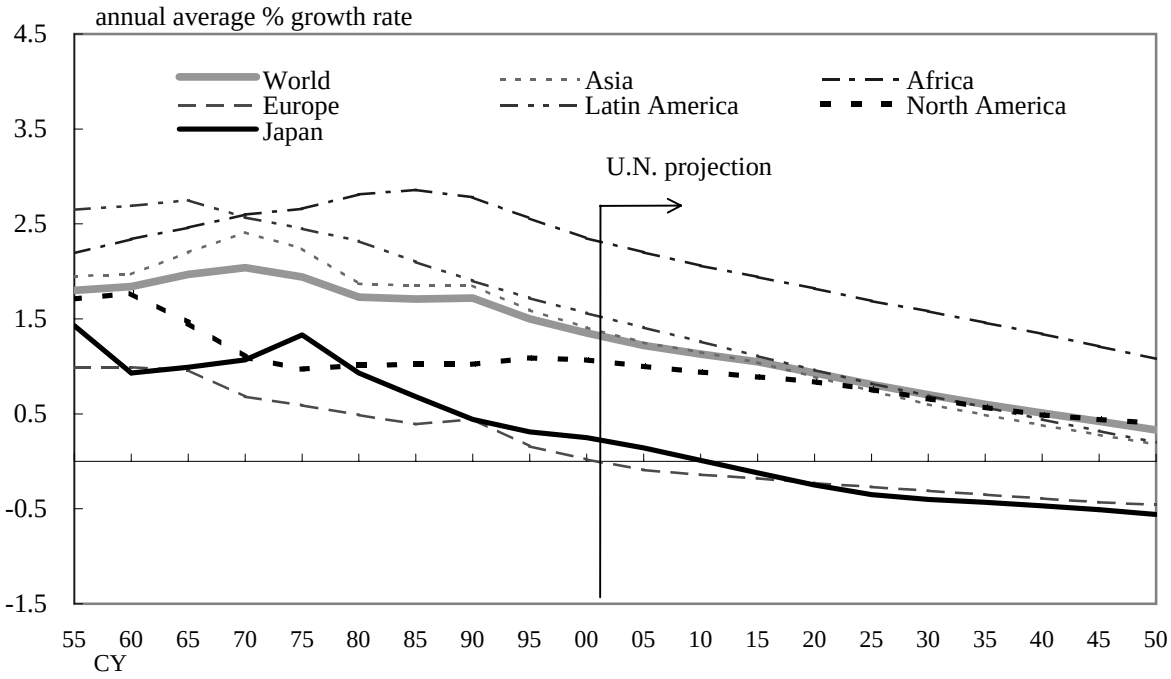


Source: National Institute of Population and Social Security Research, "Population Projection for Japan"

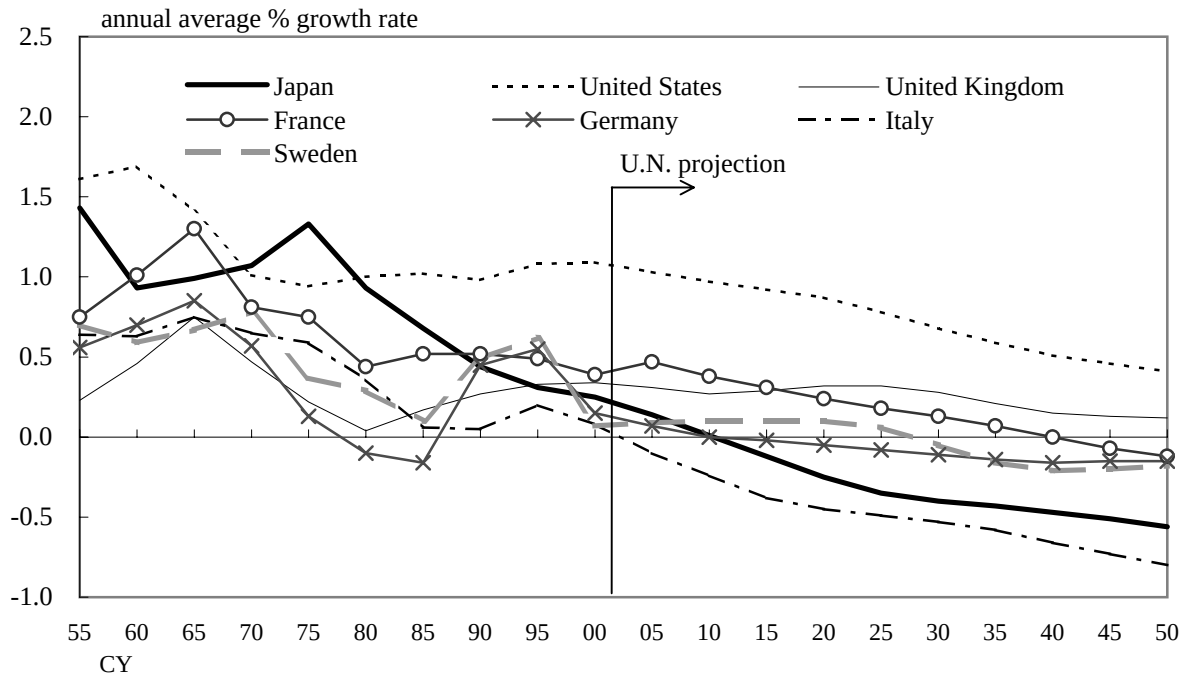
Chart 6

World Population Growth Rate

(1) World



(2) Europe and other industrialized countries

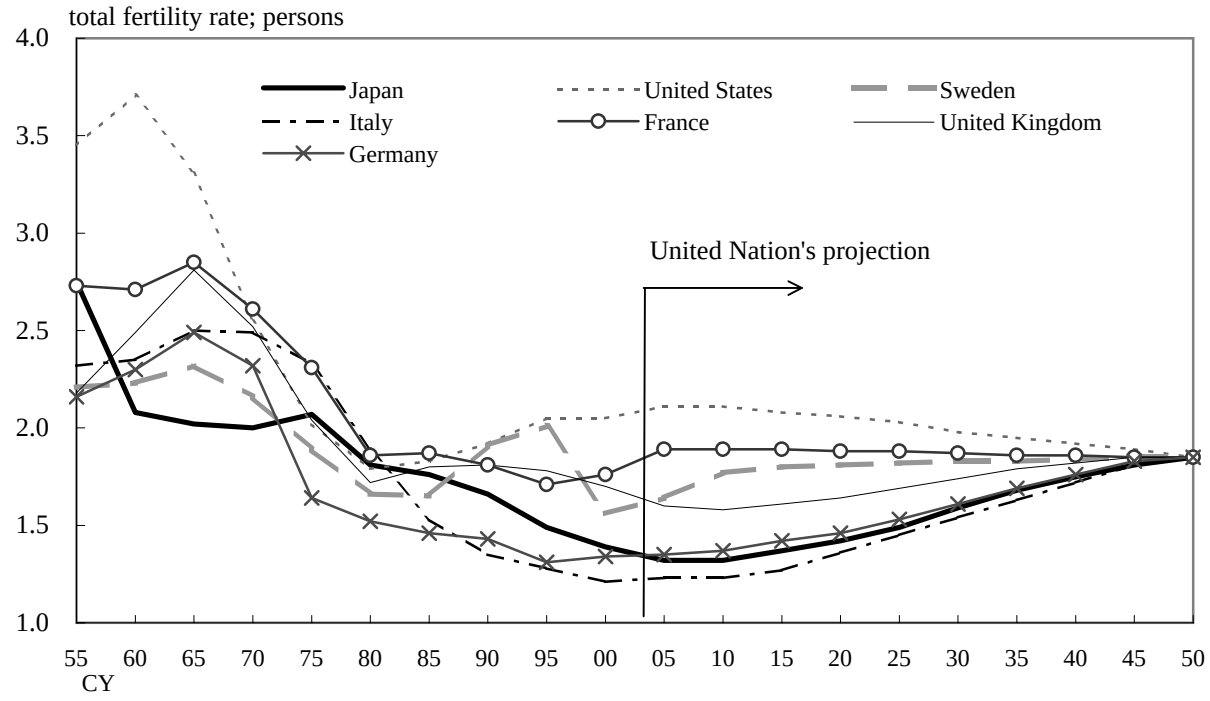


Source: United Nations

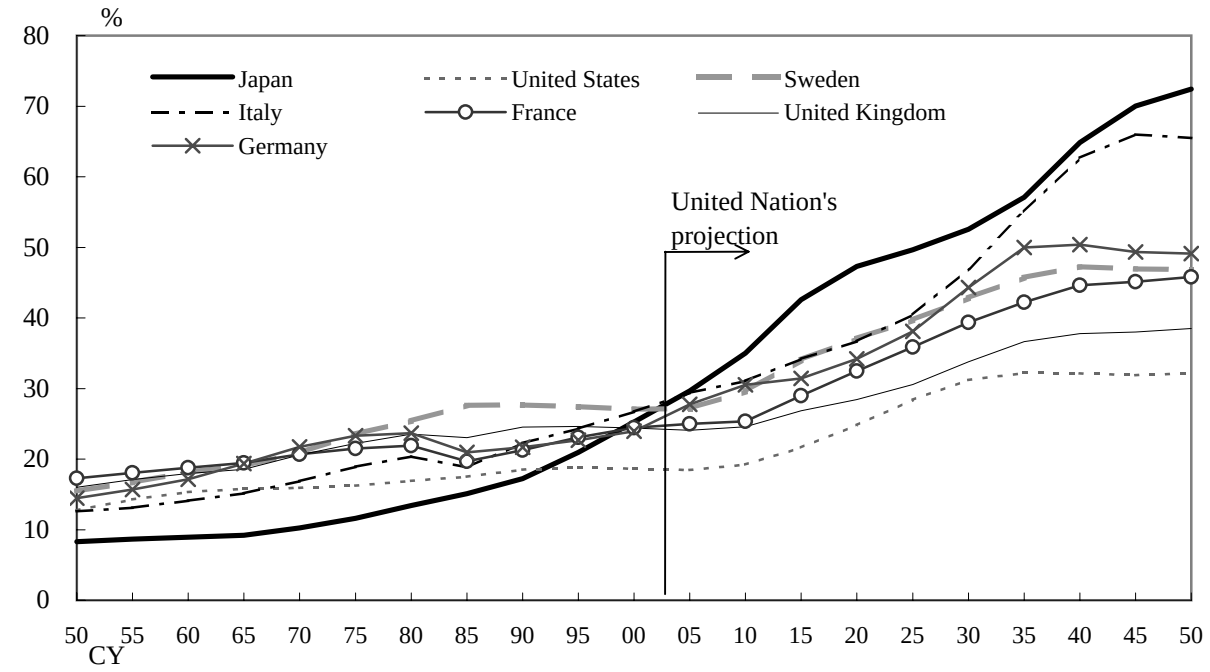
Chart 7

World Total Fertility Rate and Aged Dependency Ratio

(1) Total fertility rates of industrialized countries



(2) Aged dependency ratio



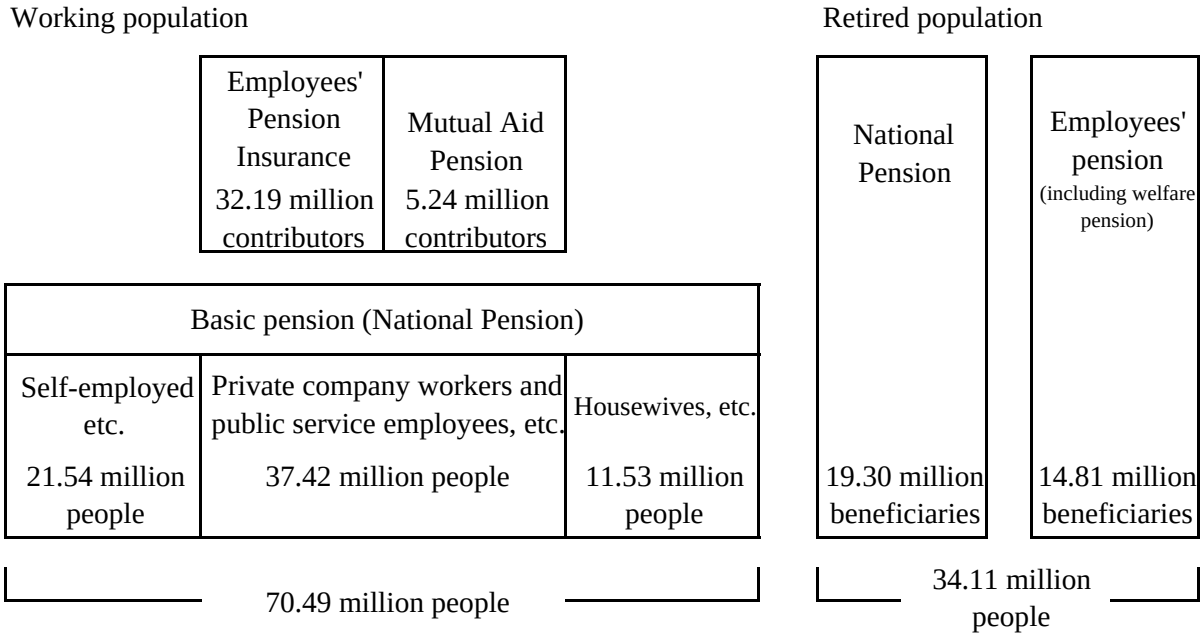
Note: Here, the aged dependency ratio indicates the ratio of 65 years old and over to the 15-64 year-old population.

Source: United Nations

Chart 8

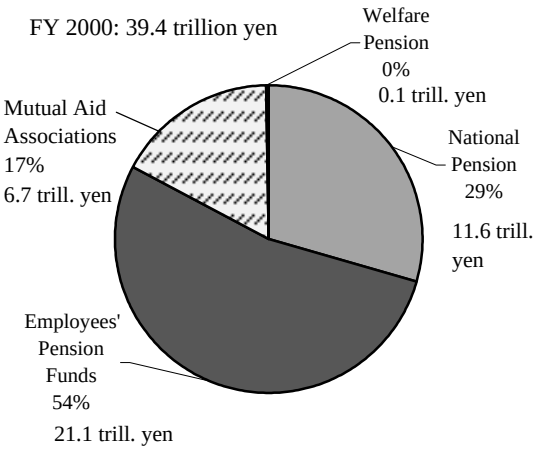
Japan's Pension System

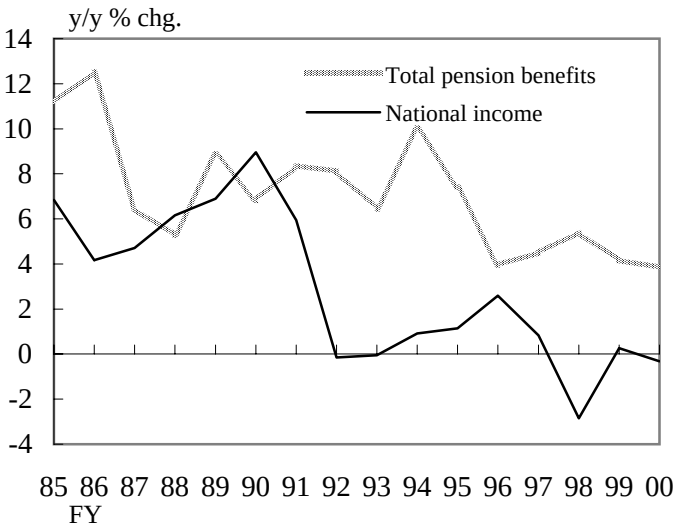
Members of the Public Pension and those receiving pensions; fiscal 2001



Developments in the Public Pension (1)

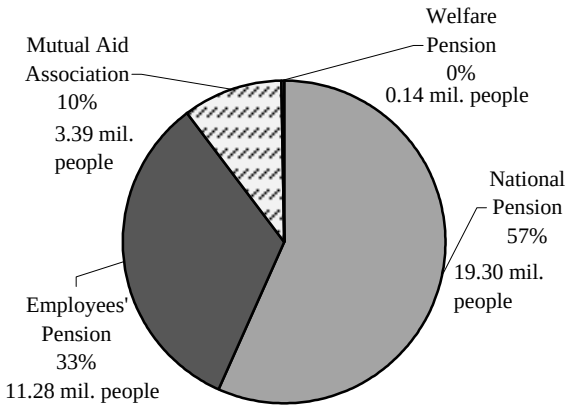
(1) Total pension benefits

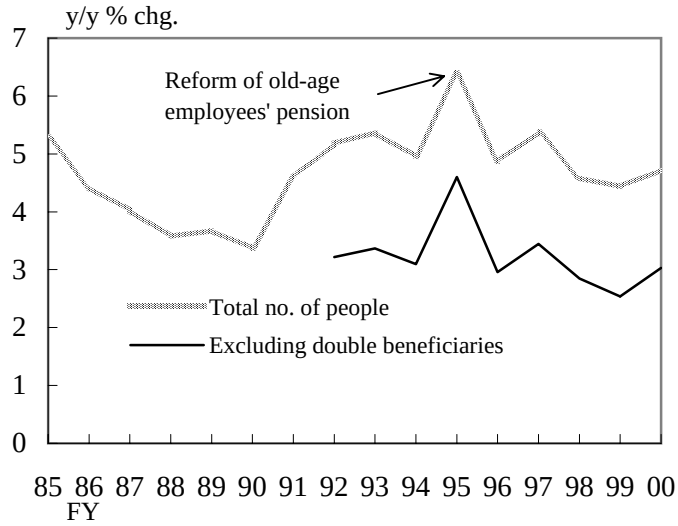




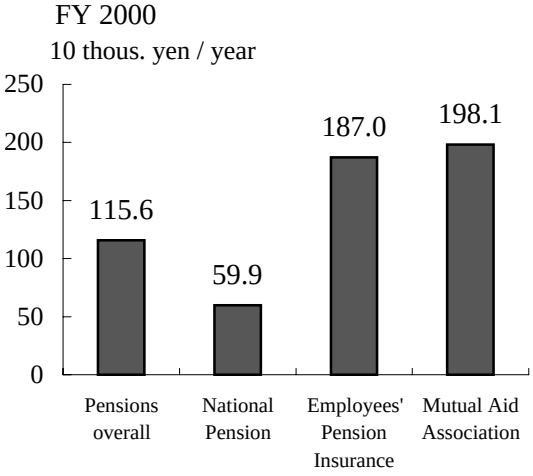
(2) Number of beneficiaries

FY 2000: 40.91 million people (total)
34.11 million people (excluding double beneficiaries)





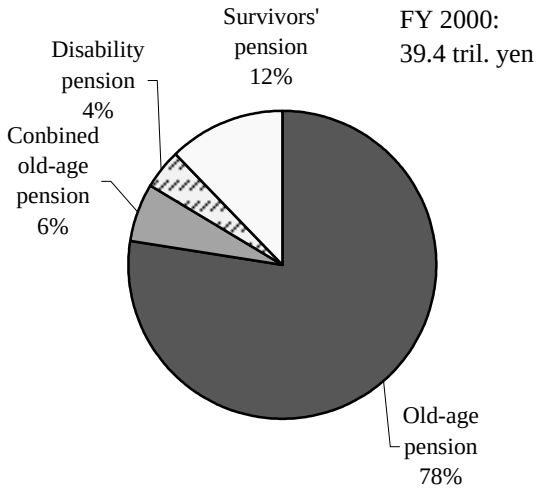
(3) Pension amount per person



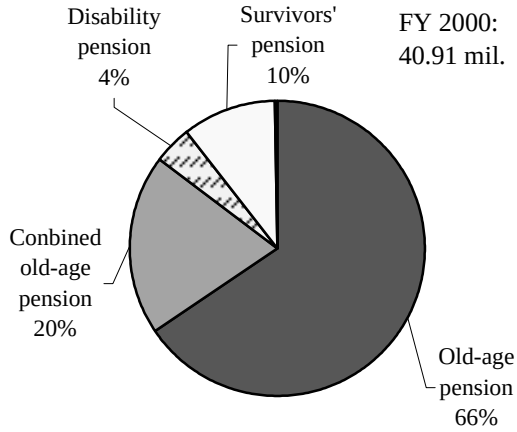
Note: Pension benefits per person = total pension benefits / pension recipients (excluding double beneficiaries). In this case, all double beneficiaries are assumed to be contributors of the Employees' Pension Insurance.

Developments in the Public Pension (2)

(1) Total pension benefits by type of pension



(2) Total number of recipients by type of pension



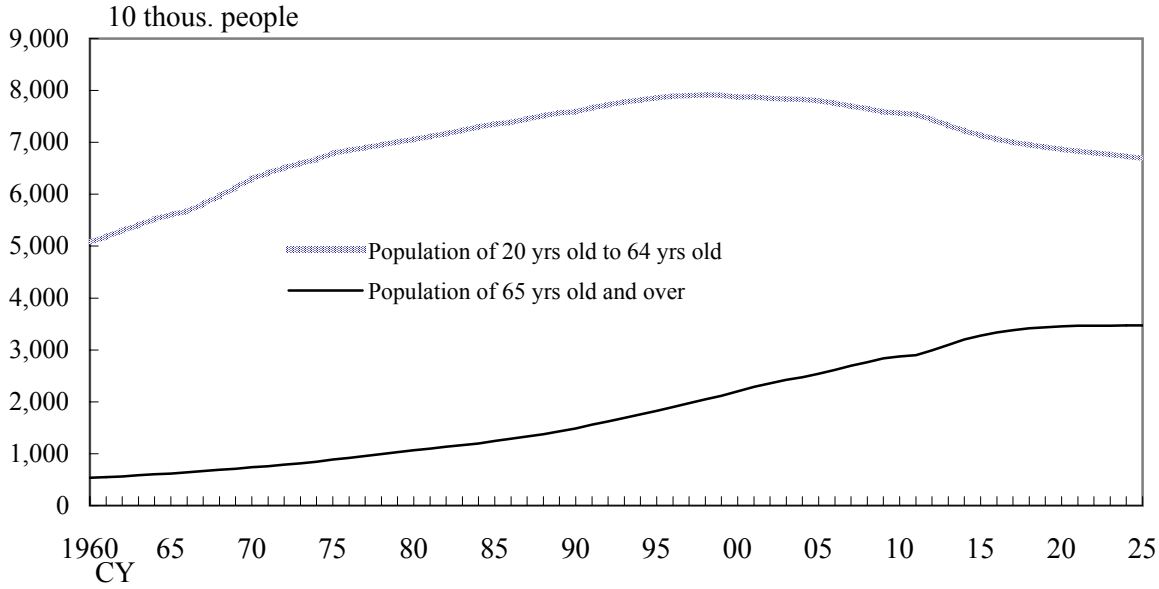
(3) Type of pension

	Content
Old-age pension	A pension paid to members when they reach a certain age after a certain period of contribution.
Combined old-age pension	A pension paid to those who have been members of various pension schemes. When the membership of each pension scheme adds up to a certain period, the pension is paid from each scheme according to the membership period.
Disability pension	A pension paid based on the certified status that he/she has serious disability (1st degree and 2nd degree). The member must be disabled due to illness or injuries and have difficulties in leading everyday life.
Survivors' pension	A pension paid to the spouse or child when the member dies.

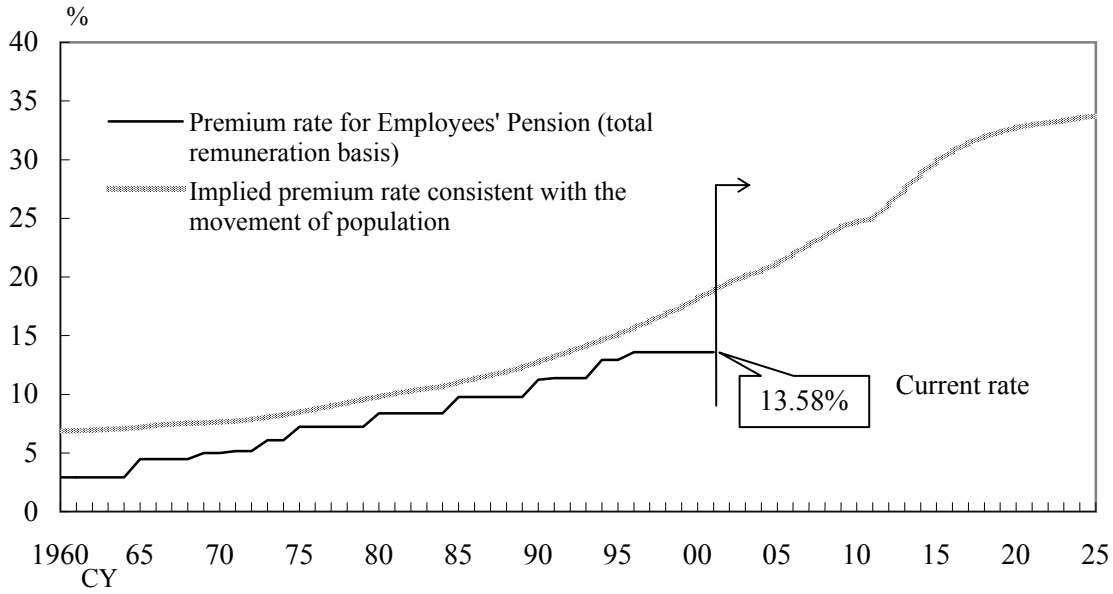
Sources for Charts 9 and 10: Social Insurance Agency, "*Jigyou Nenpou* (annual report on businesses)"; Health and Welfare Statistics Association, "*hoken to nenkin no doukou* (developments in public insurance and pension)."

Premium Rate for Employees' Pension Insurance implied by Population Balance

(1) Population balance of the working and retired populations



(2) Implied premium rate consistent with changes in population



Estimation of the implied premium rate consistent with the movement of population is made as follows:

1 Assume that all Japanese are beneficiaries of the Employees' Pension Insurance. The pay-as-you-go system is applied so that pension benefits of the retired population are covered by premiums from the then working population. Income and expenditure are kept in balance each year, and there are no fiscal deficits. There are also no taxes coming in (no government's contribution to basic pension).

2 α (Insurance premium) = $\frac{b \text{ (pension benefit per person of the retired population)} * \text{retired population}}{W \text{ (wage per person of the working population)} * \text{working population}}$

3 Working population = 20 to 64 yrs old, retired population = 65 yrs old and over.

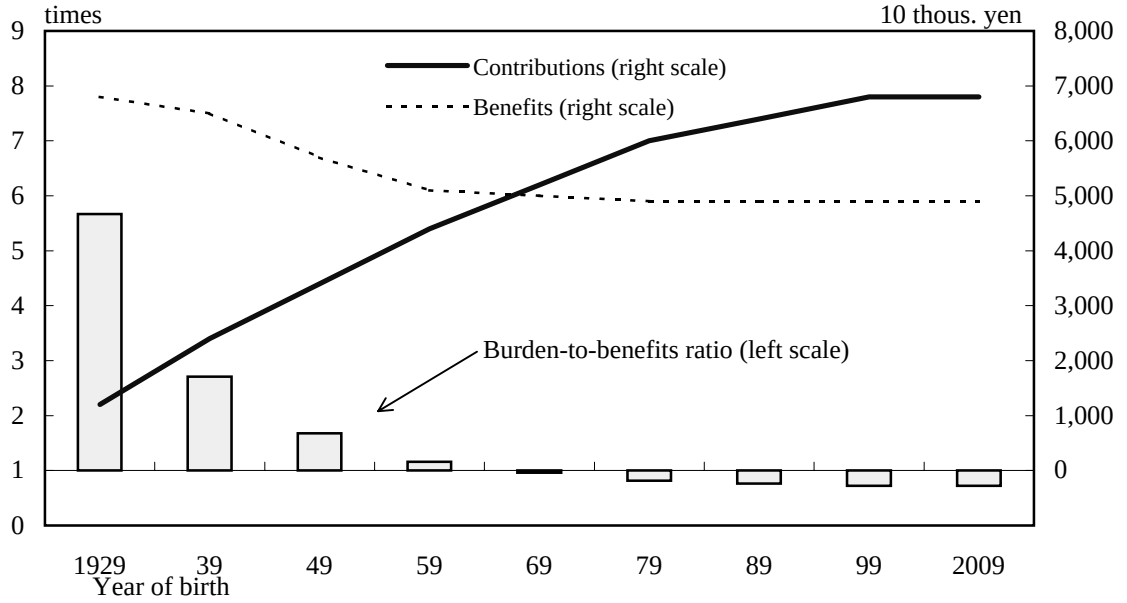
4 b (pension benefit per person of the retired population) is the level of benefits set so that the 65 percent of wages of the working population in the year 1960 is guaranteed. It increases at the same rate as the wage of the working population does.

5 W (wages) represent the total cash earnings in the Monthly Labour Survey.

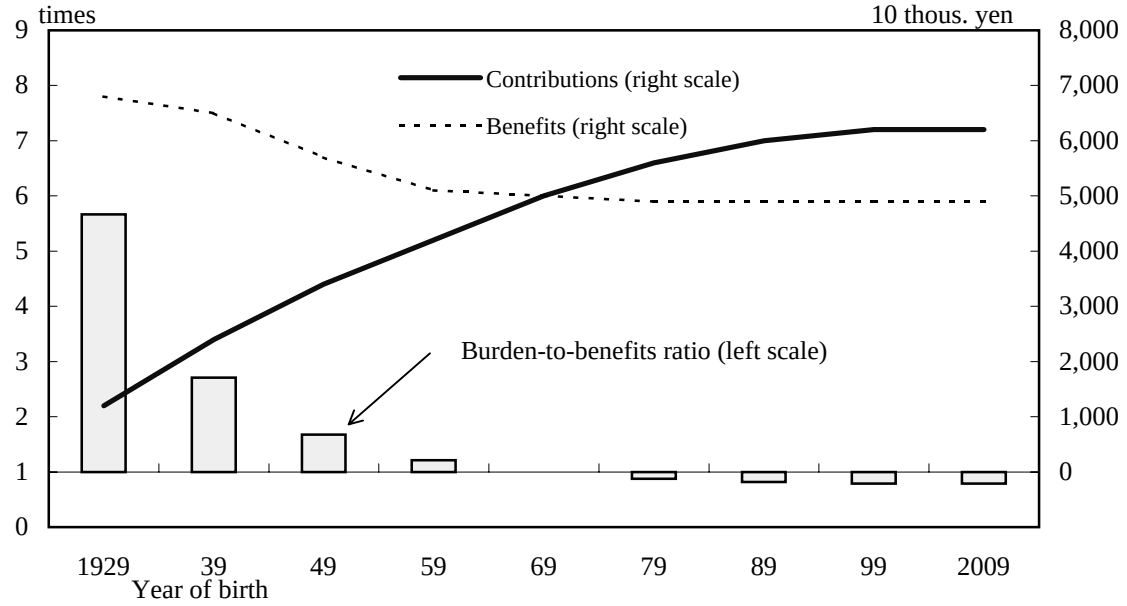
Sources: Ministry of Health, Labour and Welfare, "Monthly Labour Survey, " etc.

Personal Lifetime Balance of Pension Benefits and Contributions of the Employees' Pension Insurance by Year of Birth

(1) Current situation: the government's contribution to the basic pension is one-third



(2) Assumption: the government's contribution to the basic pension is raised to half

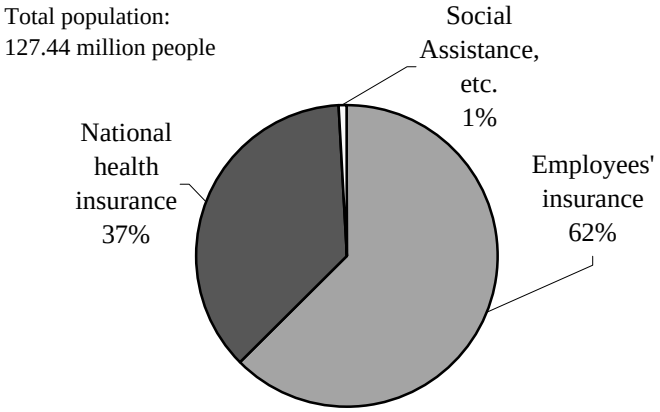


Notes: 1. Contributions consist of both individual and corporate contributions. We assume that contributions are equally shared by employers and employees.
2. The government's contribution is counted but not indicated in the contributions of the charts.
3. Data indicate the amount of a standard household consisting of a couple and two children.

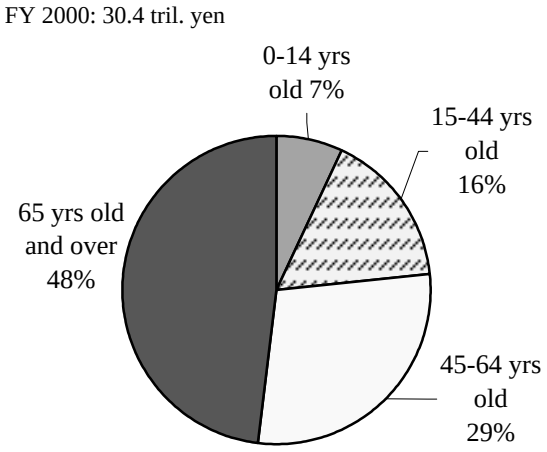
Source: Ministry of Health, Labour and Welfare.

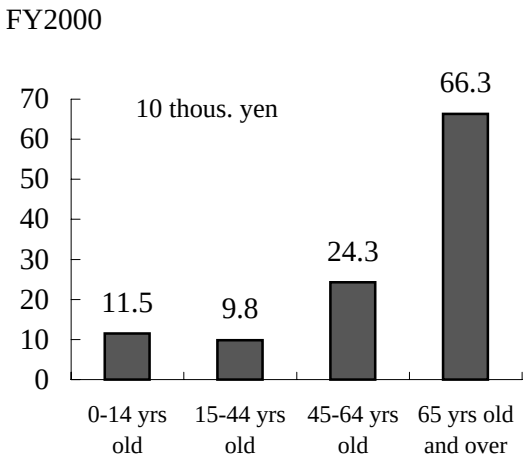
Developments in Medical Expenses

(1) Members of the health insurance system

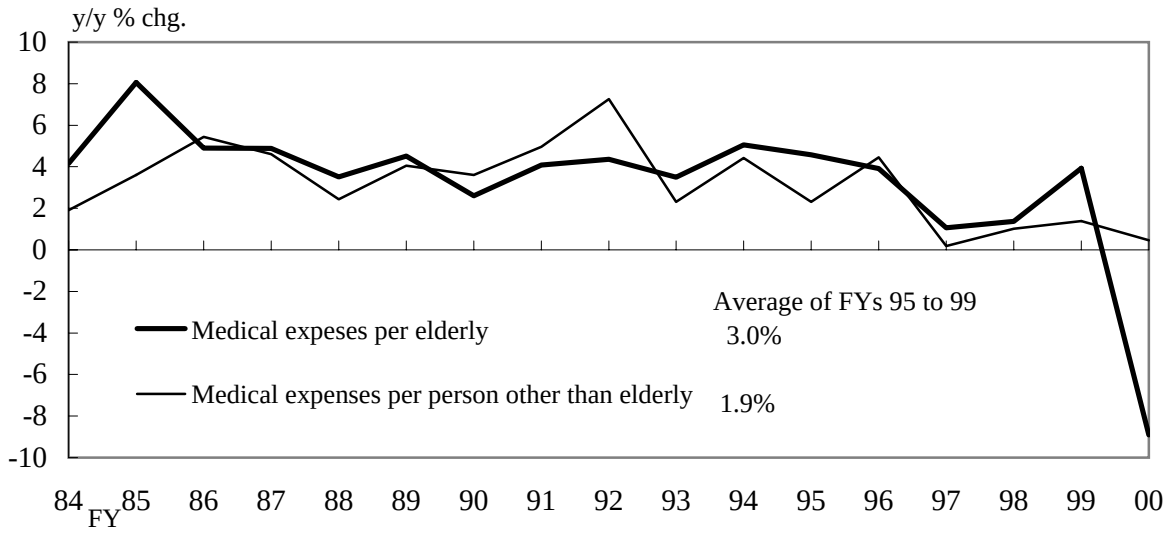


(2) Breakdown by age





(3) Medical expeses per elderly



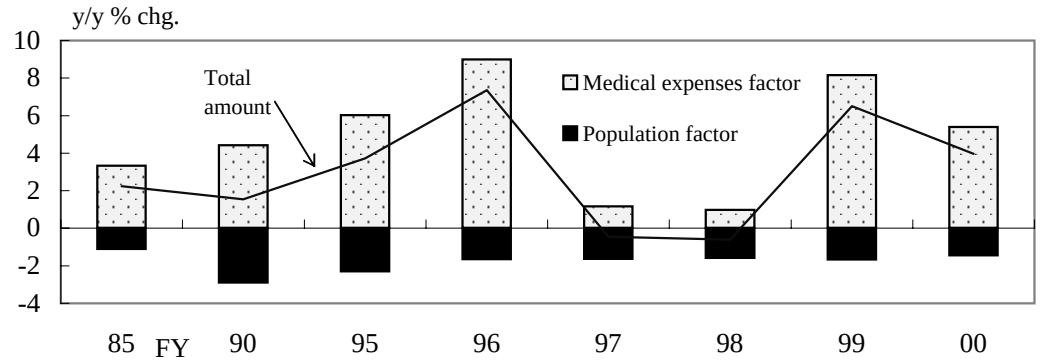
Note: 1.Medical expenses per elderly is the medical cost of a person eligible for the National Health Insurance for the elderly.

2.Medical expenses per person other than elderly = (total national medical expenses minus national medical expenses for elderly)/total population excluding those eligible for the National Health Insurance for the elderly

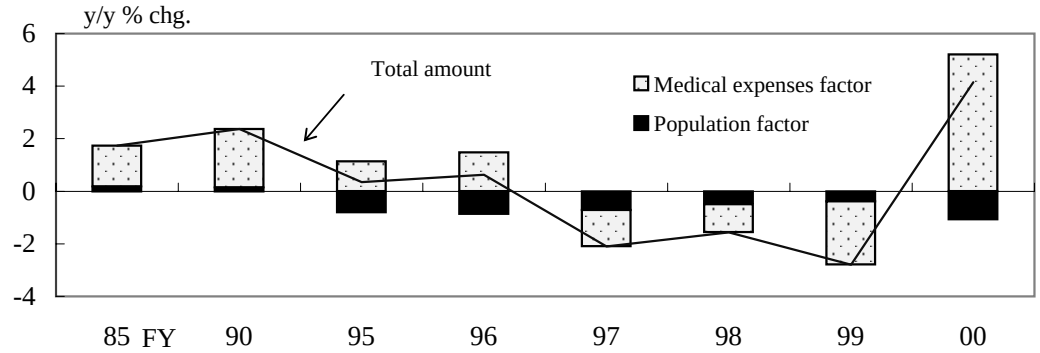
Source: Ministry of Health, Labour and Welfare, "National Medical Care Expenses."

Factors of the Changes in Medical Expenses by Age Group

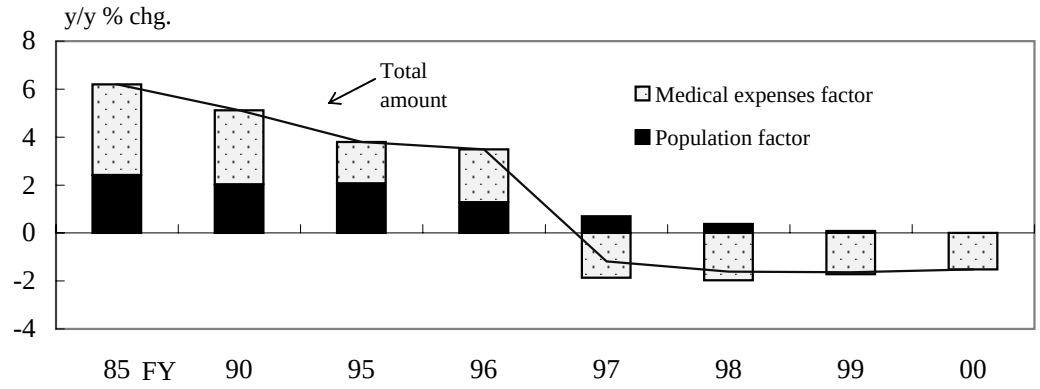
(1) 0-14 years old



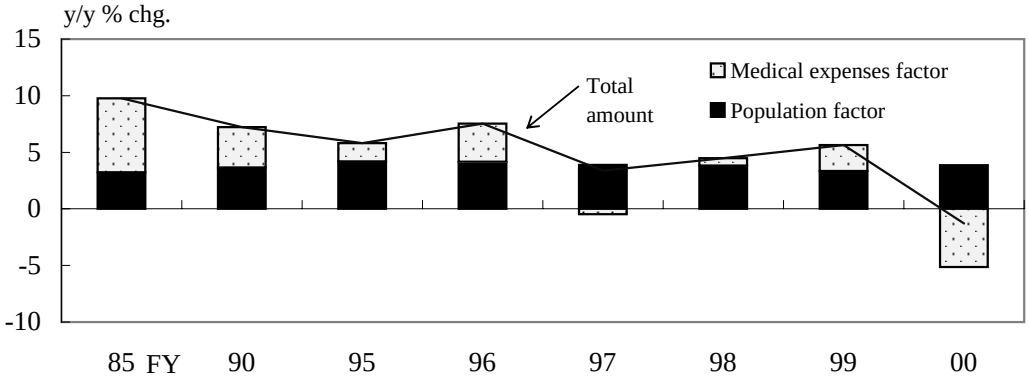
(2) 15-44 years old



(3) 45-64 years old



(4) 65 years old and over



Notes: 1. Data are based on medical expenses excluding dentistry. Figures for FYs 80-85, 85-90, and 90-95 are annualized.

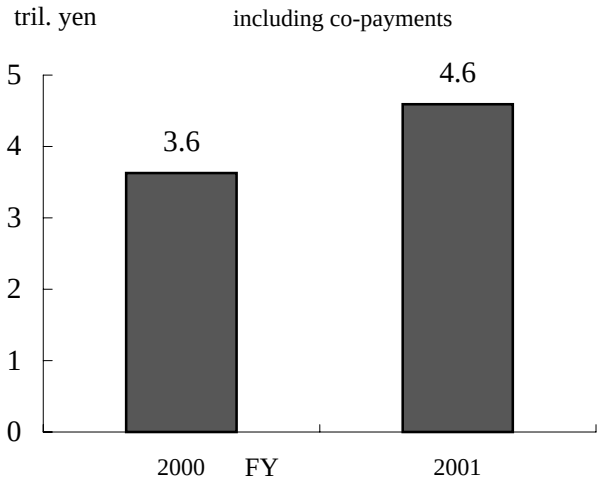
2. Medical expenses factor = year-on-year changes in total medical expenses minus year-on-year changes in population in each age group

Sources: Ministry of Health, Labour and Welfare, "*heisei 12 nendo kokumin iryouhi no gaikyou* (report on national medical expenses, fiscal 2000)"; Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Population Estimates."

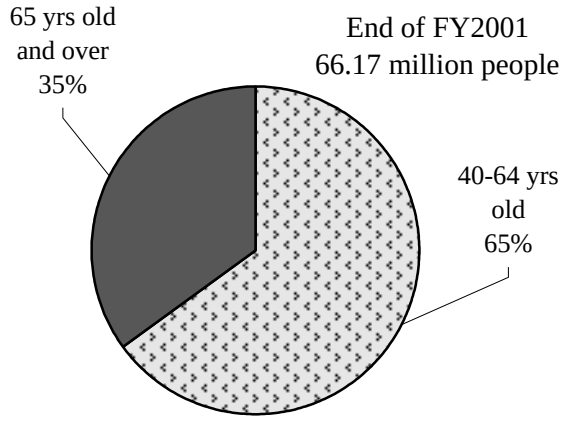
Chart 15

Developments in Nursing Care Insurance

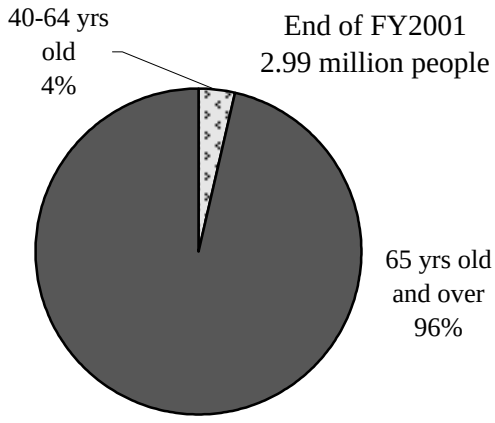
(1) Total payment of nursing care benefit



(2) Number of people insured



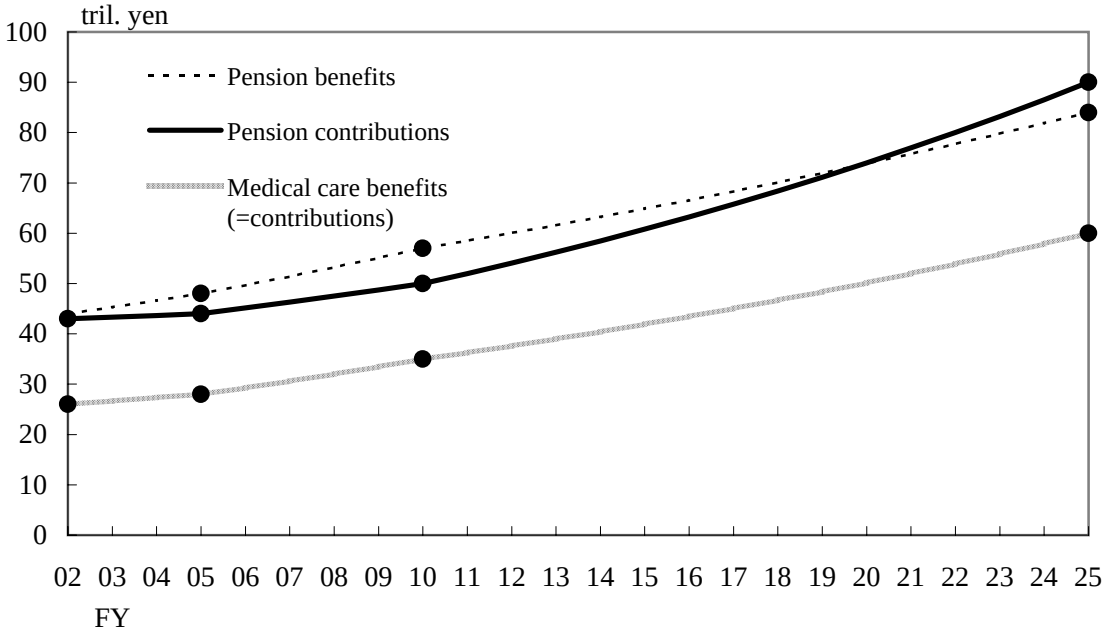
(3) Number of elderly people certified as needing nursing care



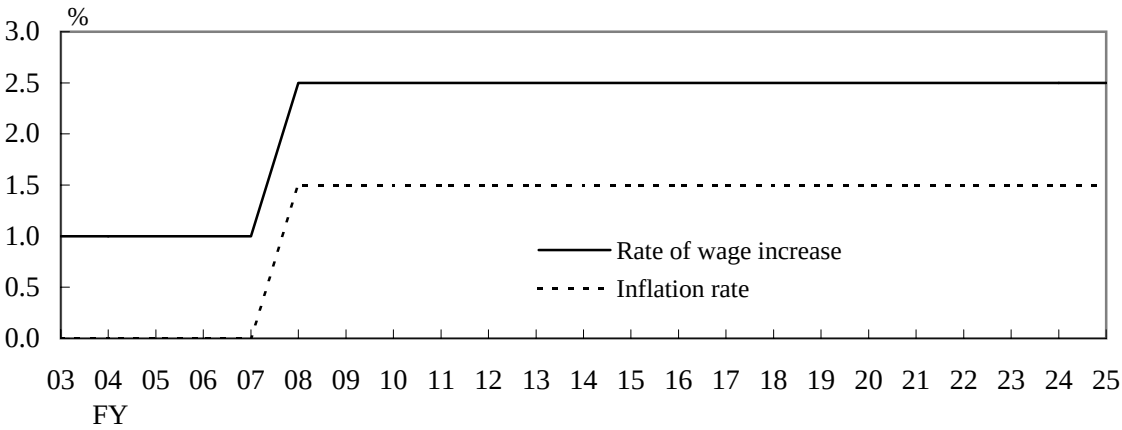
Note: Co-payments are what patients pay themselves when they are treated.
Sources: Ministry of Health, Labour and Welfare, "Survey of National Medical Care Insurance Services," "White Paper Annual Report on Health and Welfare."

Forecasts of Social Security Benefits and Contributions

(1) Forecasts of benefits and contributions by Ministry of Health, Labour and Welfare



(2) Assumption for the forecast



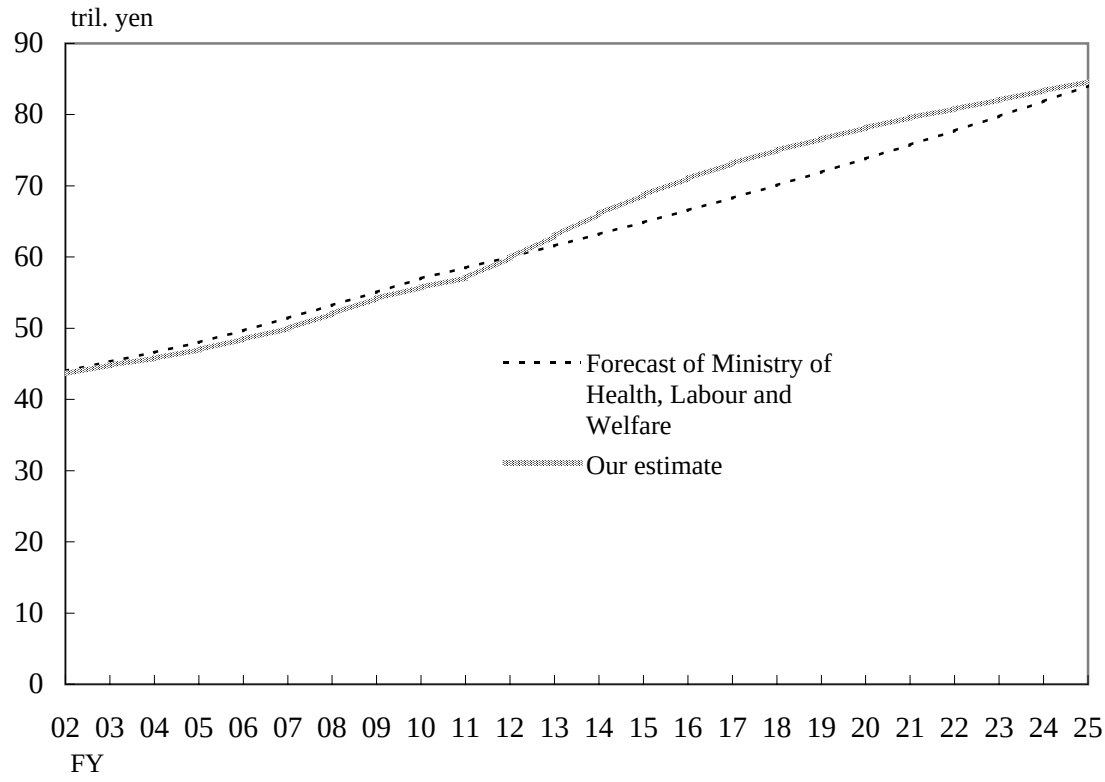
Pensions	Estimated by incorporating the economic assumption and the effects of the population projection of Jan. 2002 into the 1999 Actuarial Valuation of the public pension under the current system.
Medical care	Estimated based on the FY2002 budget and the recent growth of the medical expenses per person, i.e., 3.2% annually for elderly people and 2.1% for the others, which are actual result of FY 1995 to 99. Also taking into account the fluctuations in the population, i.e., aging and changes in population, and the recent effects of the medical insurance system reform.

Notes: 1. Figures are released by the Ministry only for fiscal years with black dots. Figures of other fiscal years are interpolated by assuming that the year-on-year changes remain unchanged
2. As for pensions, there is a discrepancy between contributions and benefits as they are calculated separately.
3. As for medical care, there are no discrepancies between contributions and benefits since the amount of benefits is calculated automatically the same as the amount of contributions under PAYG scheme.

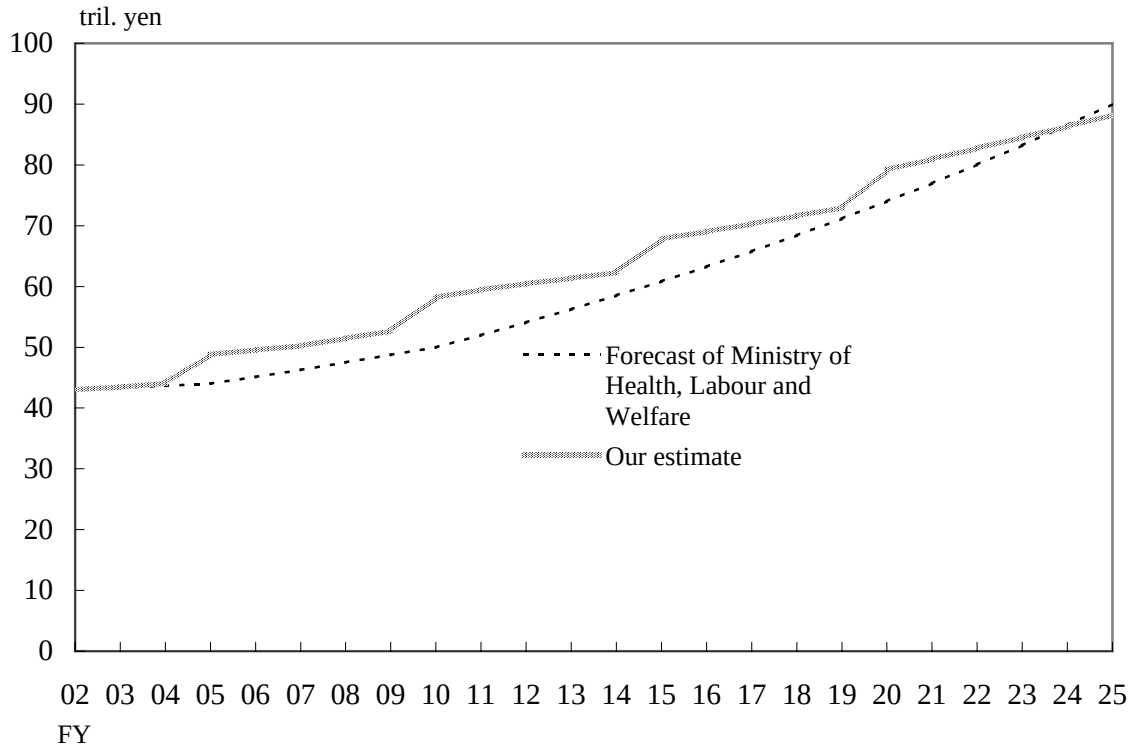
Source: Ministry of Health, Labour and Welfare, "Forecast of the Benefits and Contributions of Social Security," May 2002.

Forecast of Pensions

(1) Benefits



(2) Contributions

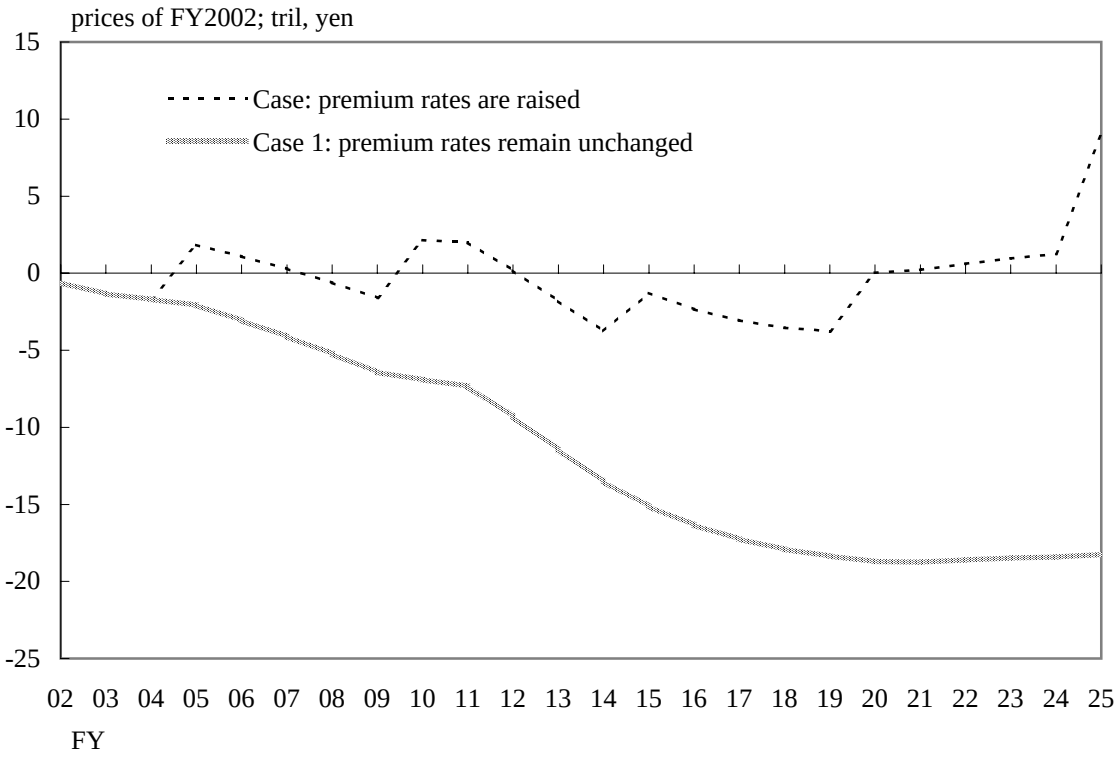


Note: As for the forecasts of the Ministry of Health, Labour and Welfare, figures are released only for FYs 2005, 2010, and 2025. Figures of the other fiscal years are interpolated.

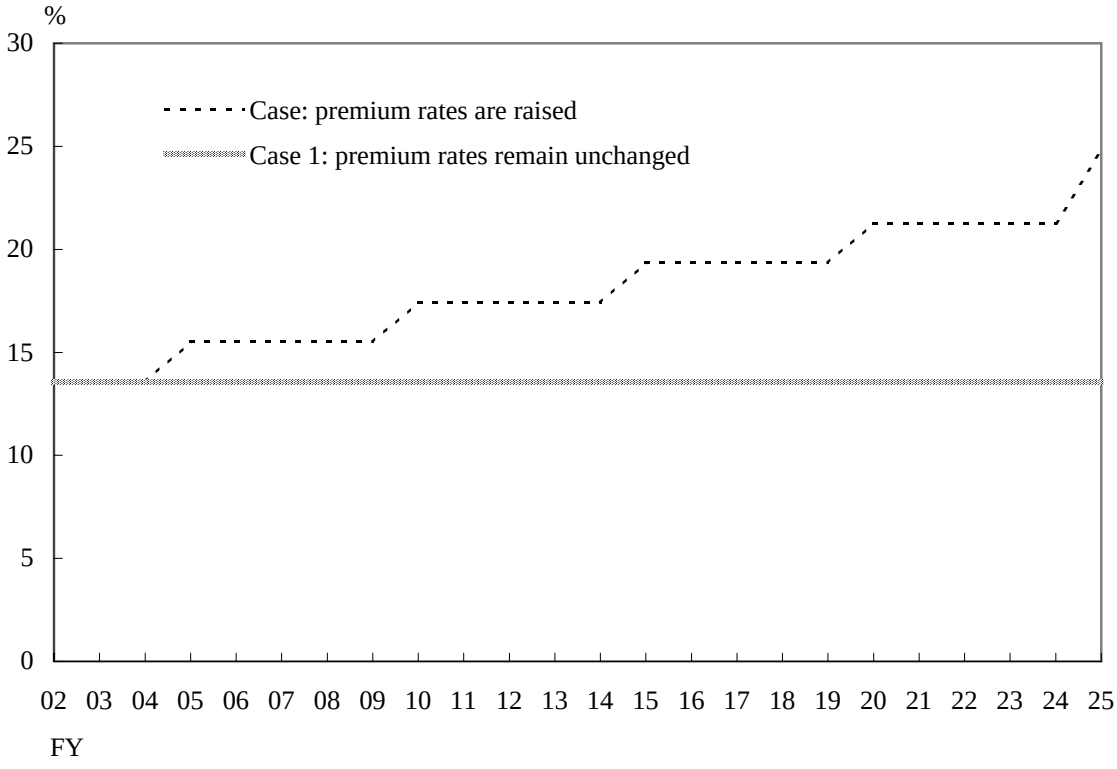
Chart 18

Case 1: Forecast of Pensions

(1) Contributions - benefits



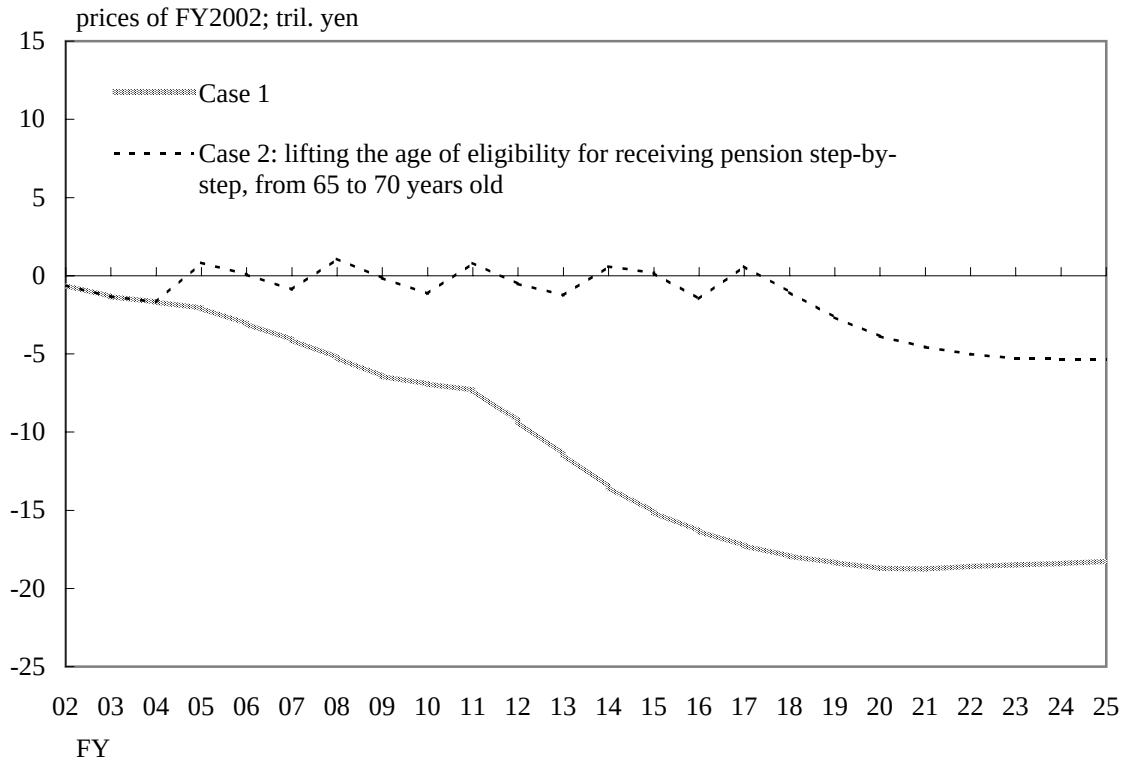
(2) Premium rates



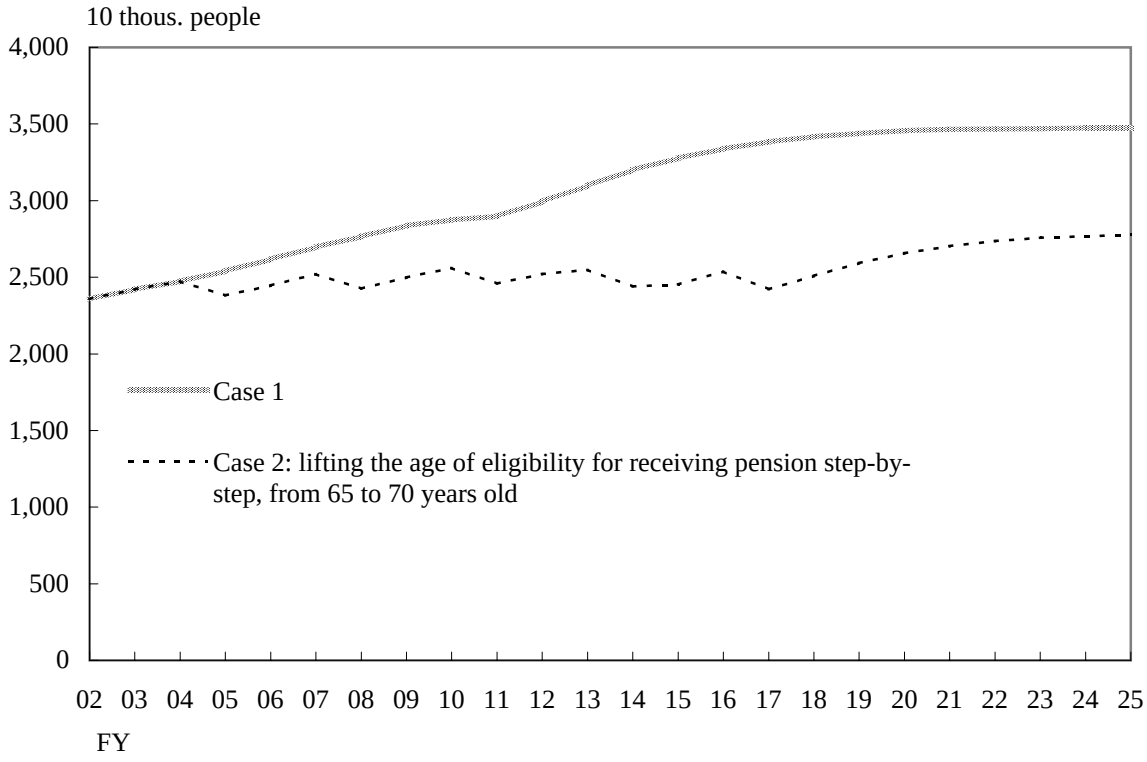
Note: Data evaluated based on prices of FY2002.

Case 2: Forecast of Pensions

(1) Contributions - benefits



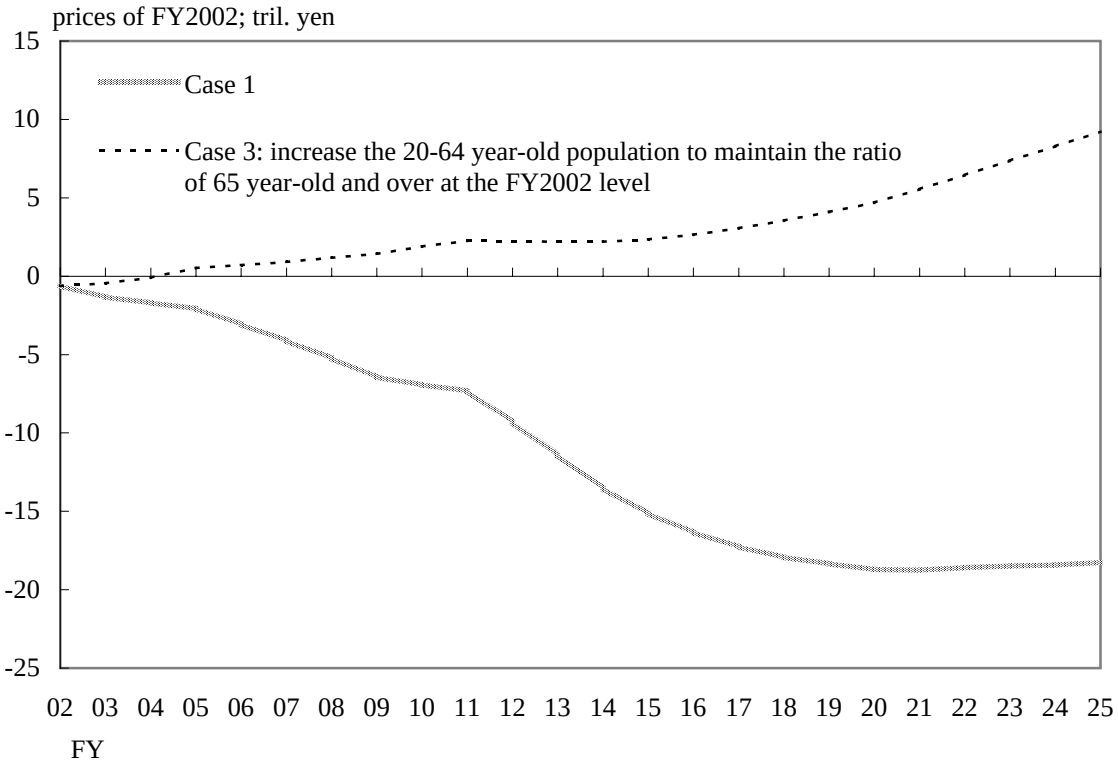
(2) Population eligible for pension payments



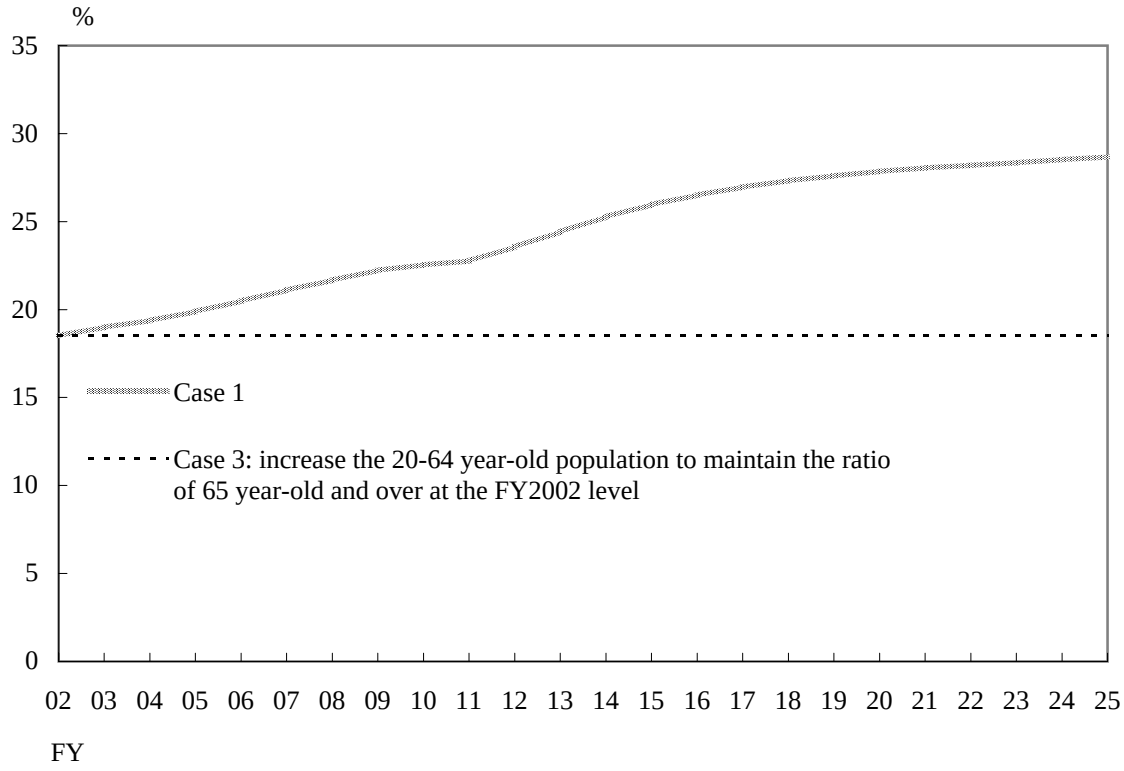
Note: Data evaluated based on prices of FY2002.

Case 3: Forecast of Pensions

(1) Contributions - benefits



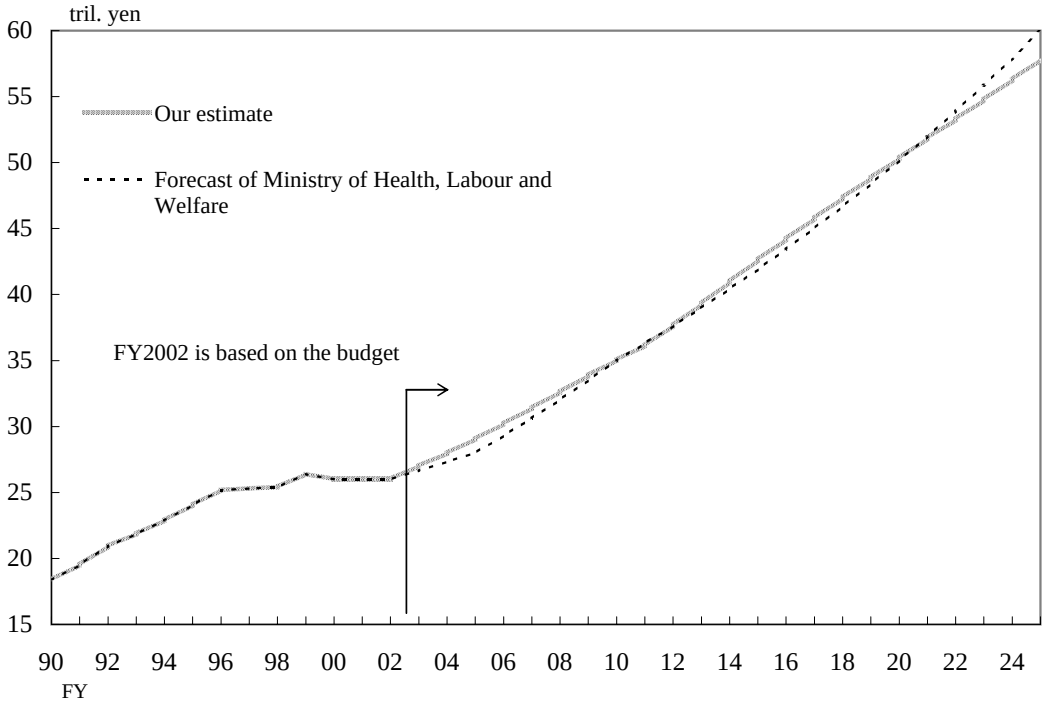
(2) Population ratio of 65 year olds and over



Note: Data evaluated based on prices of FY2002.

Chart 21

Forecast of Medical Expenses



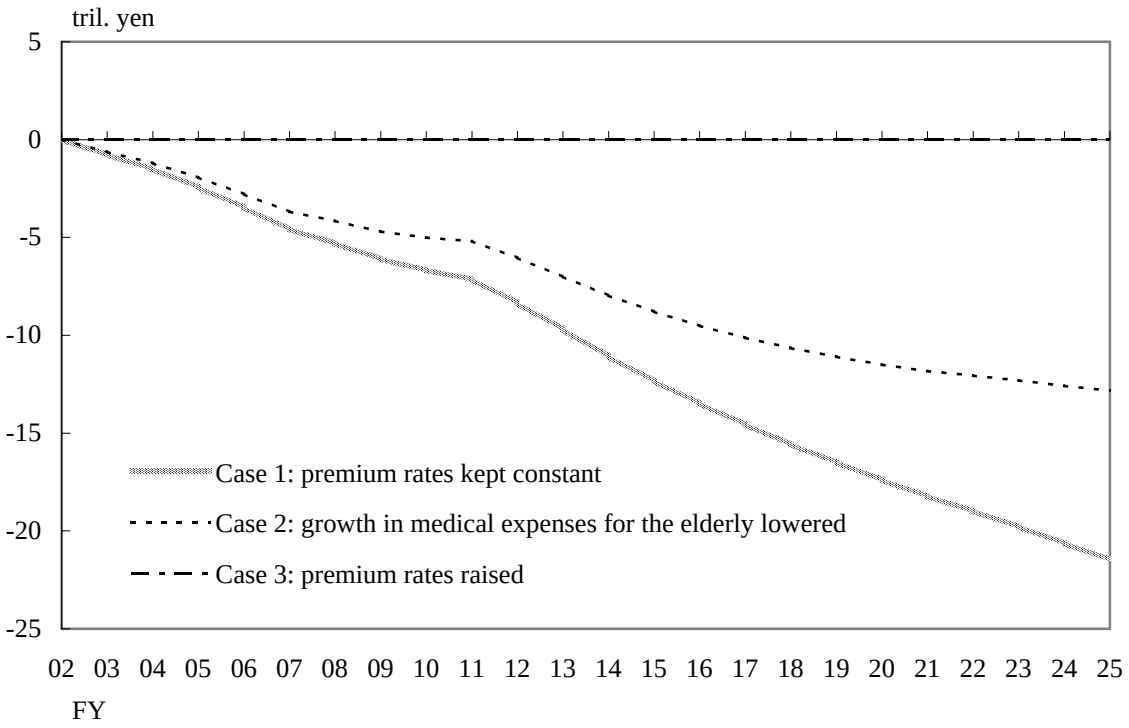
Notes: 1. Medical expenses exclude co-payments paid by the patients when they are treated.
2. Forecast of Ministry of Health, Labour and Welfare is based on the "Forecast of the Benefits and Contributions of Social Security," in May 2002.
Figures are released only for FY 2002, 2005, 2010, and 2025. Hence, data for the other years are interpolated by assuming that the year-on-year change remains unchanged.
3. Medical expenses per person of four age groups (0-14 yrs old, 15-44 yrs old, 45-64 yrs old, and 65 yrs old and over) and the growth rate of medical expenses forecasted by the Ministry of Health, Labour and Welfare are used. Based on them, estimates are extended by multiplying the medium variant of the population projection (Jan. 2002 estimate). The reproduction of the estimate for the growth rate of medical expenses is incomplete since the age groups differ from those of the forecast of the Ministry of Health, Labour and Welfare.

Sources: Ministry of Health, Labour and Welfare,"Forecast of the Benefits and Contributions of Social Security," May 2002, "Report on National Medical Care Expenses, Fiscal 2000";
Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Population Census Reports."

Chart 22

Forecast of Medical Expenses: Cases 1-3

(1) Contributions - benefits



(2) Premium rates (implicit)

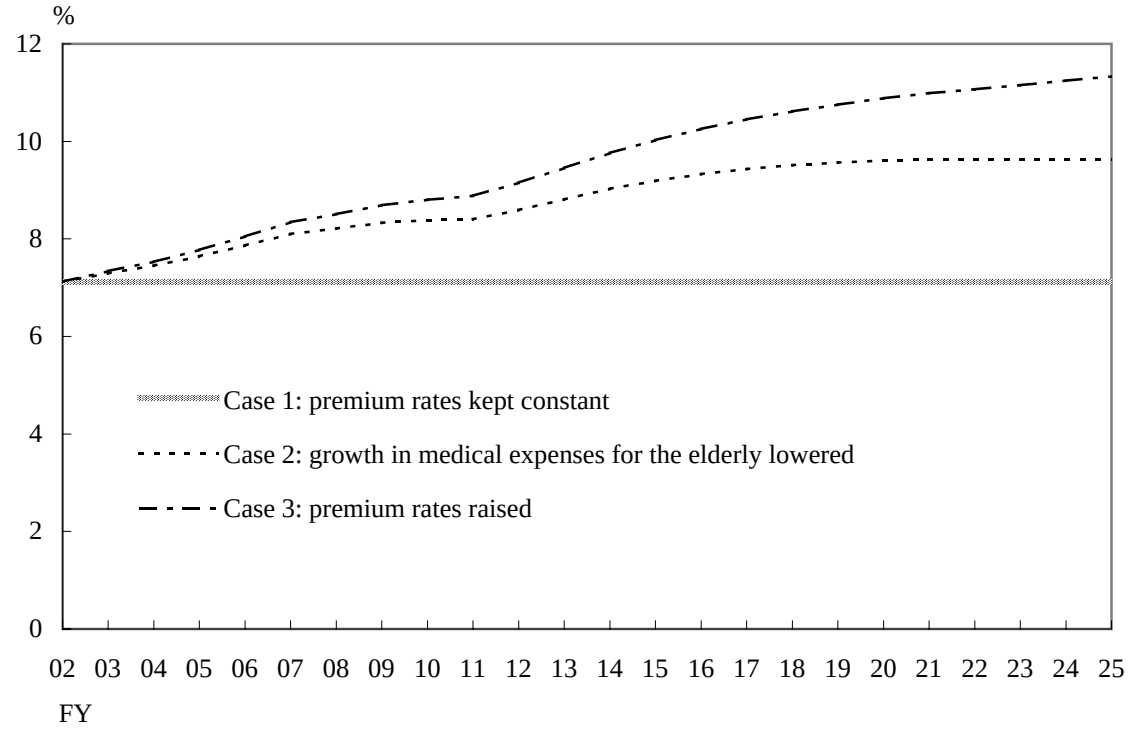
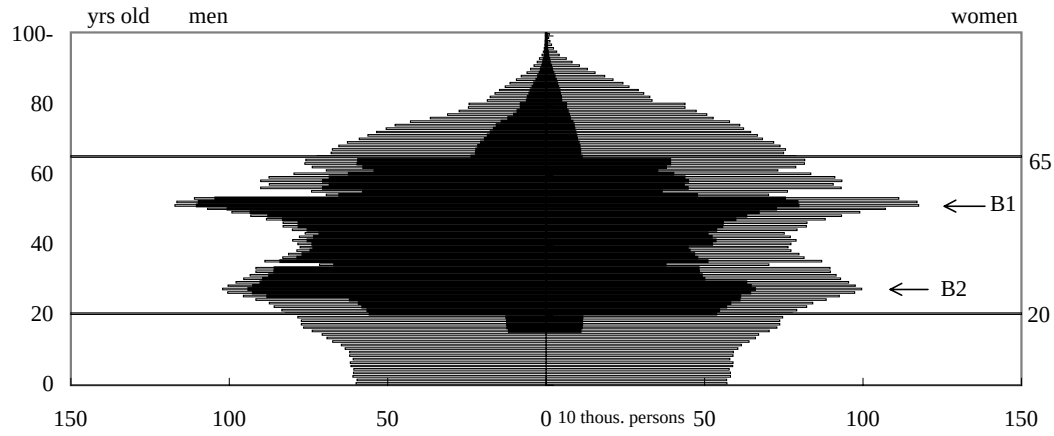


Chart 23

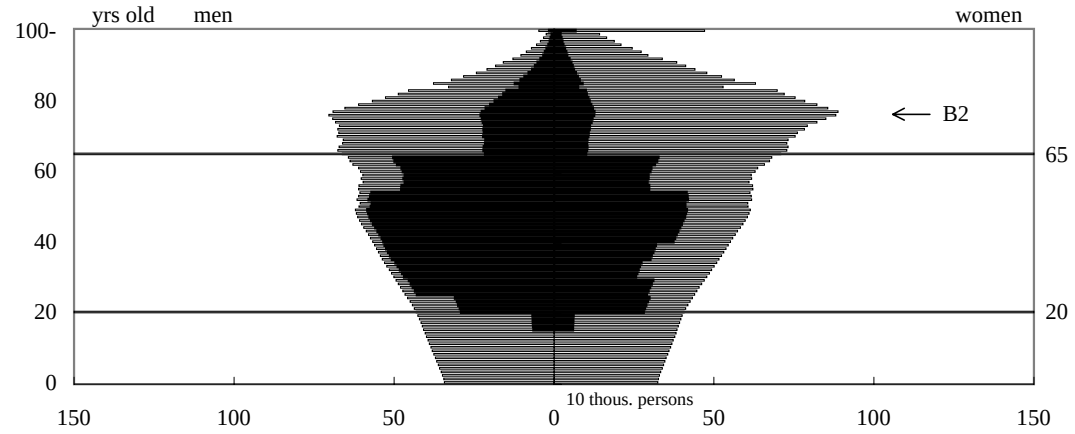
Pyramid of Population in Employment

(1) Year 2000



(2) Year 2025

(3) Year 2050

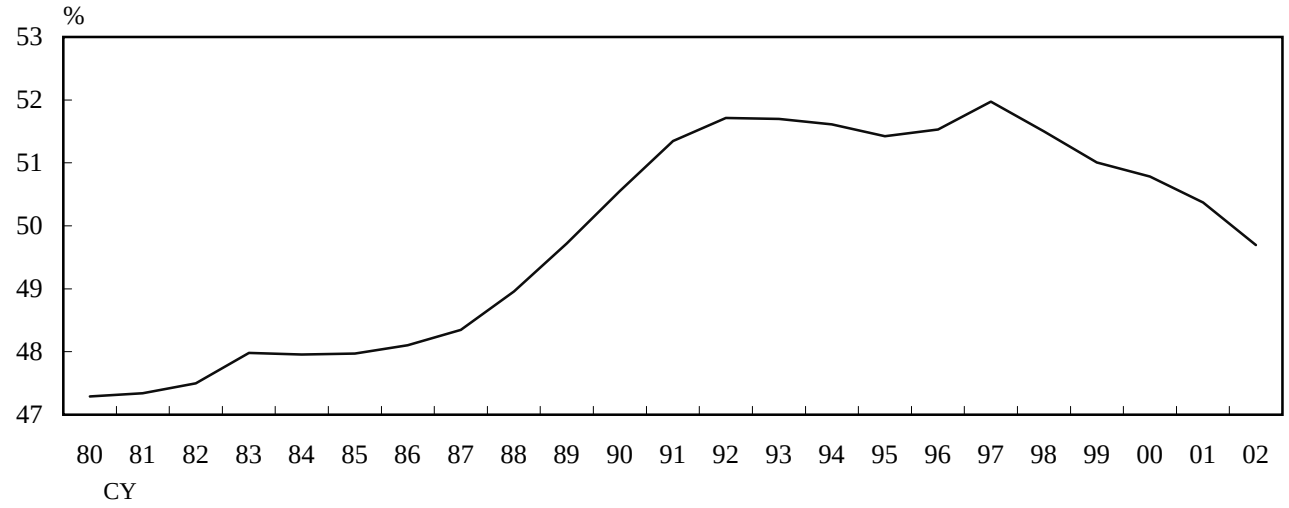


Notes: 1. The black lines indicate the number of those in employment and the grey lines show the number of population, assuming that the employees/population ratio by sex and age group remains unchanged from 2000 onwards.
2. B1 = the baby-boom generation born in 1947 to 49; B2 = the baby-boom junior generation born in 1971 to 74.

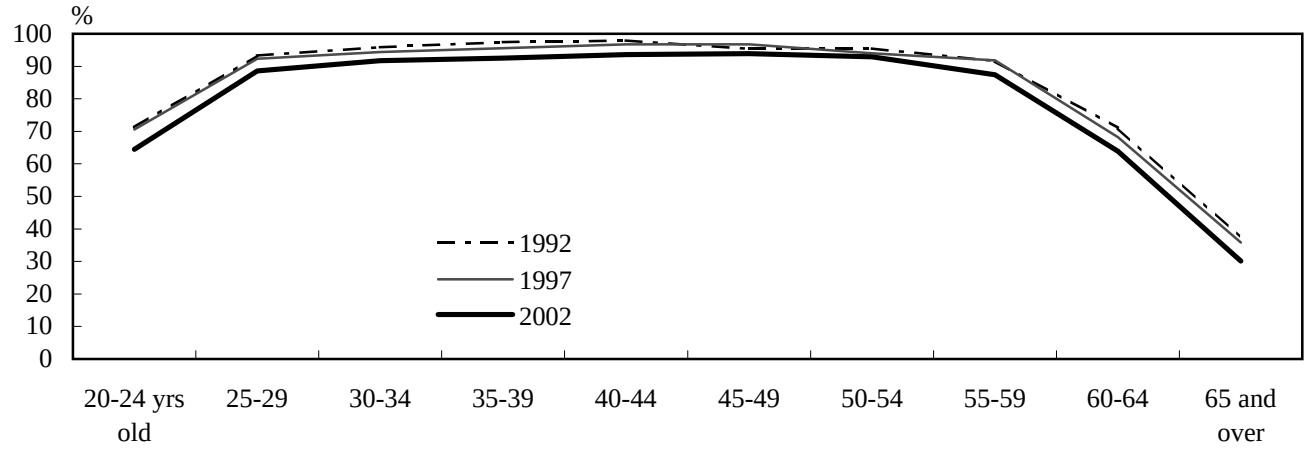
Sources: National Institute of Population and Social Security Research, "Population Projection for Japan";
Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Population Estimates."

Rates of Employment by Sex and Age

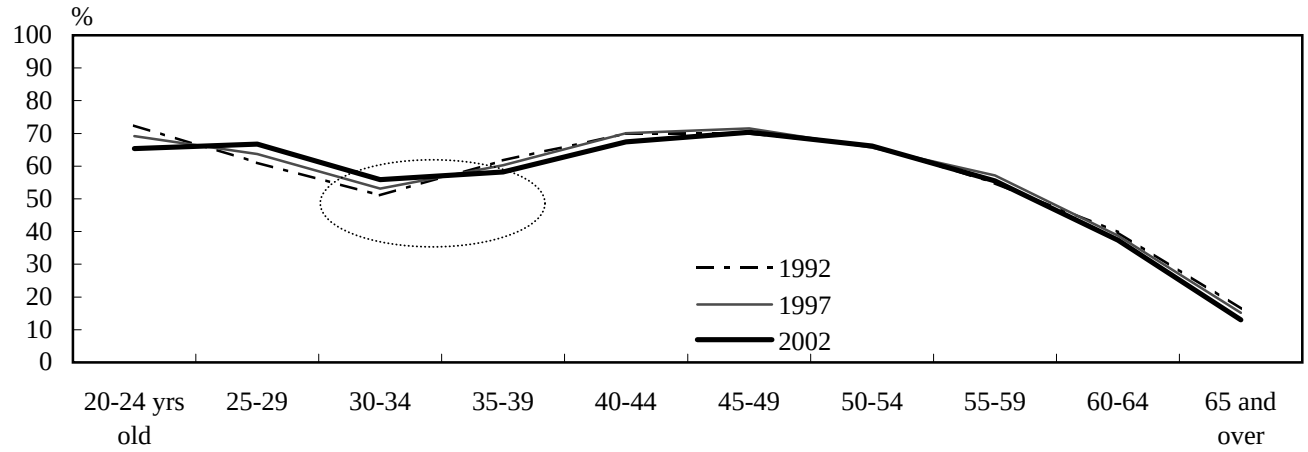
(1) rates of employment: total of men and women



(2) Rates of employment men by age



(3) Rates of employment women by age

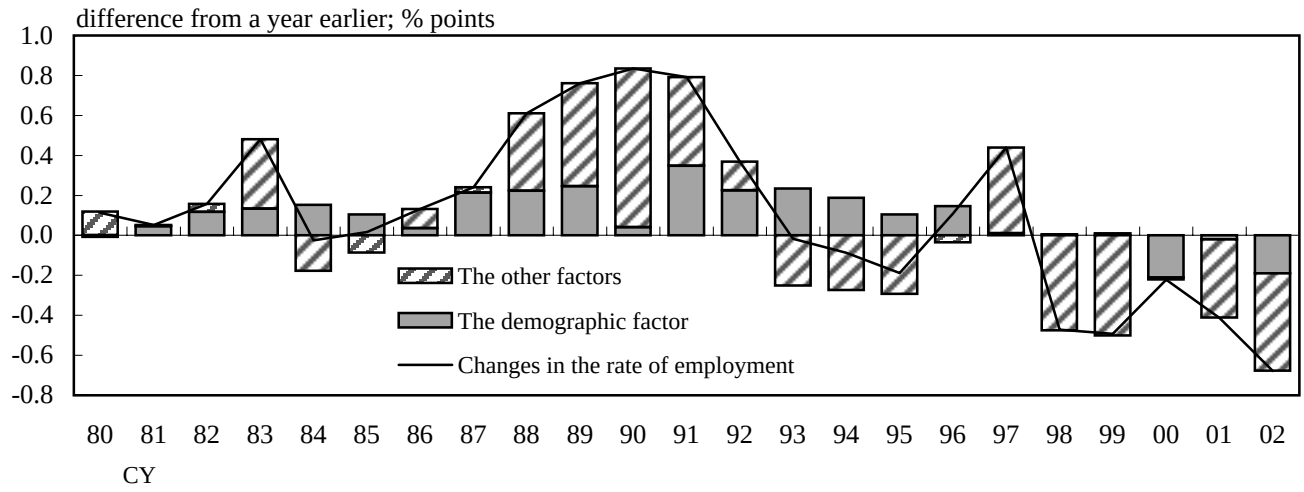


Notes: 1. Rates of employment is the total number of those in employment divided by the total population.
2. Rates of employment by age is the number of those in employment by age divided by the total population by age

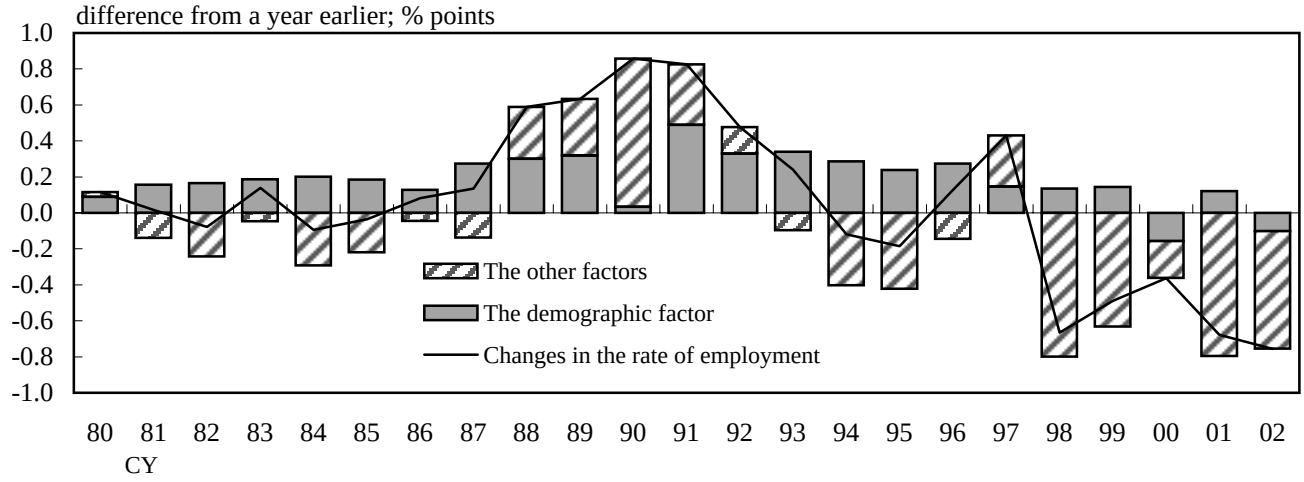
Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Labour Force Survey."

Breakdown of Changes in the Rate of Employment

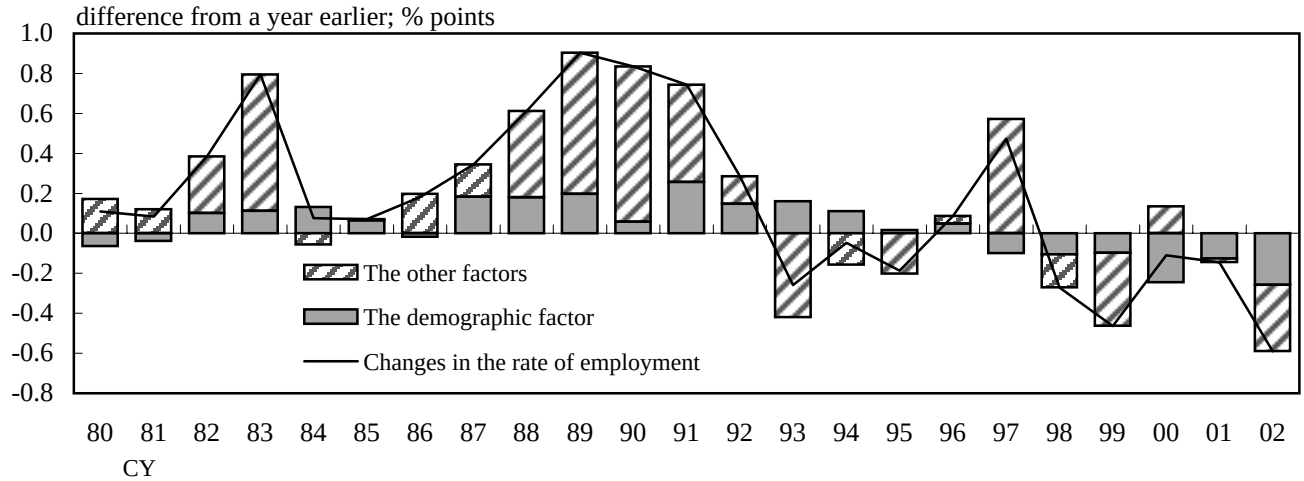
(1) Total of men and women



(2) Men



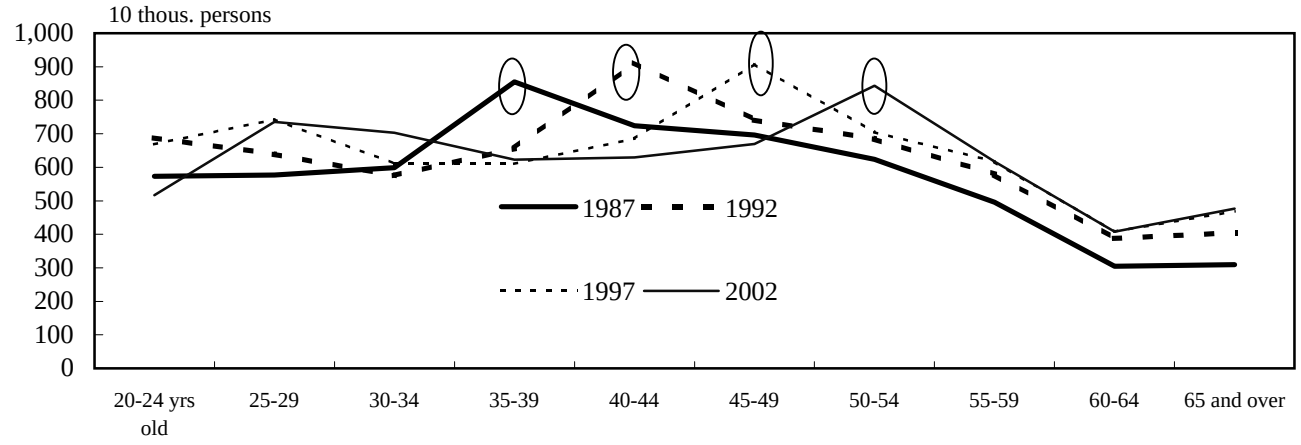
(3) Women



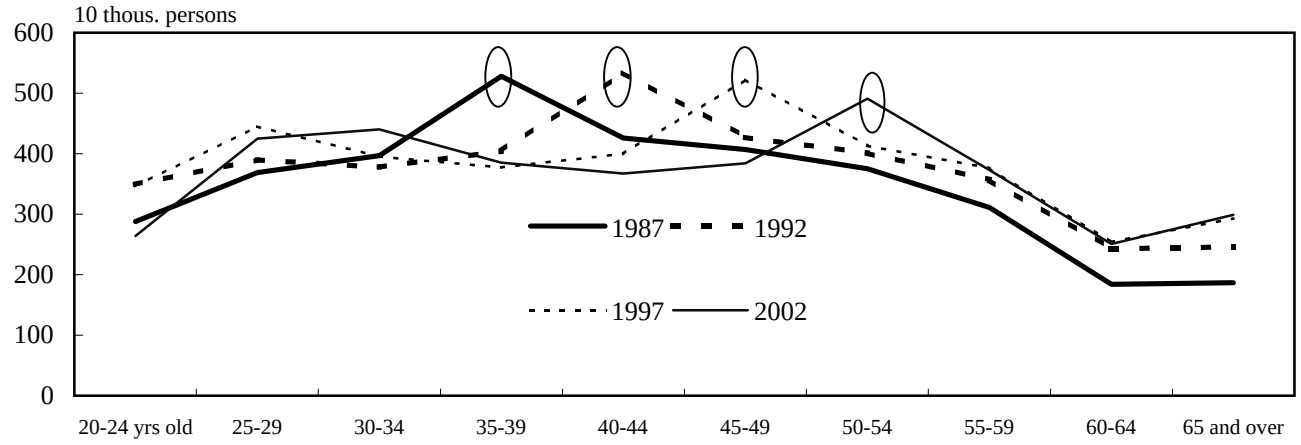
Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Labour Force Survey"; "Population Estimates."

Number of those in employment by Sex and Age

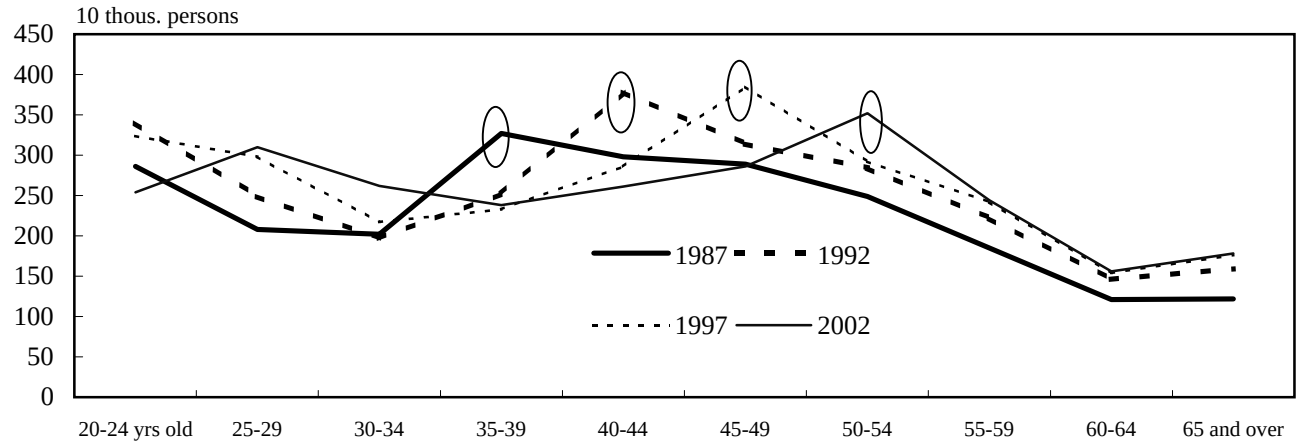
(1) Total of men and women



(2) Men



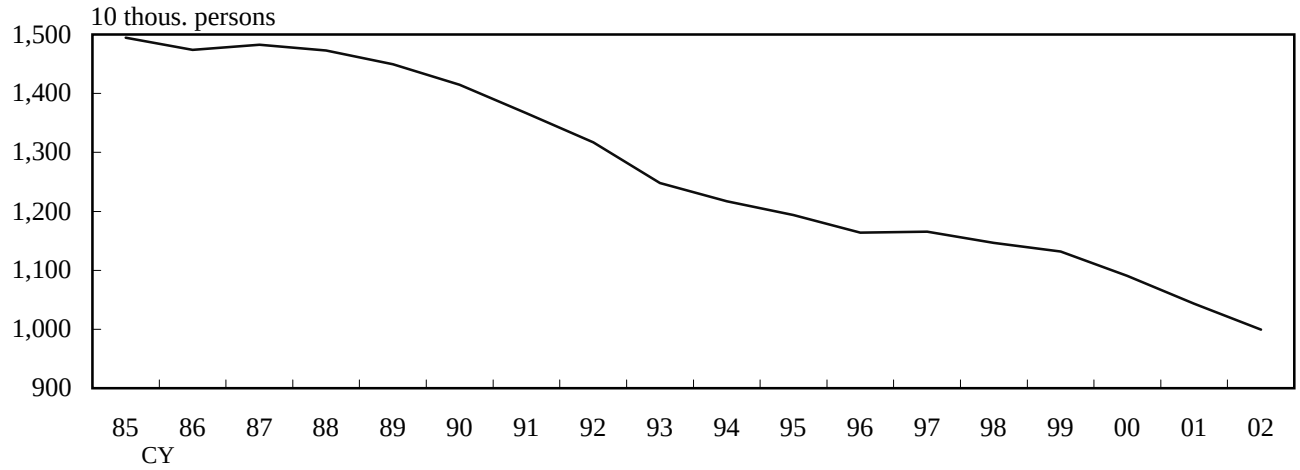
(3) Women



Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Labour Force Survey."

Self-employed and Family Workers

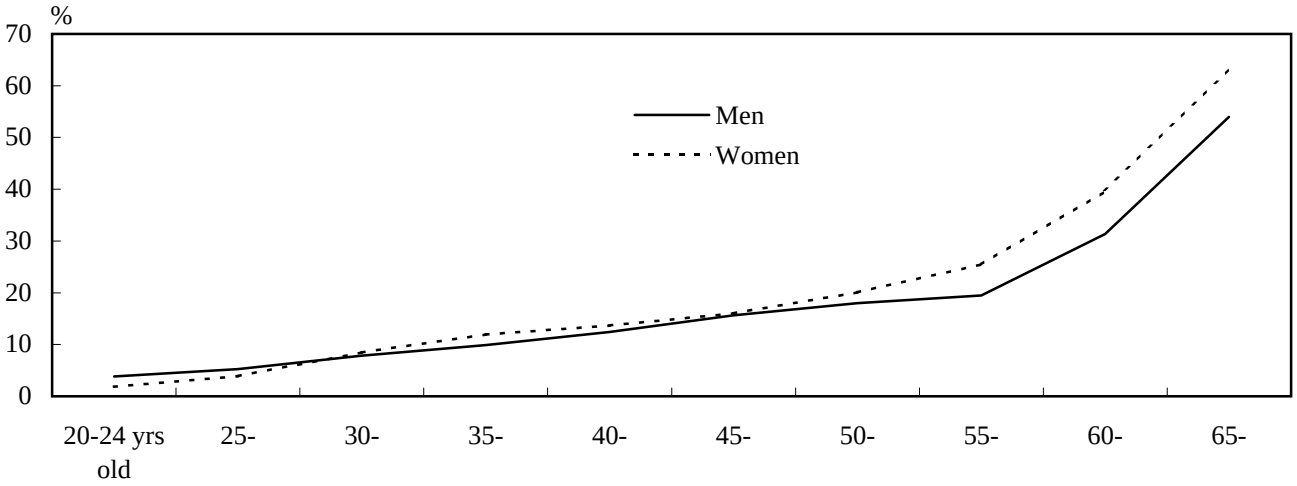
(1) Number of self-employed and family workers



(2) New Entrants in the year 2000

Note: For example, those in the second half of the 40s in 2000 are compared to those in the first half of the 40s in 1995.
When the figure is positive (negative), this indicates that there has been a net entry (exit).
Negative figure means that the number of those leaving is greater than the number of those entering.

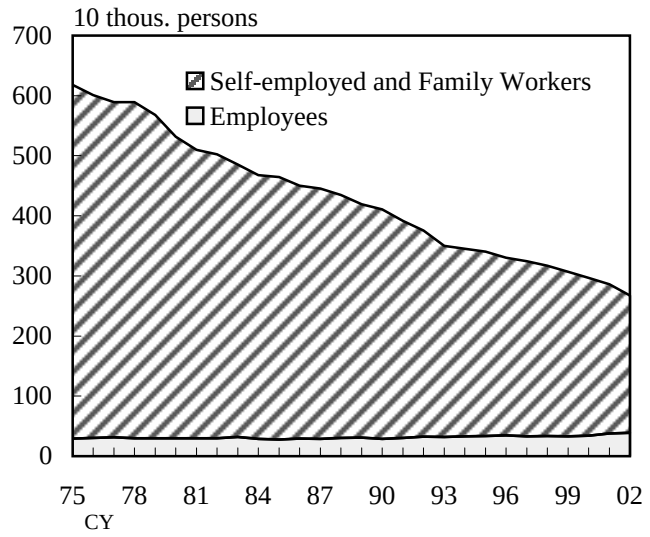
(3) Ratio of self-employed and family workers by age in the year 2000
(number of self-employed and family workers/number of those in employment)



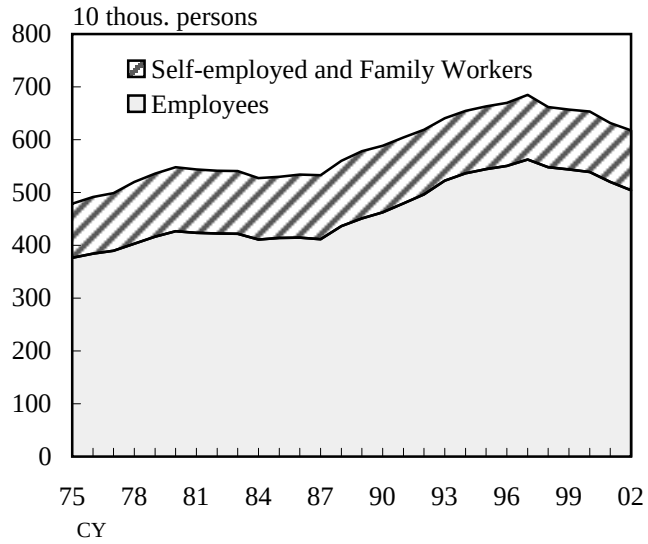
Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Labour Force Survey"; "Population Census."

Employees and Self-employed and Family Workers by Industry

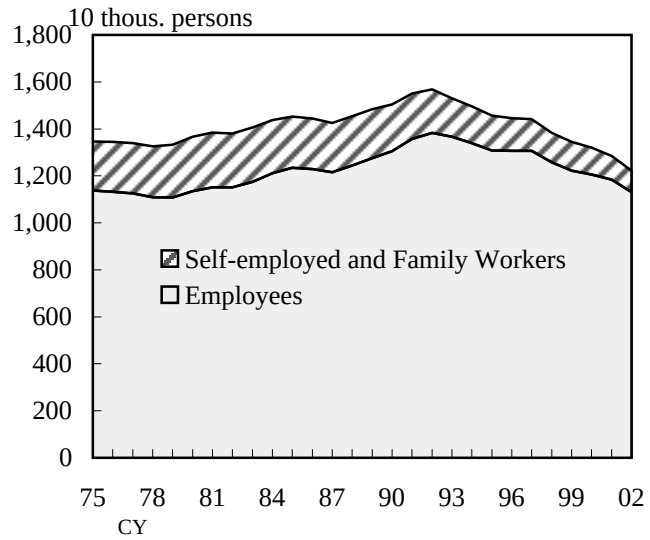
(1) Agriculture and forestry



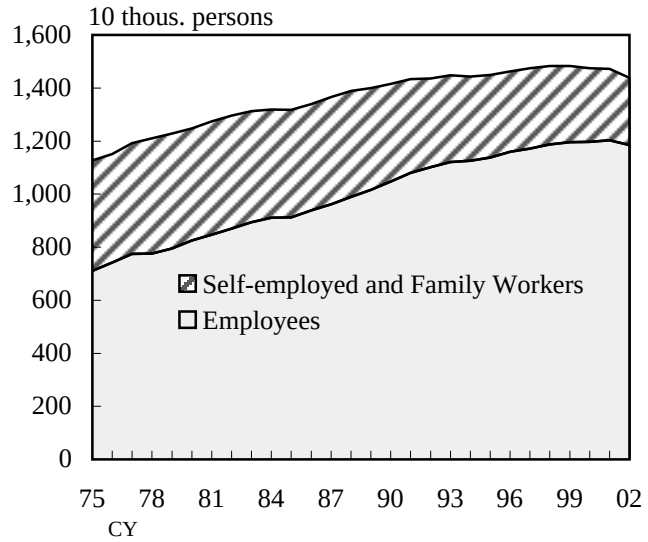
(2) Construction



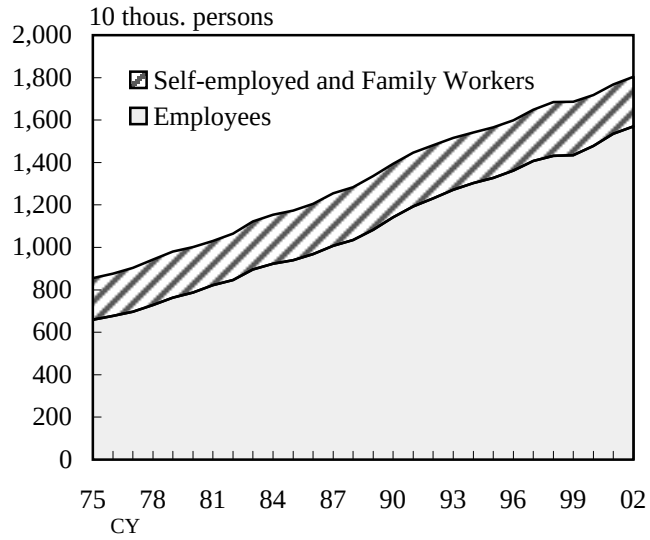
(3) Manufacturing



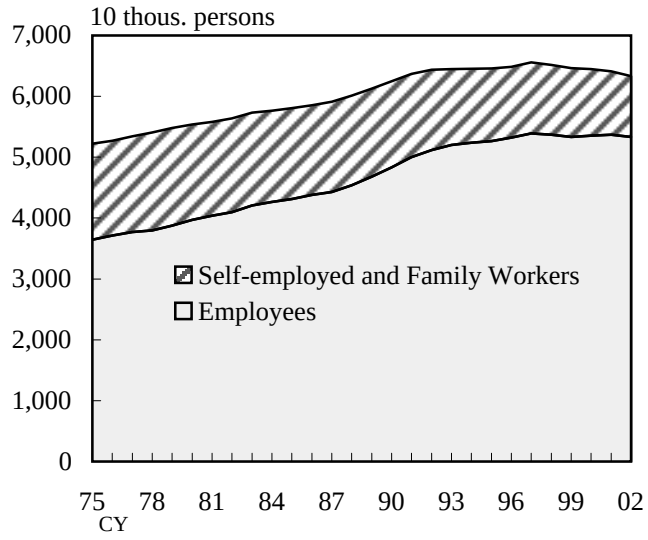
(4) Wholesale and retail trade, Eating and drinking places



(5) Services



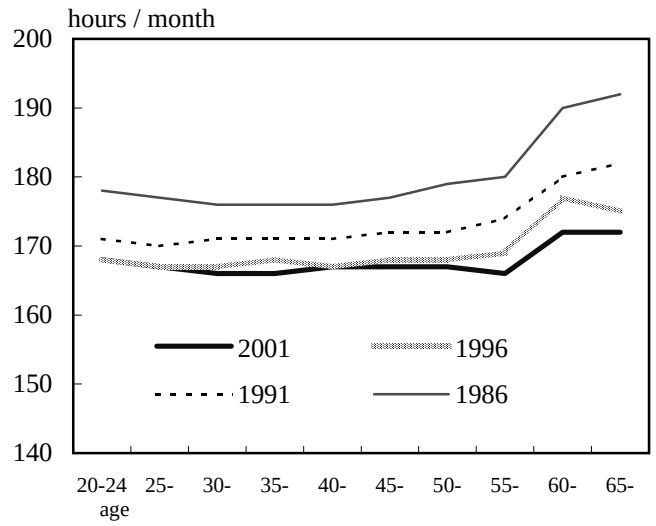
(6) All industries



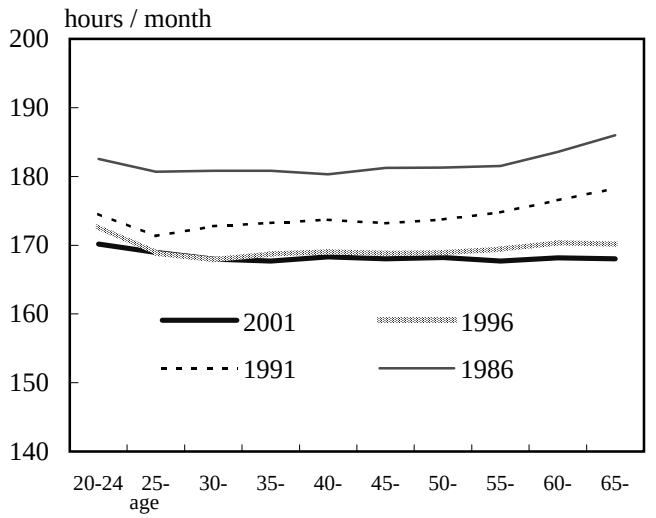
Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Labour Force Survey."

Working Hours: Full-time Male Workers

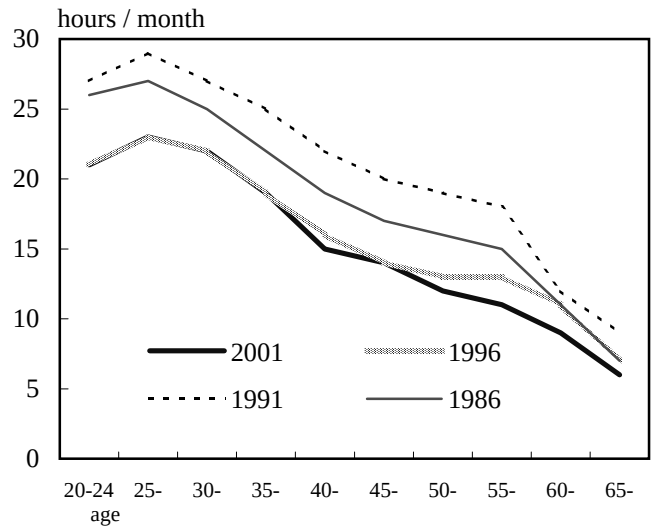
(1) Manufacturing (regular)



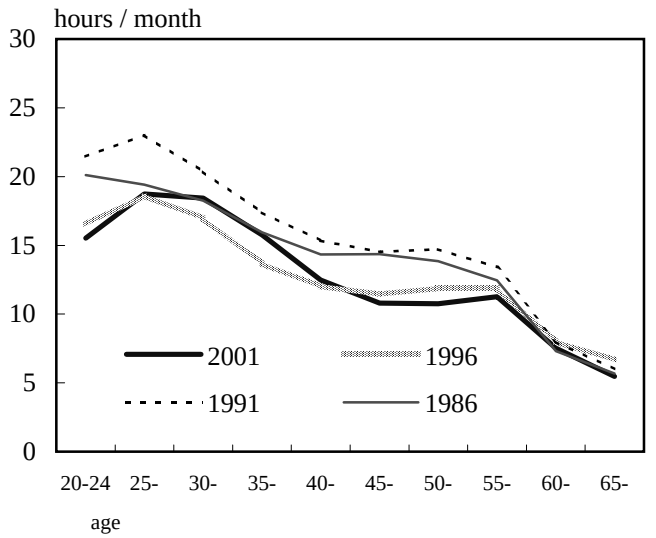
(2) Non-manufacturing (regular)



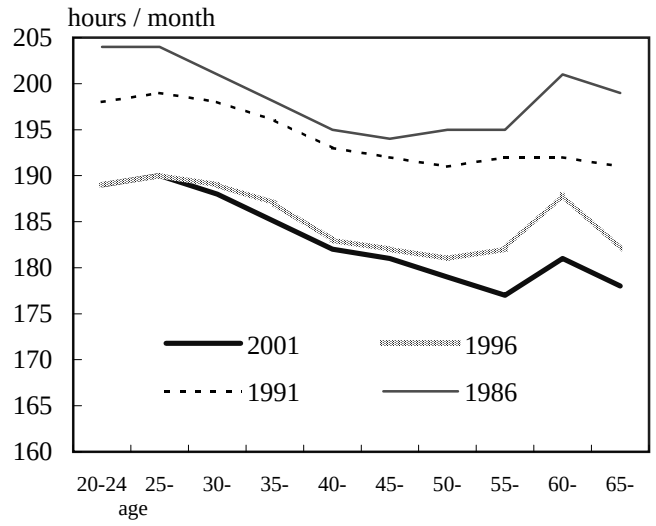
(3) Manufacturing (overtime)



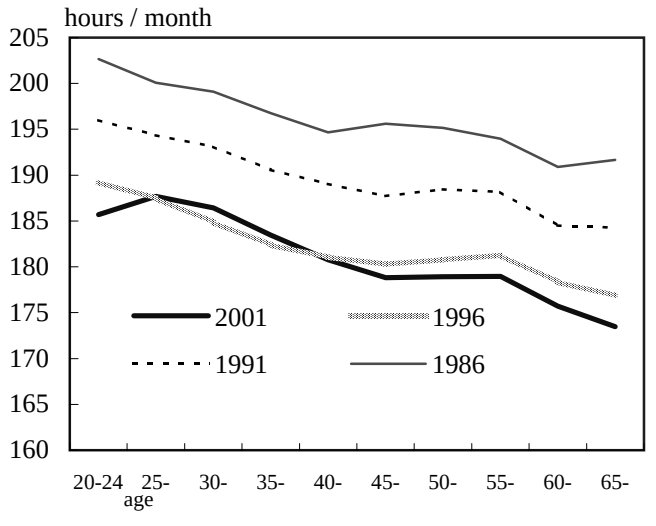
(4) Non-manufacturing (overtime)



(5) Manufacturing (total working hours per worker)



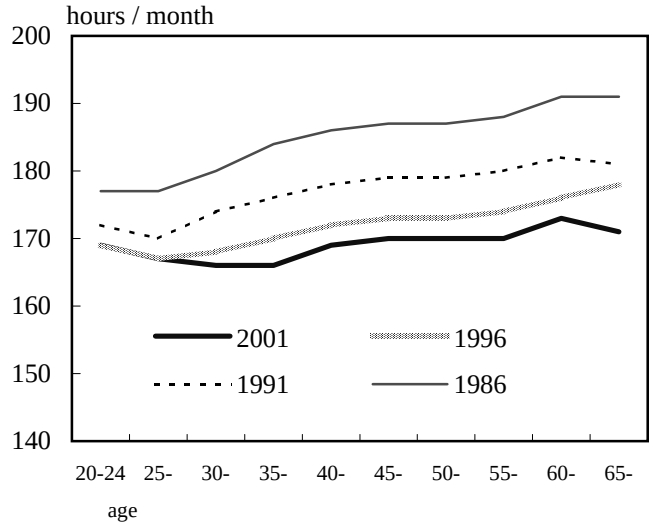
(6) Non-manufacturing (total working hours per worker)



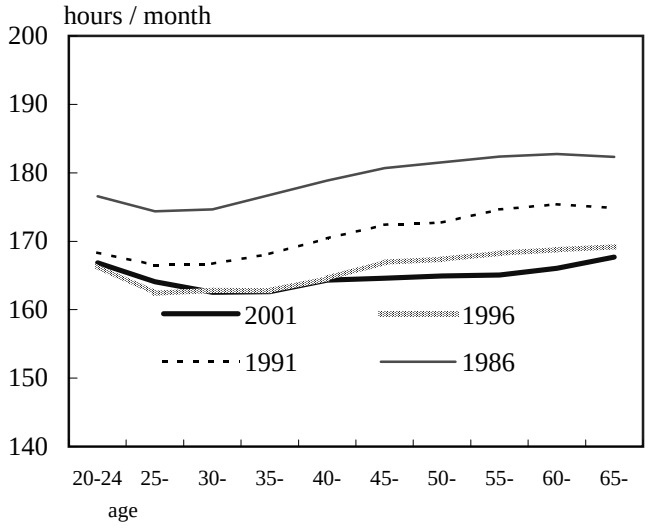
Source: Ministry of Health, Labour and Welfare, "Basic Survey on Wage Structure."

Working Hours: Full-time Female Workers

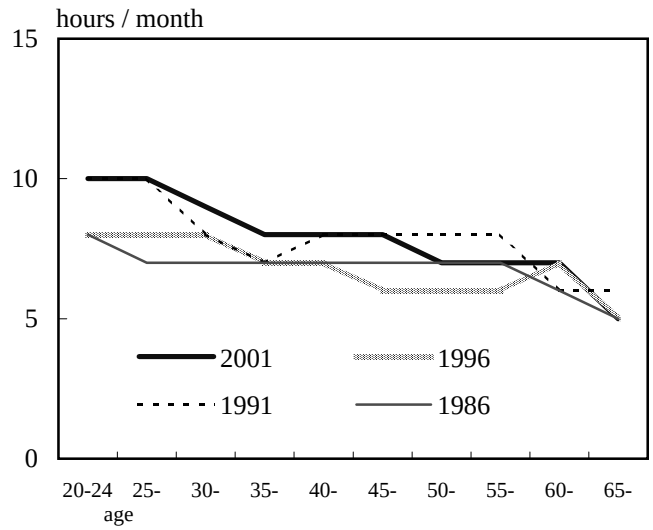
(1) Manufacturing (regular)



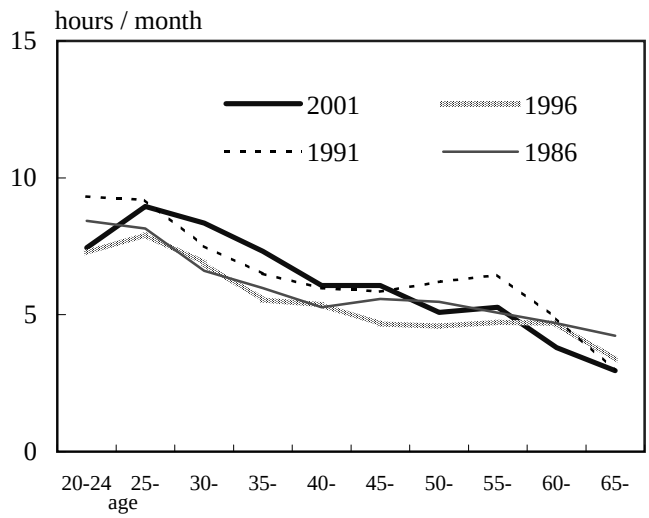
(2) Non-manufacturing (regular)



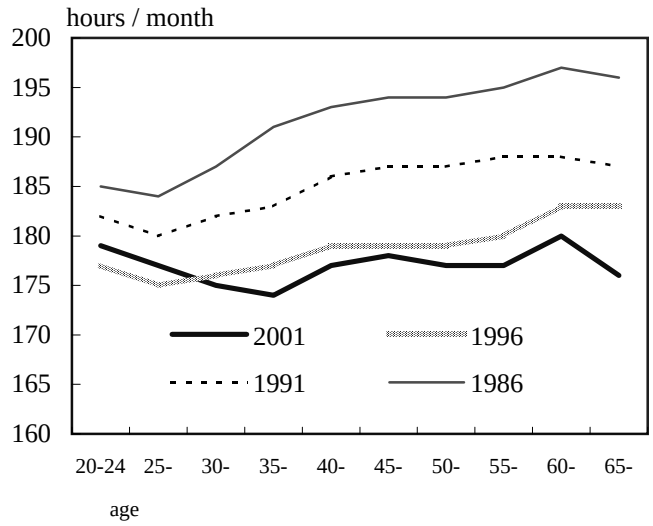
(3) Manufacturing (overtime)



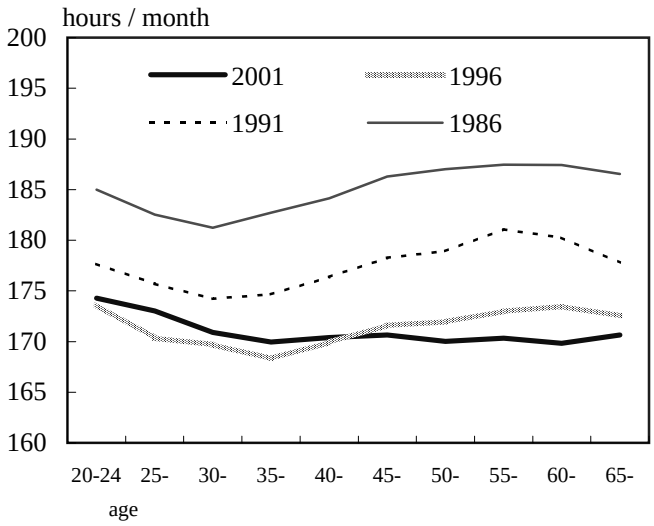
(4) Non-manufacturing (overtime)



(5) Manufacturing (total working hours per worker)



(6) Non-manufacturing (total working hours per worker)

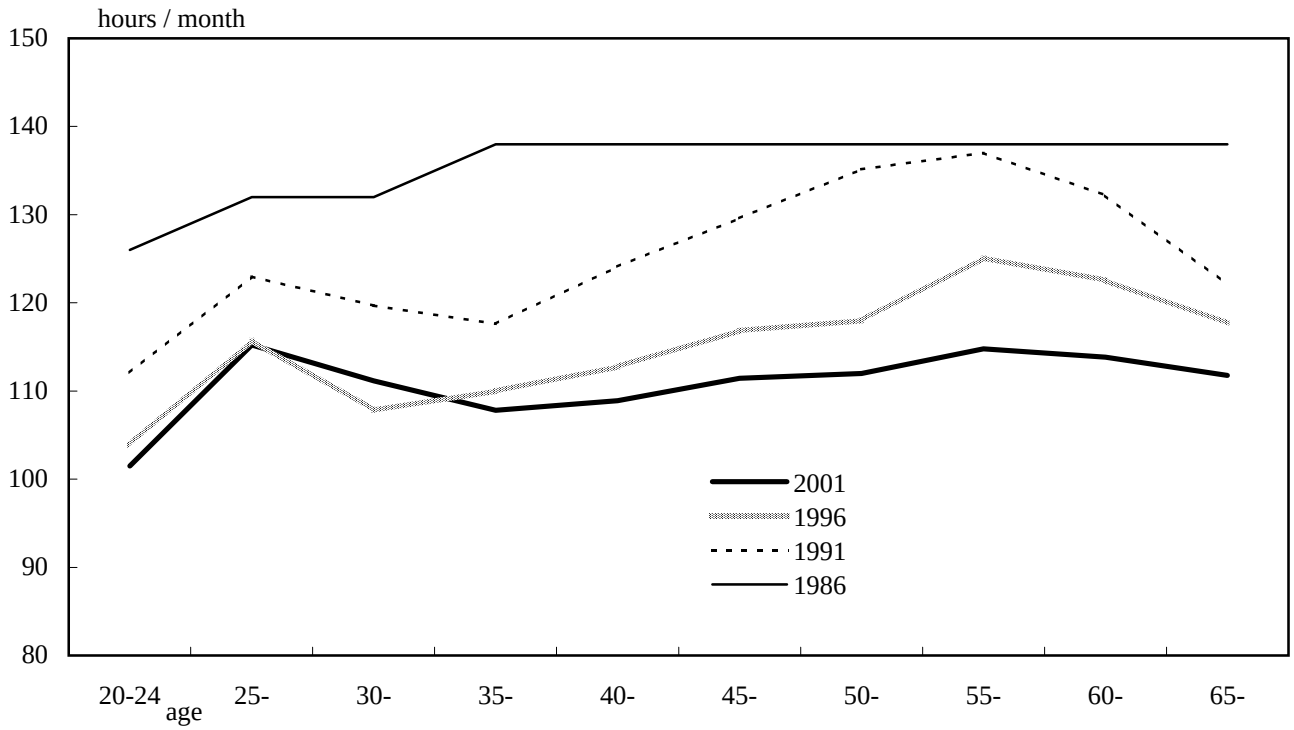


Source: Ministry of Health, Labour and Welfare, "Basic Survey on Wage Structure."

Working Hours: Part-time Workers

(1) Men

(2) Women

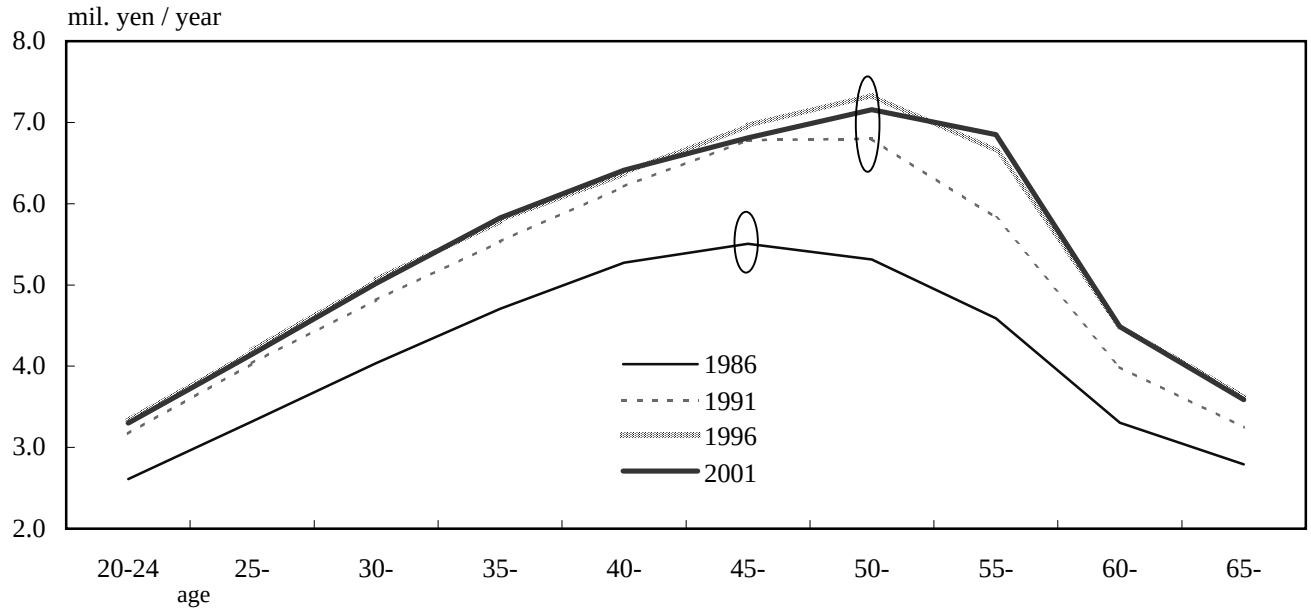


Source: Ministry of Health, Labour and Welfare, "Basic Survey on Wage Structure."

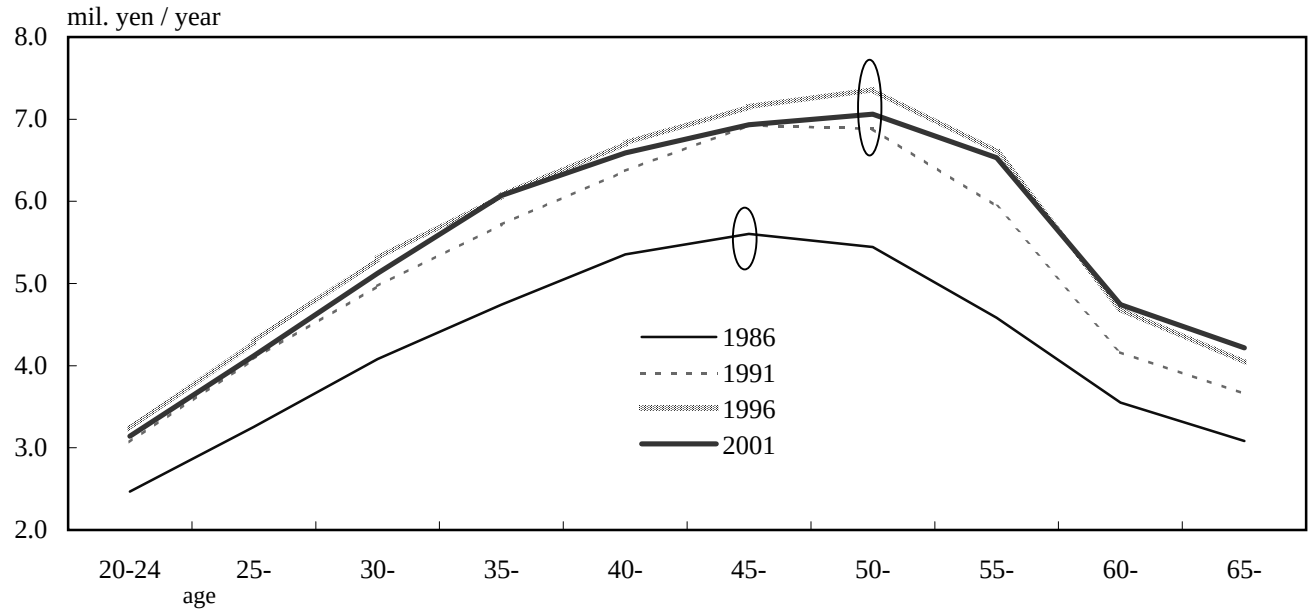
Chart 32

Wage Profile: Full-time Male Workers

(1) Manufacturing



(2) Non-manufacturing



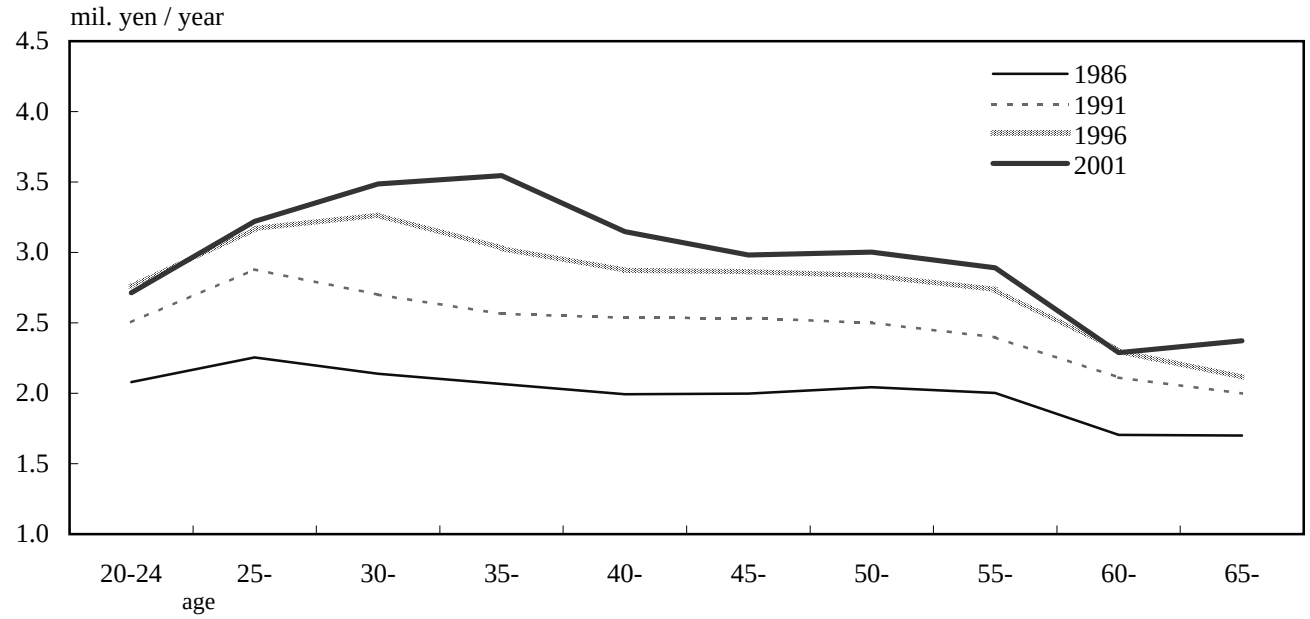
Note: Aggregates of educational level and size of enterprises.

Source: Ministry of Health, Labour and Welfare, "Basic Survey on Wage Structure."

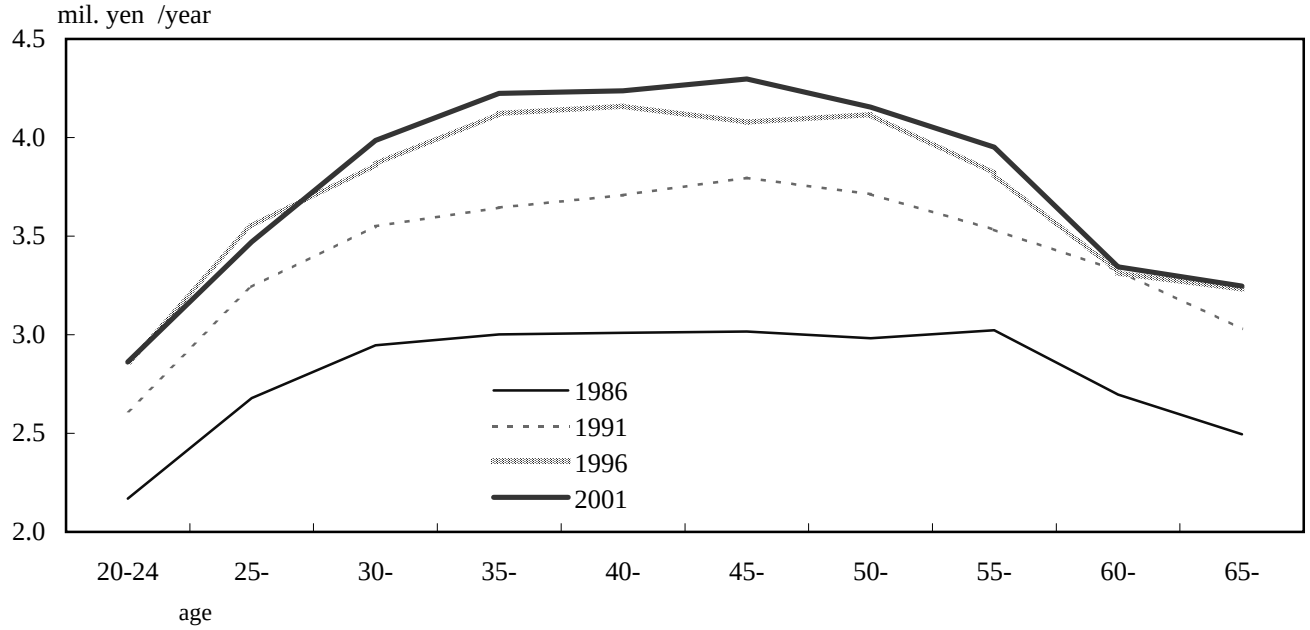
Chart 33

Wage Profile: Full-time Female Workers

(1) Manufacturing



(2) Non-manufacturing



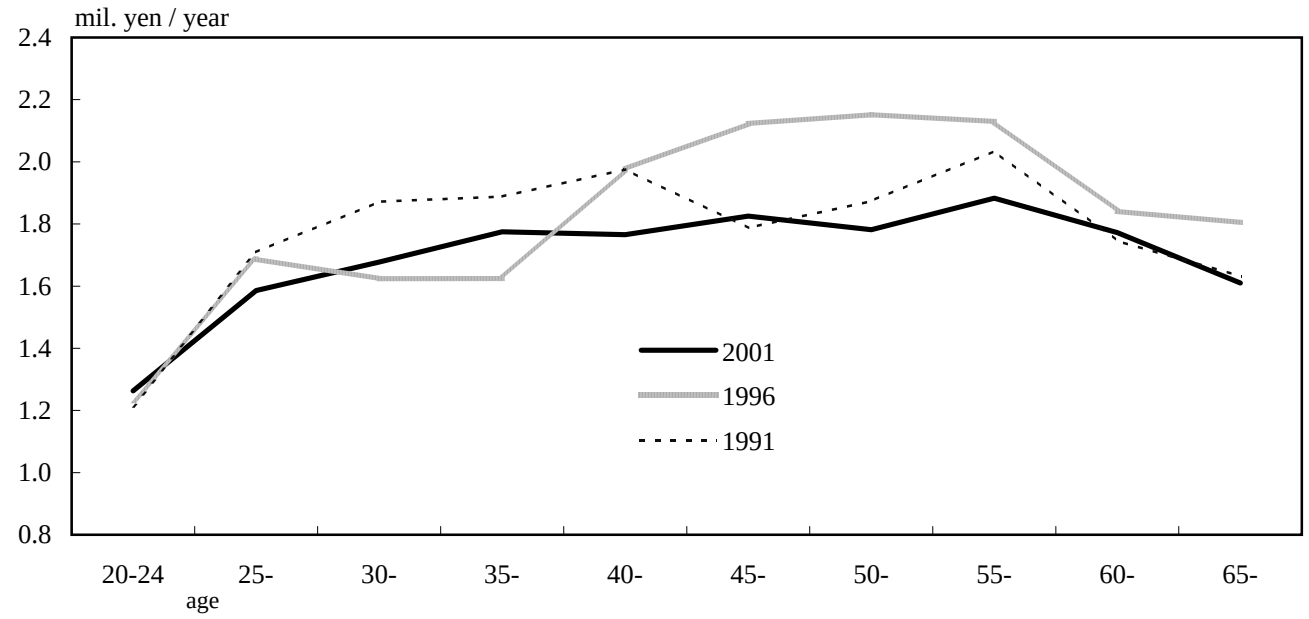
Note: Aggregates of educational level and size of enterprises.

Source: Ministry of Health, Labour and Welfare, "Basic Survey on Wage Structure."

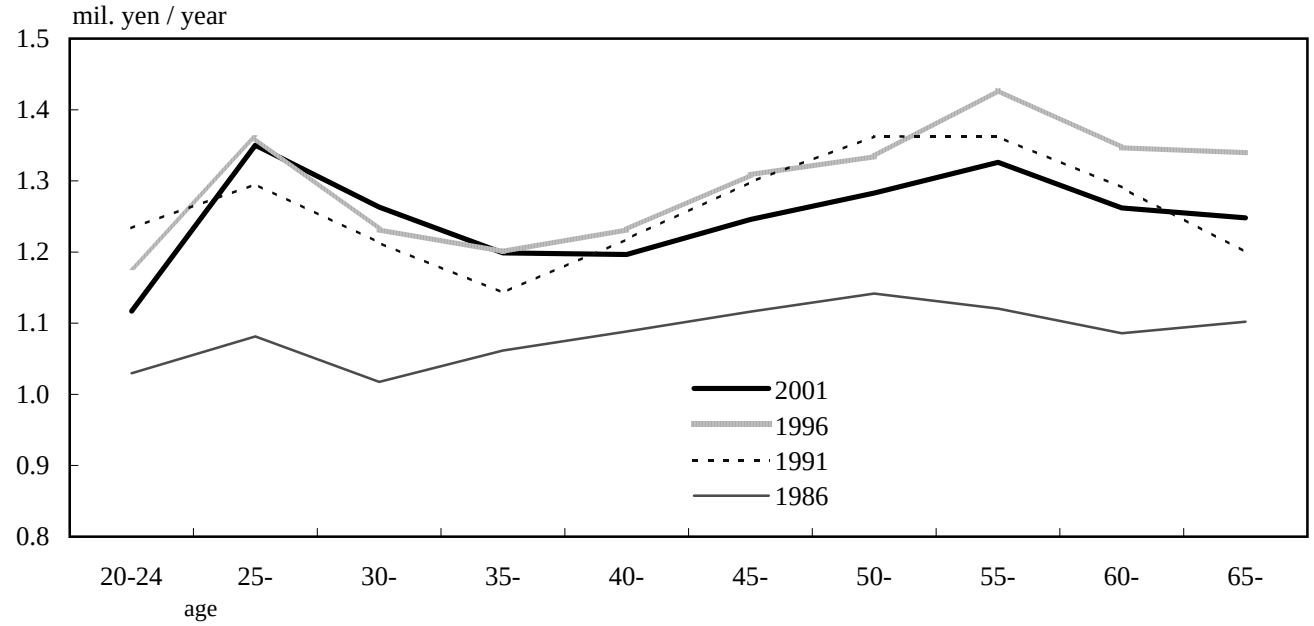
Chart 34

Wage Profile: Part-time Workers

(1) Men



(2) Women

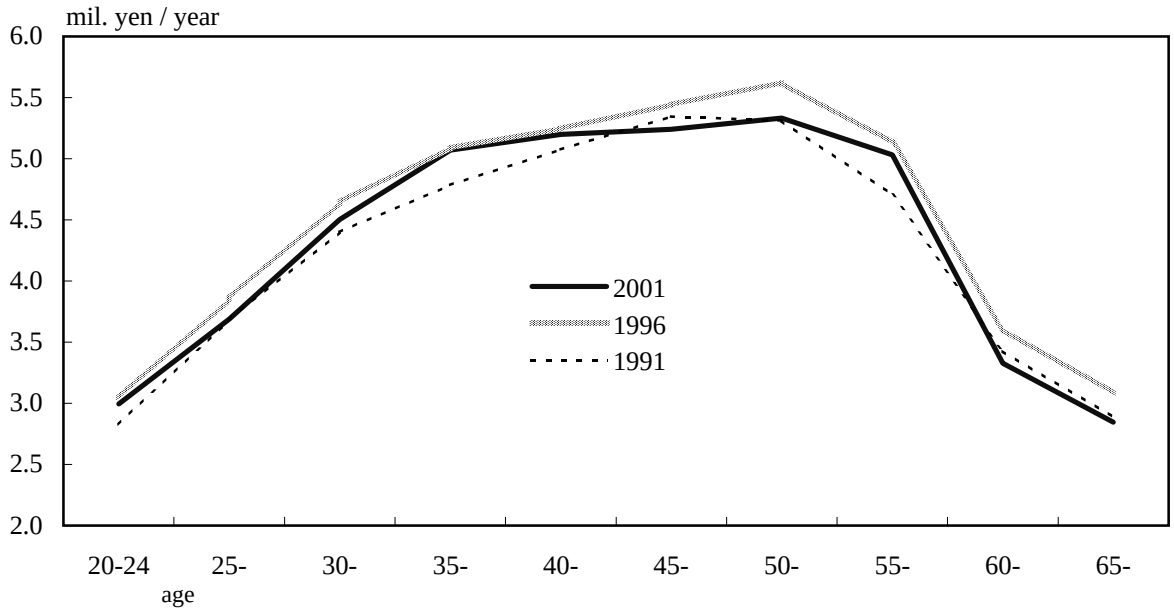


Source: Ministry of Health, Labour and Welfare, "Basic Survey on Wage Structure."

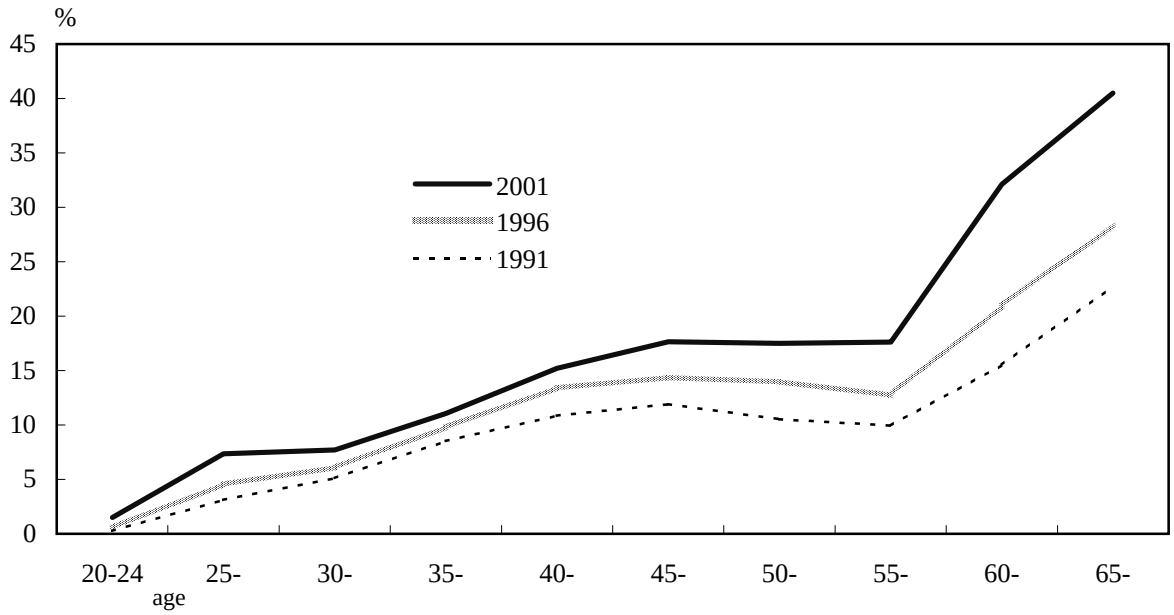
Chart 35

Wage Profile including Part-time Workers (All Industries)

(1) Total of men and women



(2) Ratio of male and female part-time workers by age

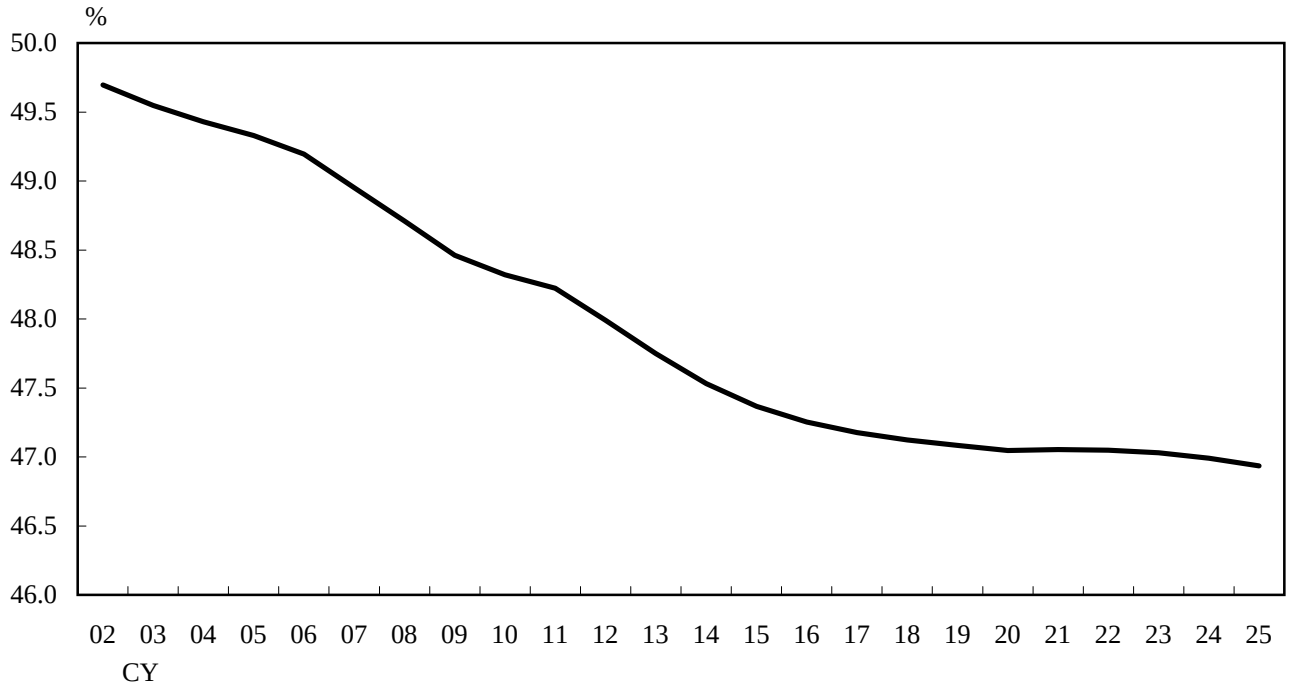


Note: Ratio of part-time workers = number of part-time workers / (number of part-time workers + number of full-time workers)

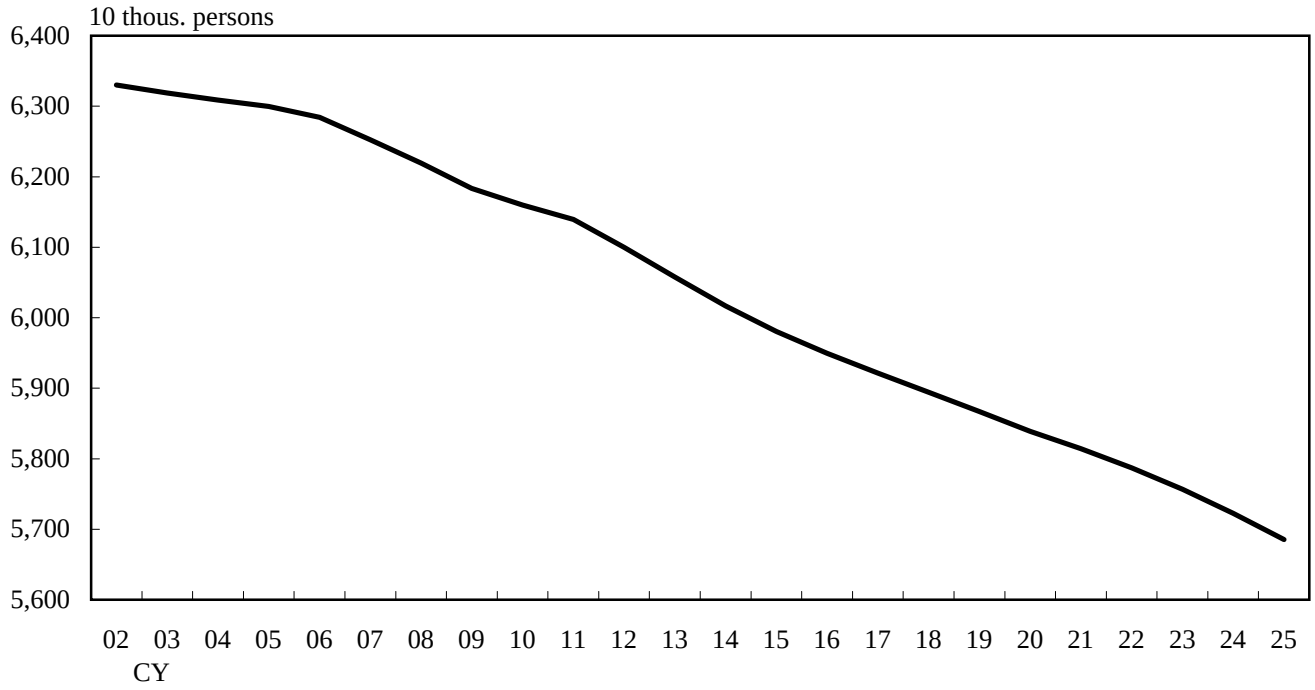
Source: Ministry of Health, Labour and Welfare, "Basic Survey on Wage Structure."

Outlook for Employment

(1) Rate of employment (number of those in employment / total population)



(2) Number of those in employment

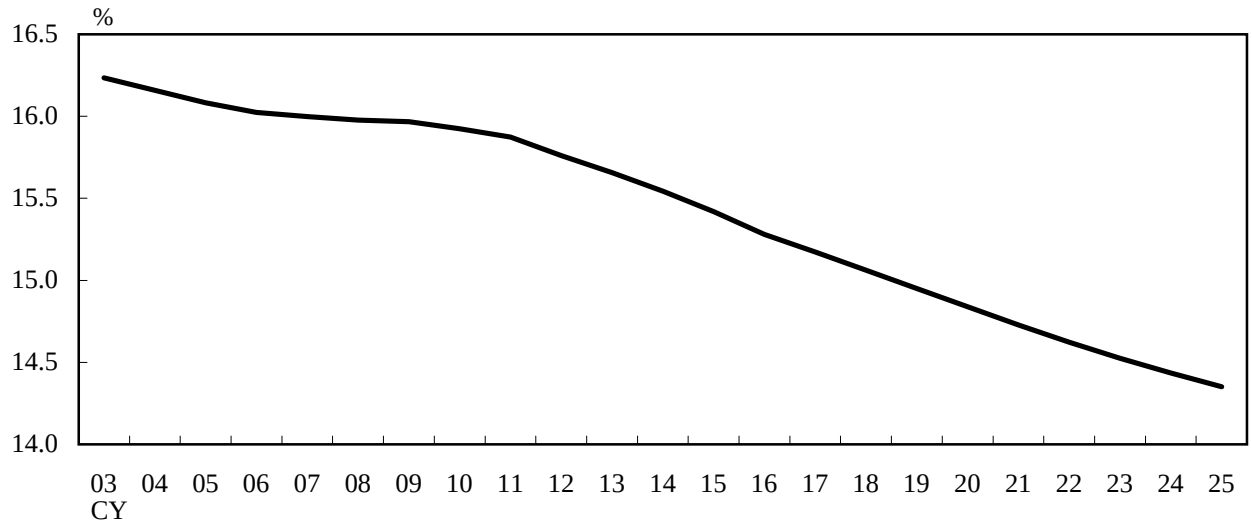


Sources: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Labour Force Survey";
National Institute of Population and Social Security Research, "Population Projection for Japan."

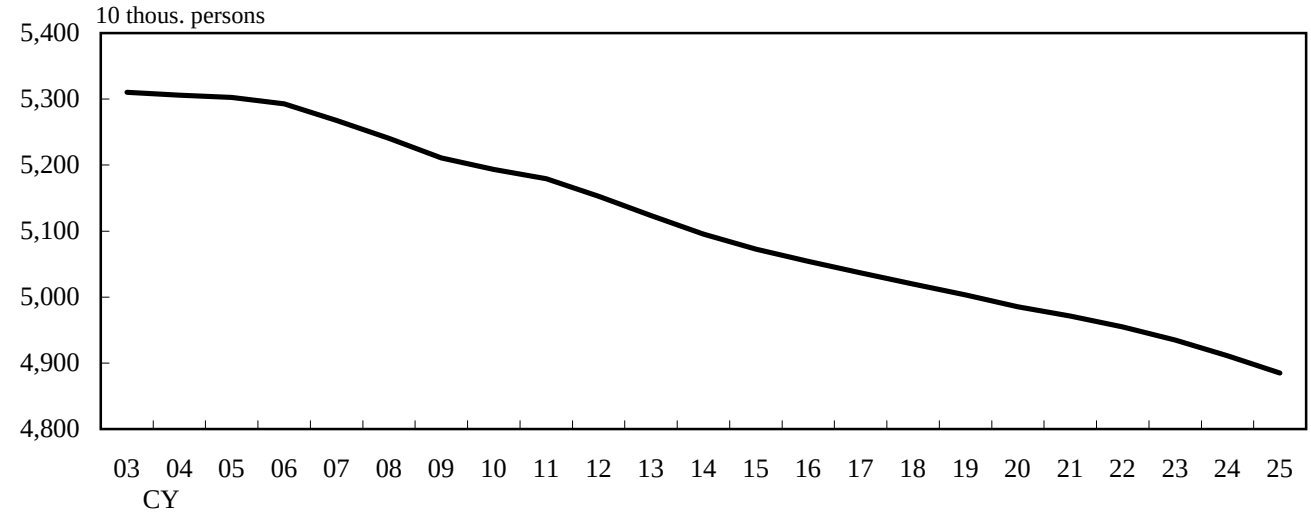
Outlook for Self-employed and Family Workers

(1) Number of self-employed and family workers

(2) Ratio of self-employed and family workers = no. of self-employed and family workers/no. of those in employment



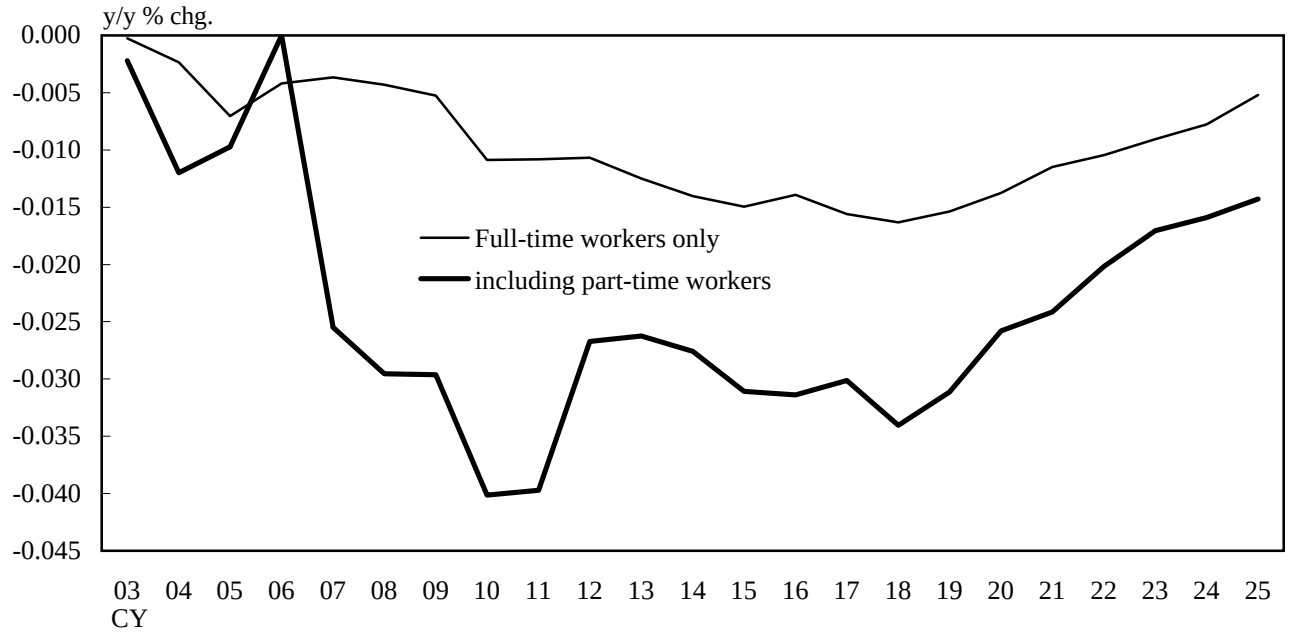
(3) Number of those in employment



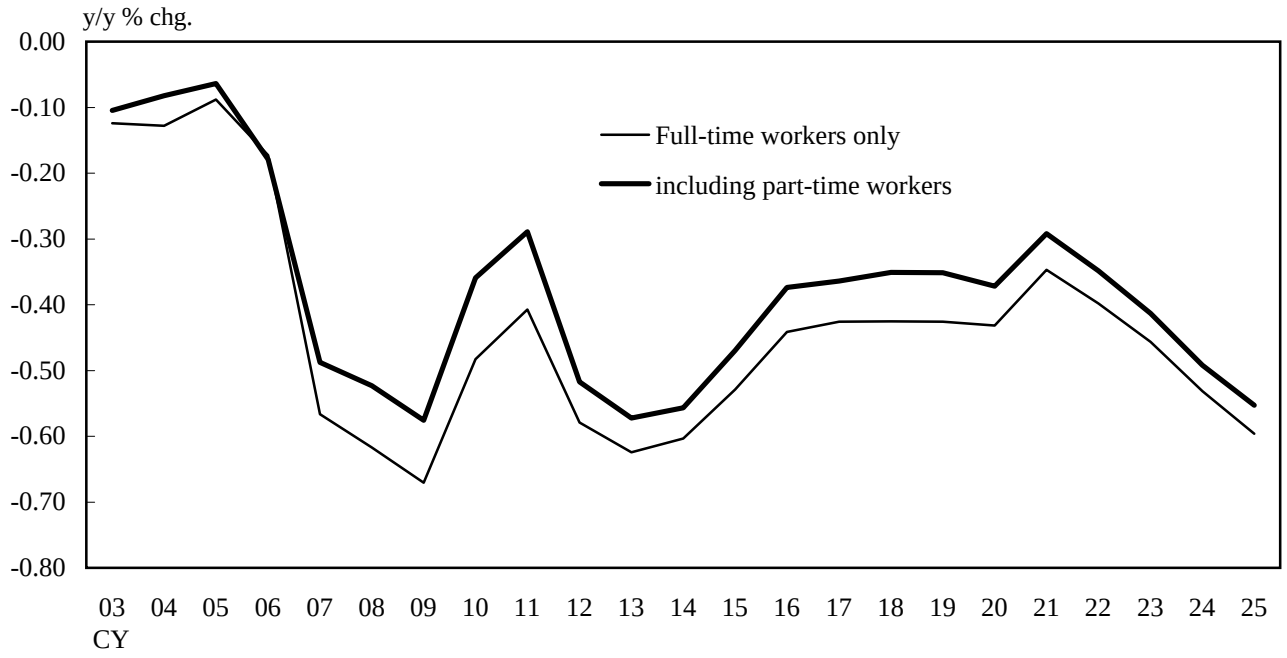
Sources: Ministry of Health, Labour and Welfare, "Basic Survey on Wage Structure."
National Institute of Population and Social Security Research, "Population Projection for Japan."

Outlook for Total Working Hours

(1) Total working hours per person



(2) Total working hours per person * number of workers

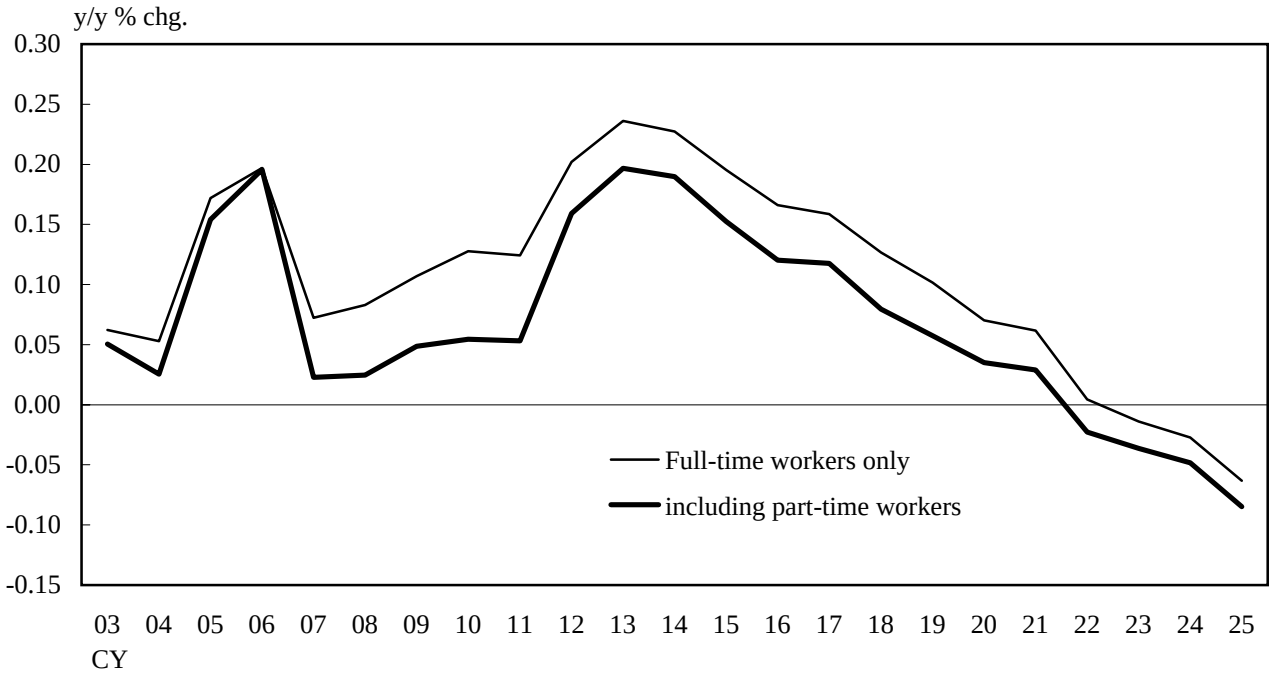


Notes: 1. Total working hours of regular workers by sex, age, and type of industry (manufacturing or nonmanufacturing; same hereafter) are unchanged.
2. Total working hours of part-time workers by sex and age are unchanged.
3. The rate of employment of full-time workers by sex, age, and industry is unchanged.
4. The ratio of part-time workers by sex and age is unchanged.
5. Age distribution of workers are based on the Basic Survey on Wage Structure.

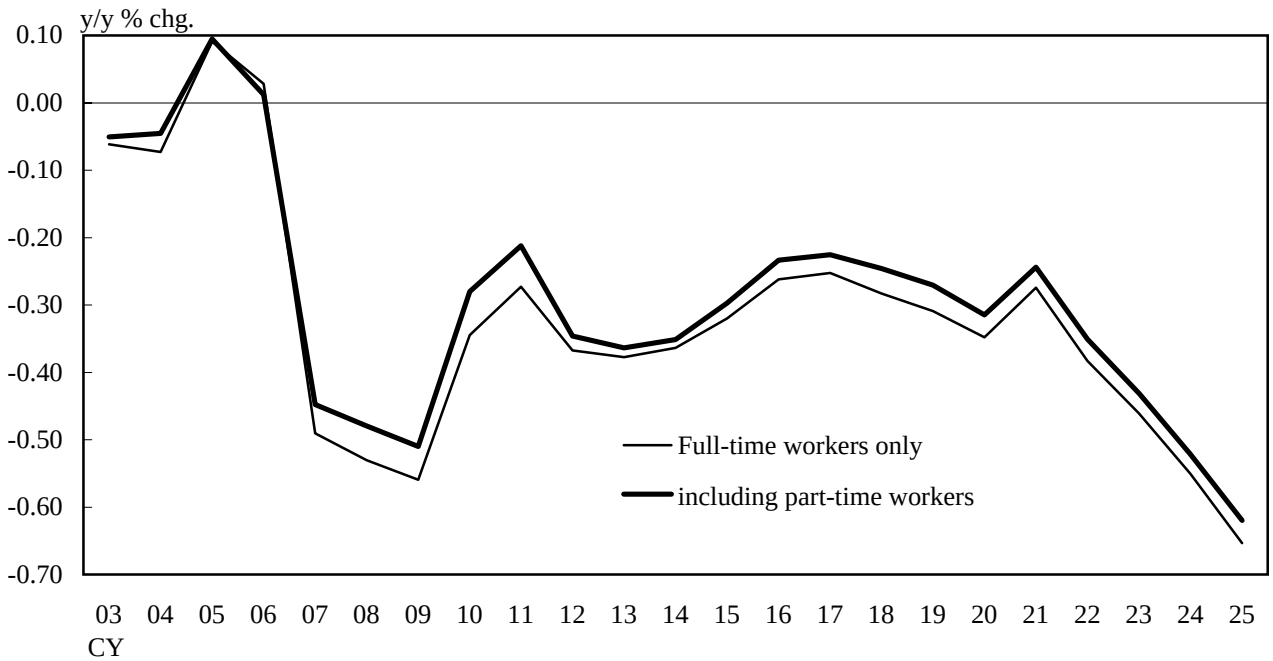
Sources: Ministry of Health, Labour and Welfare, "Basic Survey on Wage Structure."
National Institute of Population and Social Security Research, "Population Projection for Japan."

Outlook for Labor Costs

(1) Wage per person



(2) Wage per person * number of workers

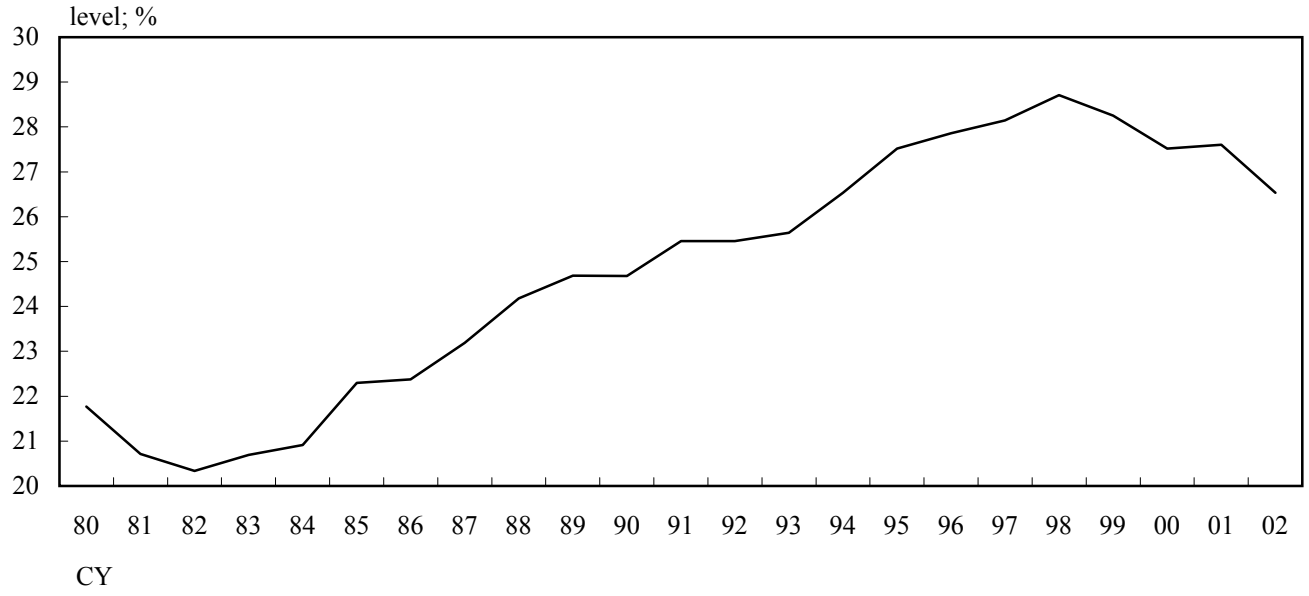


Notes: 1. Total working hours of regular workers by sex, age, and type of industry (manufacturing or nonmanufacturing; the same hereafter) are unchanged.
2. Total working hours of part-time workers by sex and age are unchanged.
3. The rate of employment of full-time workers by sex, age, and industry is unchanged.
4. The ratio of part-time workers by sex and age is unchanged.
5. Age distribution of workers are based on the Basic Survey on Wage Structure.

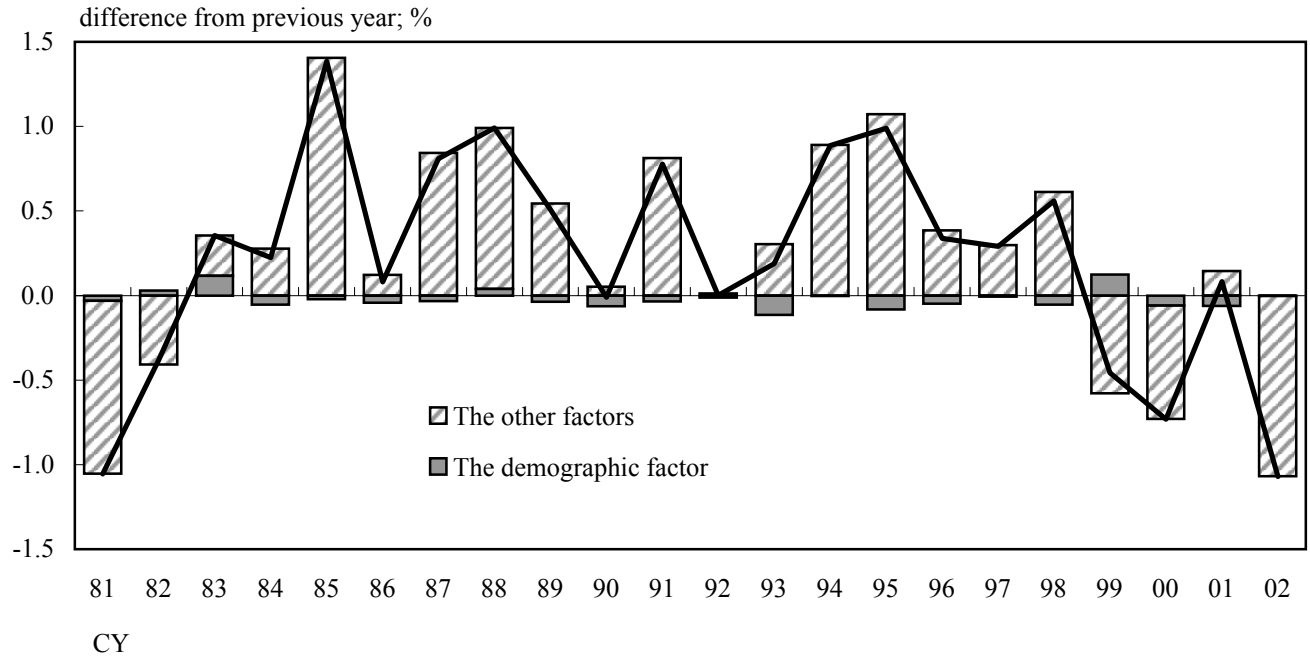
Sources: Ministry of Health, Labour and Welfare, "Basic Survey on Wage Structure."
National Institute of Population and Social Security Research, "Population Projection for Japan."

Breakdown of Changes in the Saving Rate

(1) Saving rate in the Family Income and Expenditure Survey



(2) Breakdown of difference from the previous year

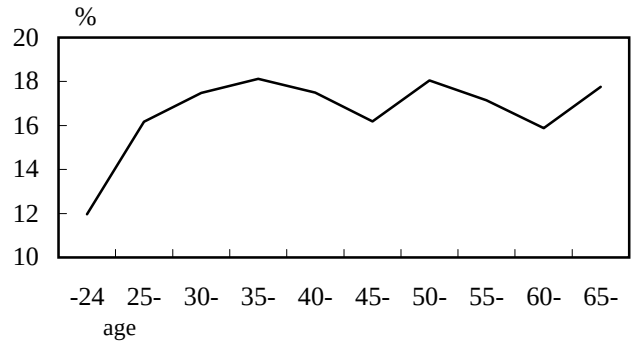


Note: Total savings = Σ (age distribution of the household head * savings of the household head by age)
Total disposable income = Σ (age distribution of the household head * disposable income of the household head by age).
The change in the saving rate can be divided into the change in the age distribution and the other changes. The former is indicated as the demographic factor and the latter as the other factors.

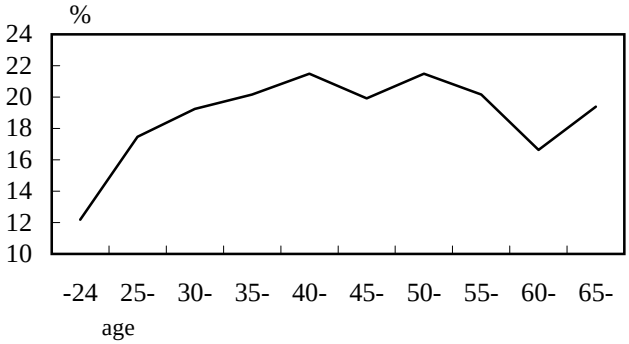
Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Family Income and Expenditure Survey."

Saving Rates of Household Head by Age in Each Period

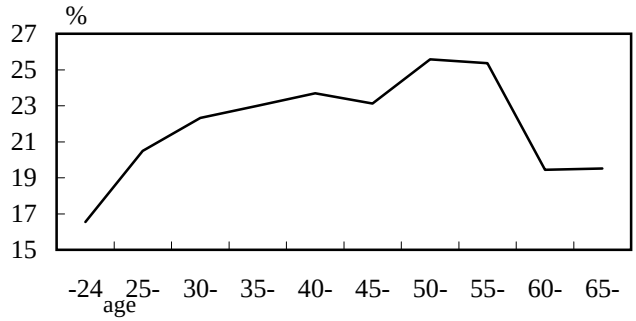
(1) Around 1965



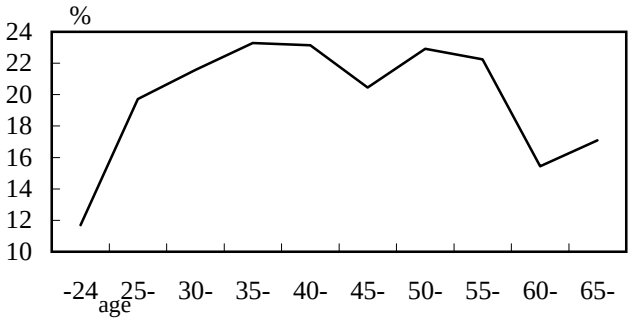
(2) Around 1970



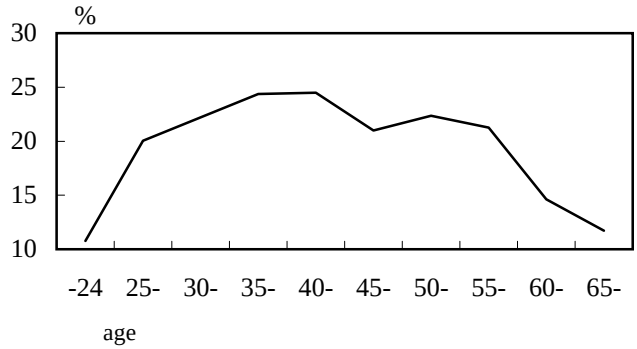
(3) Around 1975



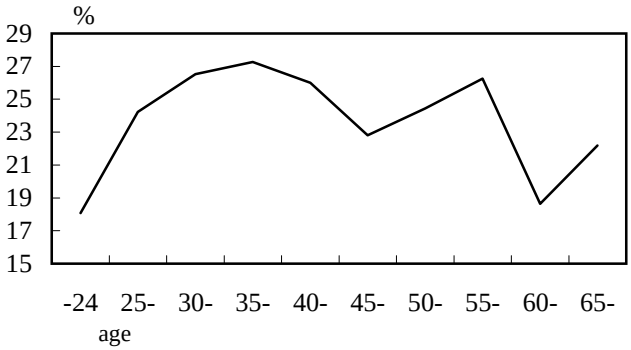
(4) Around 1980



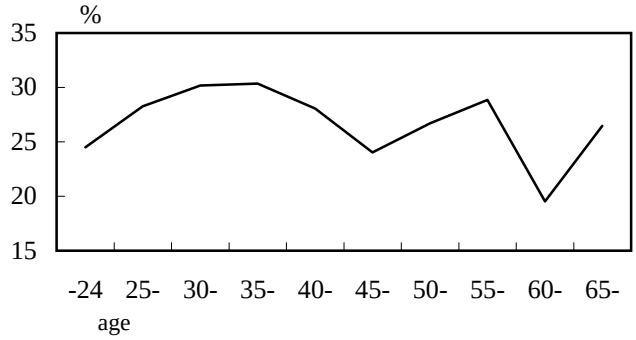
(5) Around 1985



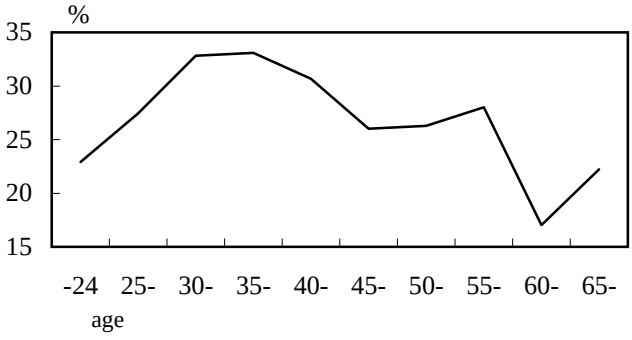
(6) Around 1990



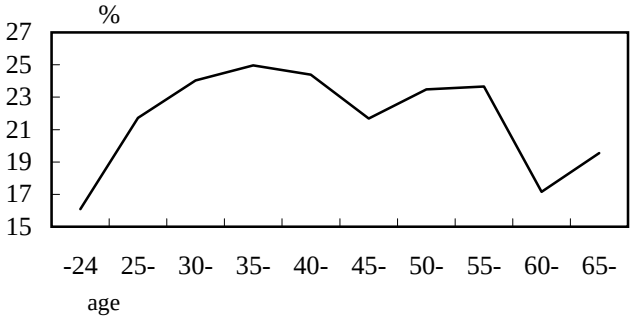
(7) Around 1995



(8) Around 2000



(9) Average of all years

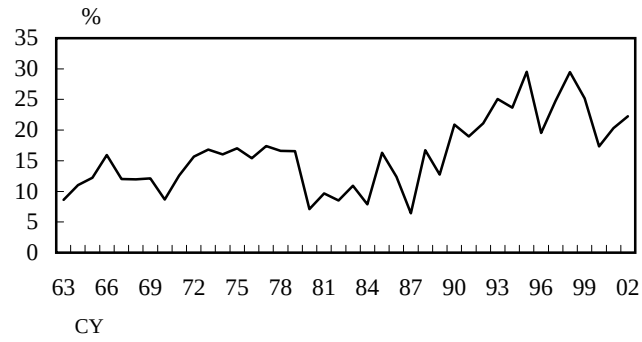


Note: "Around" indicates the average of 5 years. For example, "around 2000" is the average of 1998-2002.

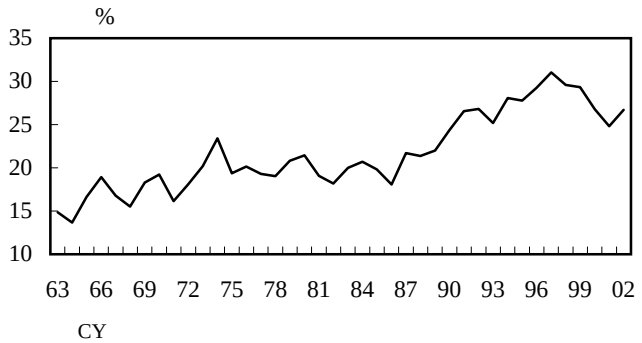
Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Family Income and Expenditure Survey."

Developments of Saving Rates by Age Group

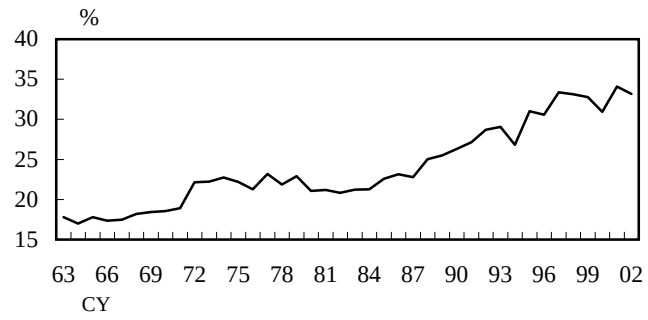
(1) -24 yrs old



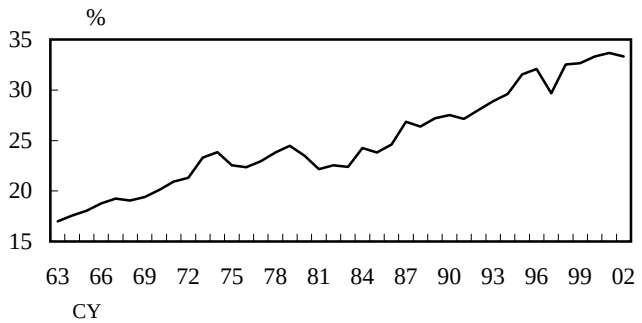
(2) 25-29 yrs old



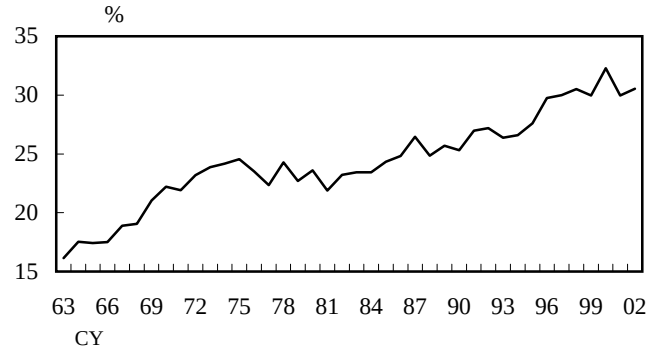
(3) 30-34 yrs old



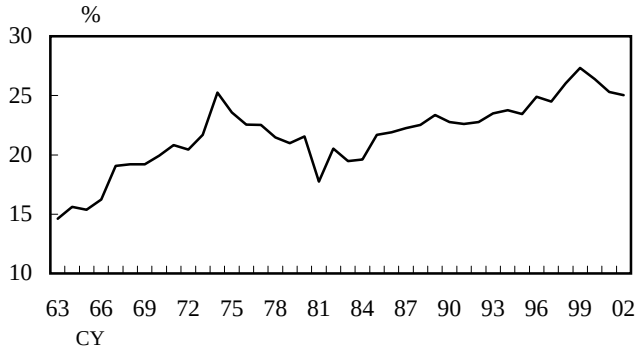
(4) 35-39 yrs old



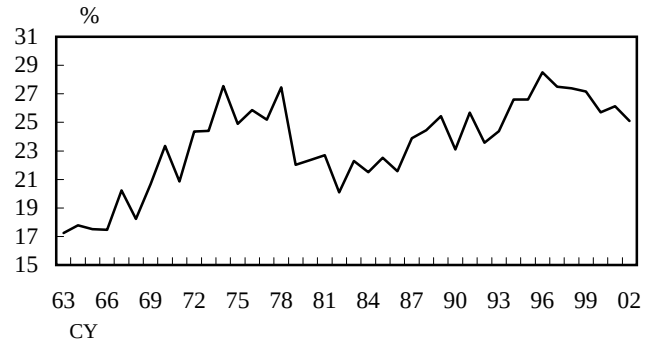
(5) 40-44 yrs old



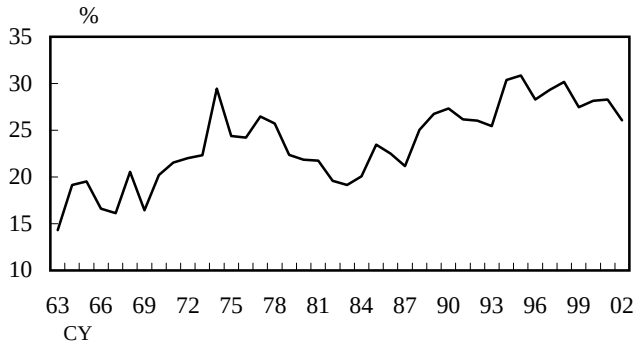
(6) 45-49 yrs old



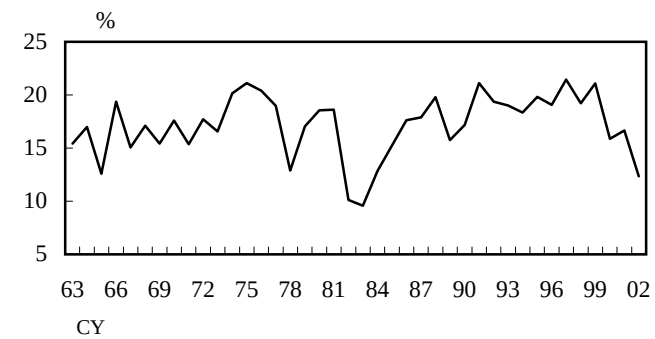
(7) 50-54 yrs old



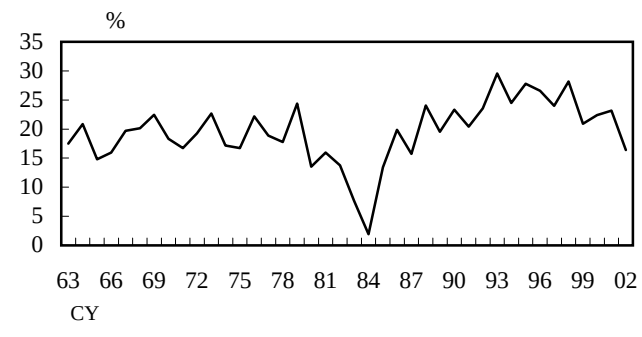
(8) 55-59 yrs old



(9) 60-64 yrs old

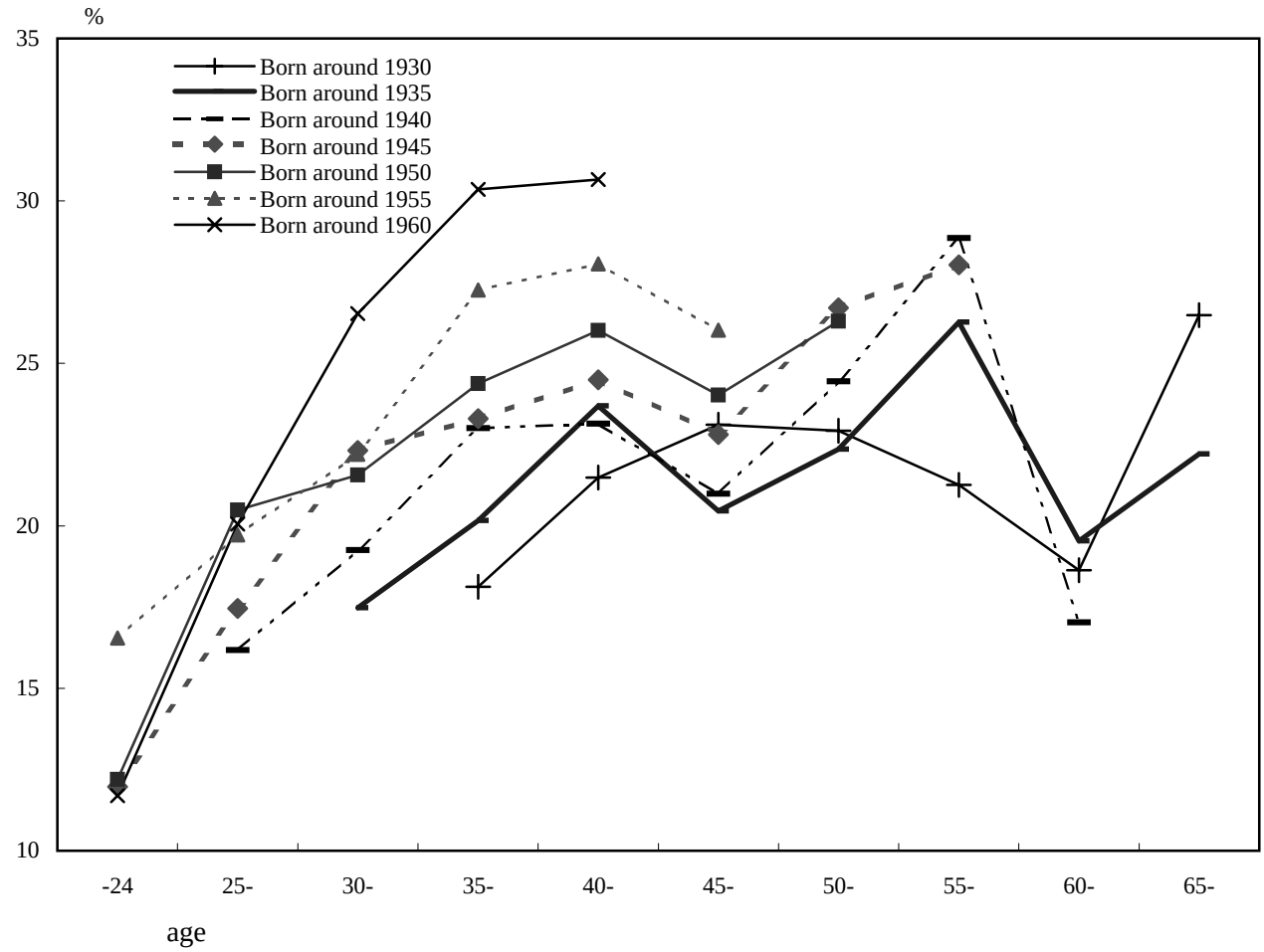


(10) 65 yrs old and over



Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Family Income and Expenditure Survey."

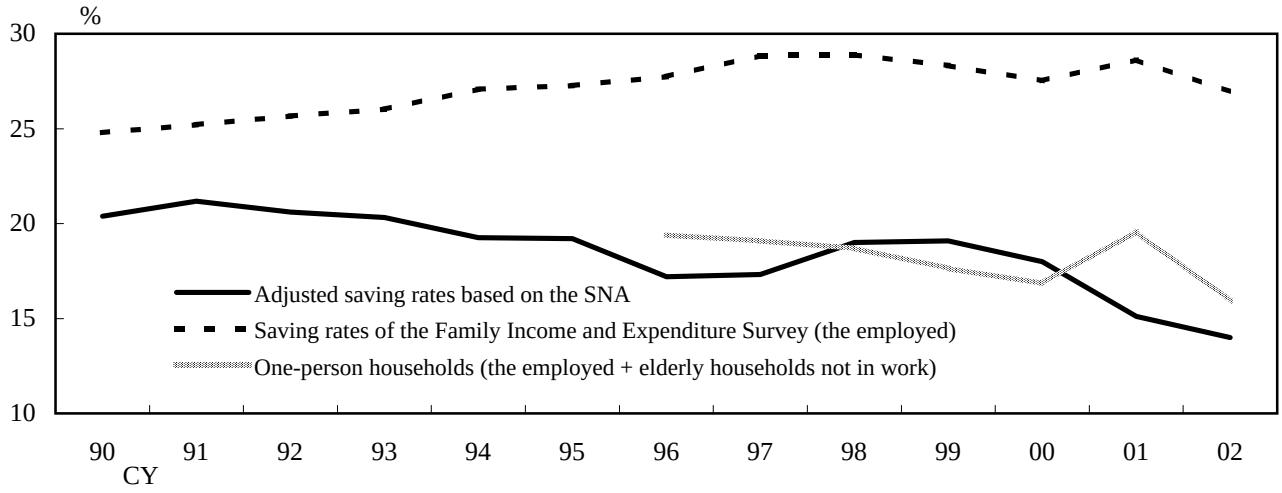
Saving Rates by Year of Birth



Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Family Income and Expenditure Survey."

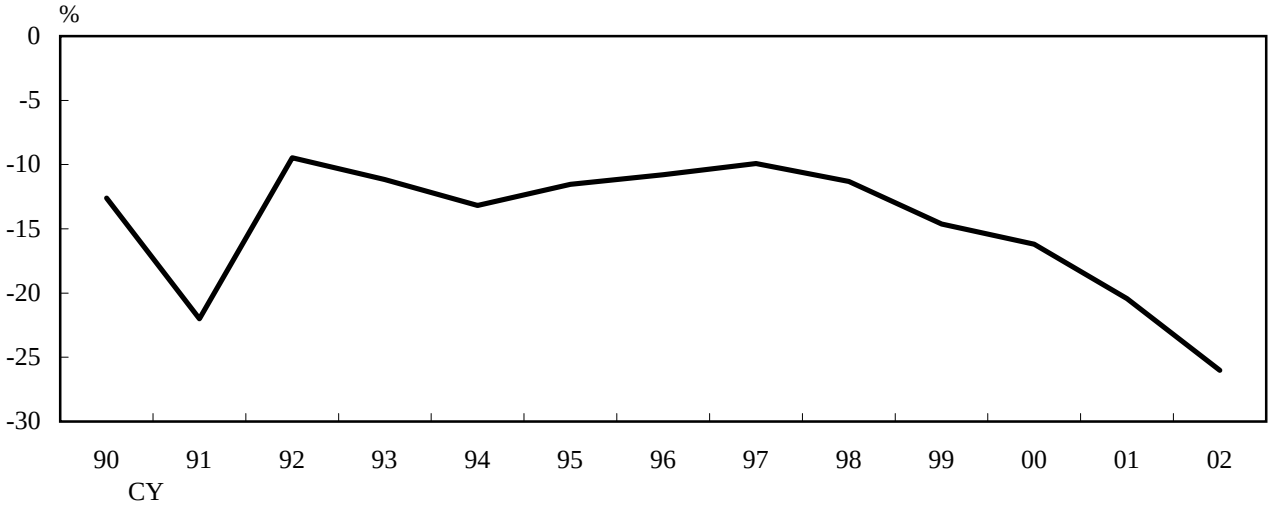
Developments of the Saving Rates

(1) Family Income and Expenditure Survey and the SNA

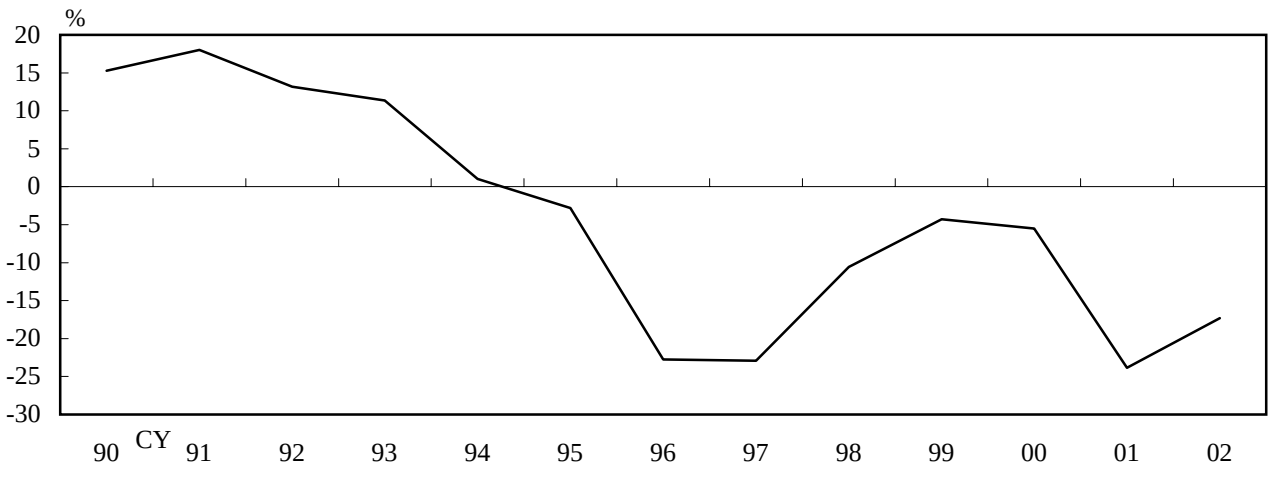


Note: Adjusted saving rates based on the SNA = 1 - (final consumption expenditure of households - imputed service of owner occupied dwellings) / (disposable income of households + changes in pension reserves in pension funds - operating surplus of owner occupied dwellings)

(2) Saving rates of elderly households not in work



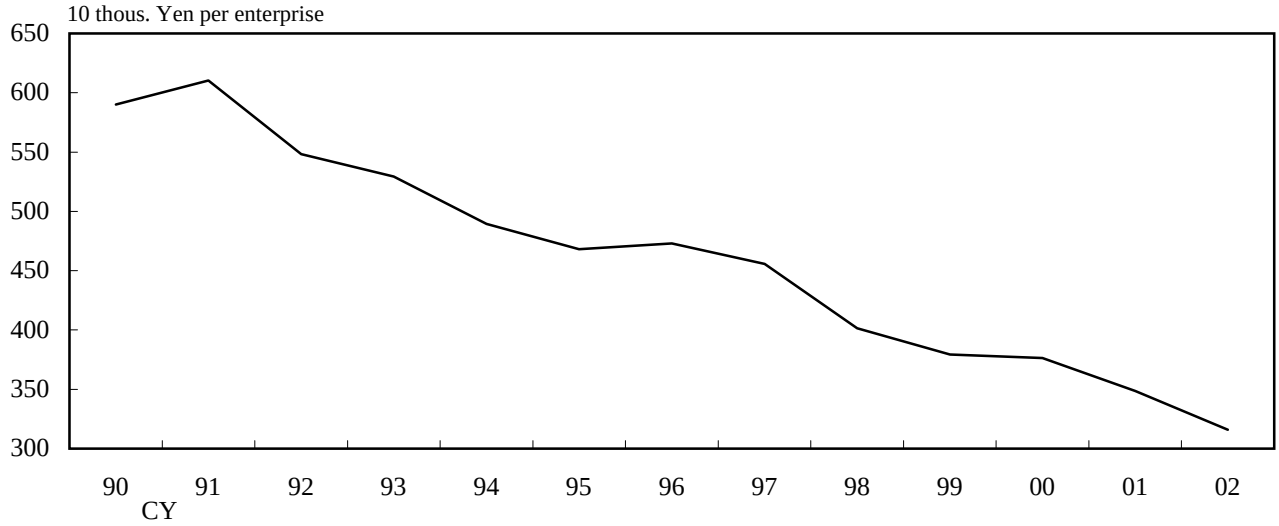
(3) The remaining households (mainly self-employed = all households - the employed - elderly households not in work)



Sources: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Family Income and Expenditure Survey"; Cabinet Office, "National Accounts."

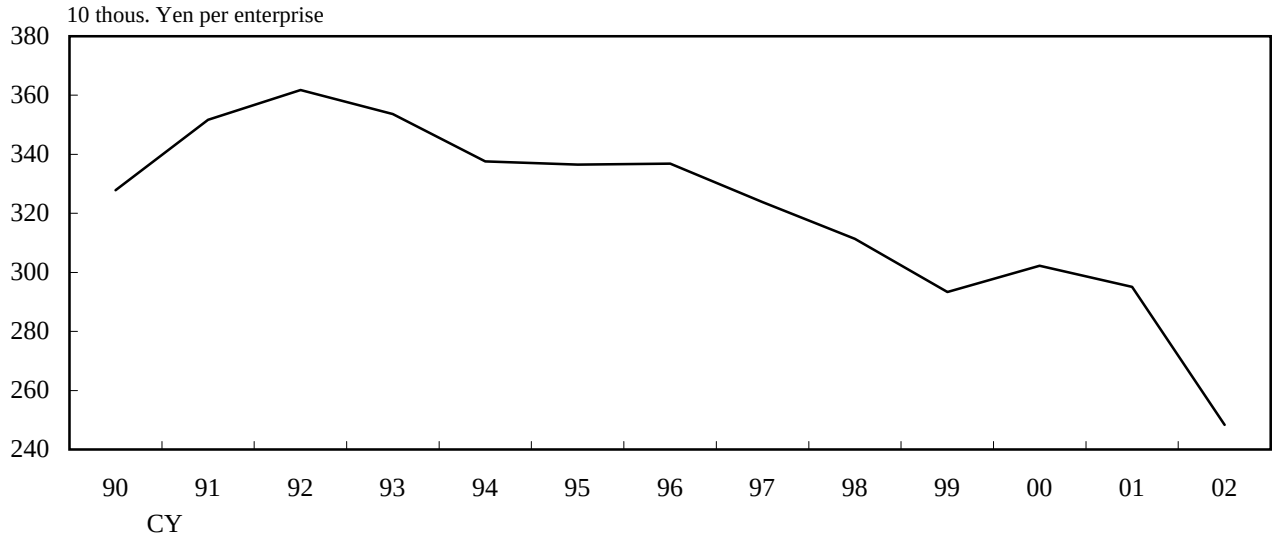
Operation Profits of Unincorporated Enterprise

(1) Manufacturing



(2) Wholesale and Retail Trade, Eating and Drinking Places

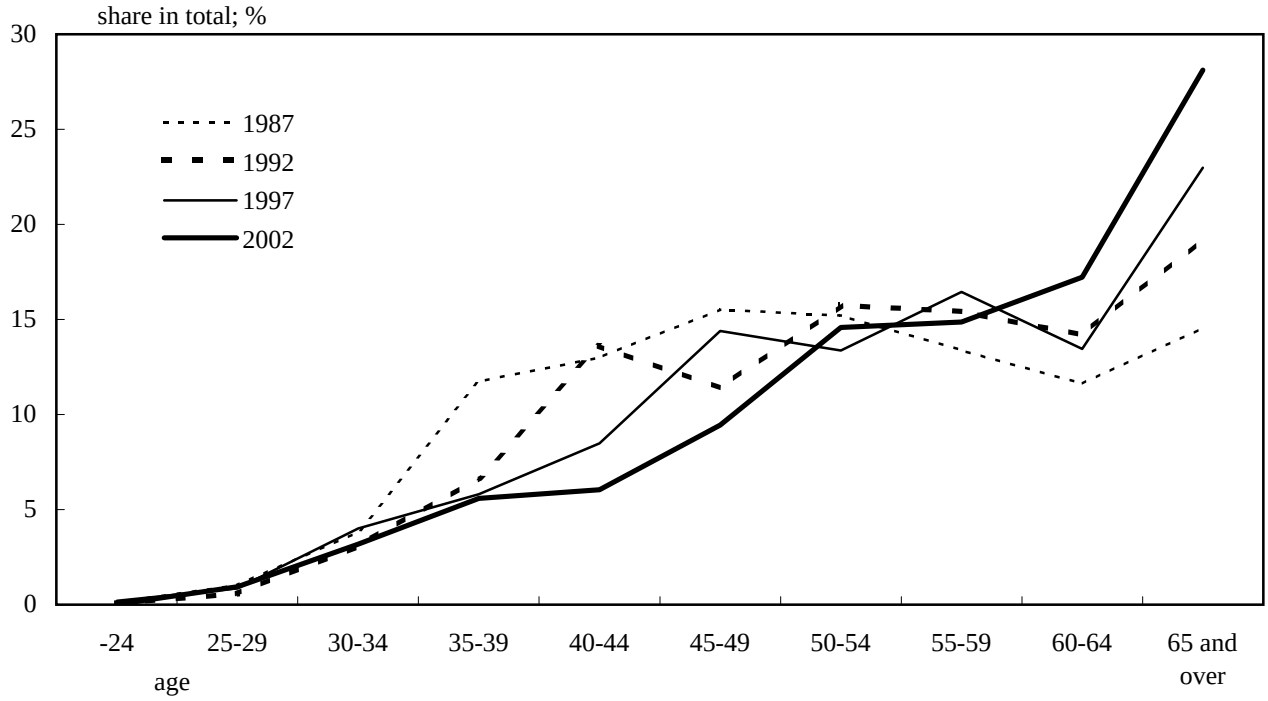
(3) Services



Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Unincorporated Enterprise Survey."

Chart 46

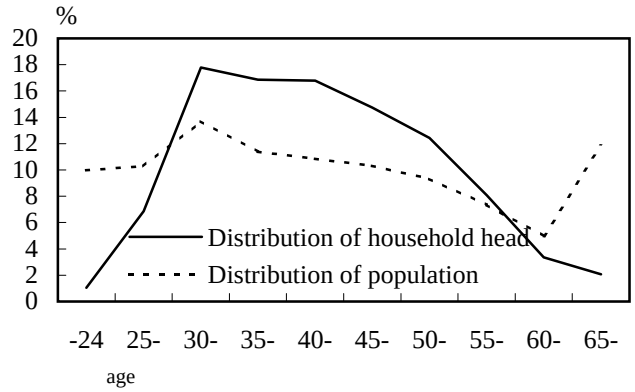
Age Composition of Self-employed Head of Household (FIES)



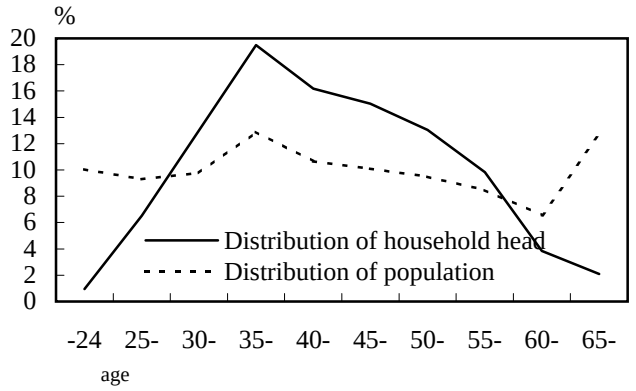
Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Family Income and Expenditure Survey (FIES)."

Age Distribution of Household Head and Population

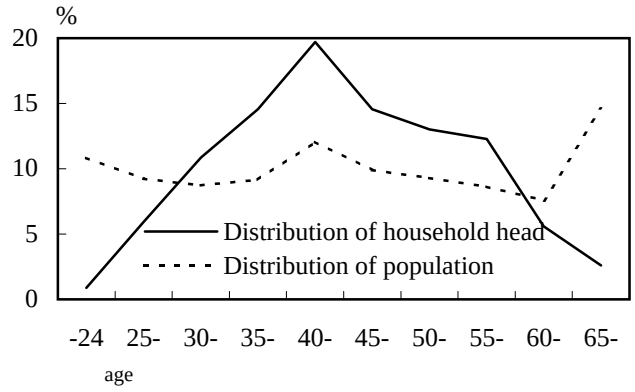
(1) 1982



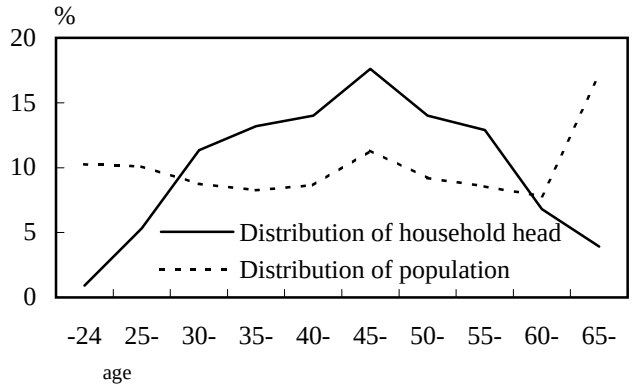
(2) 1987



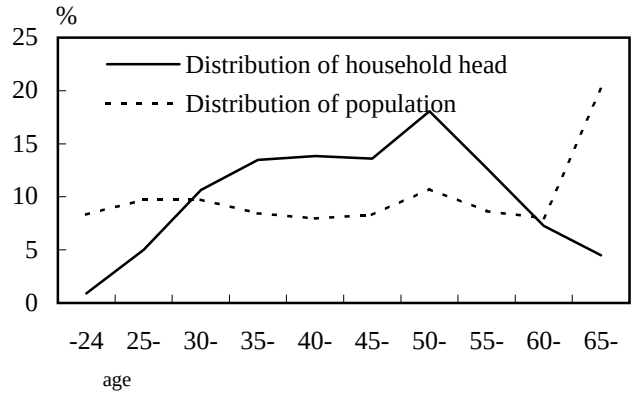
(3) 1992



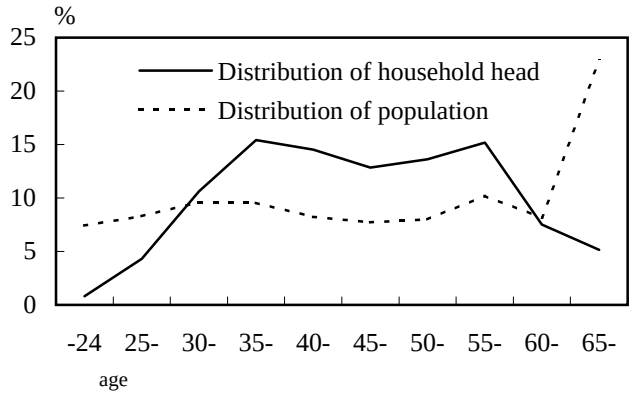
(4) 1997



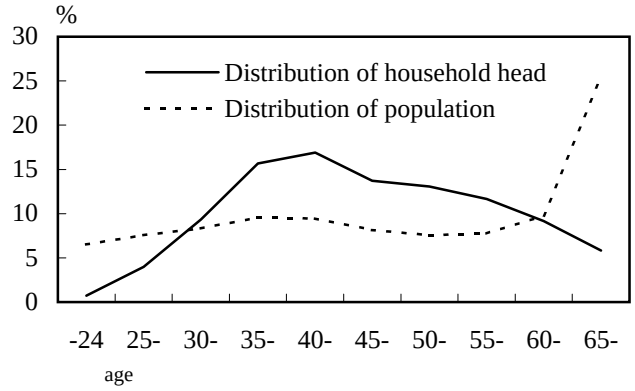
(5) 2002



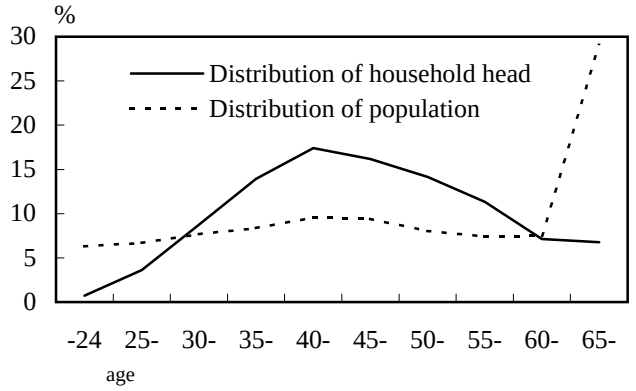
(6) 2007



(7) 2012



(8) 2017



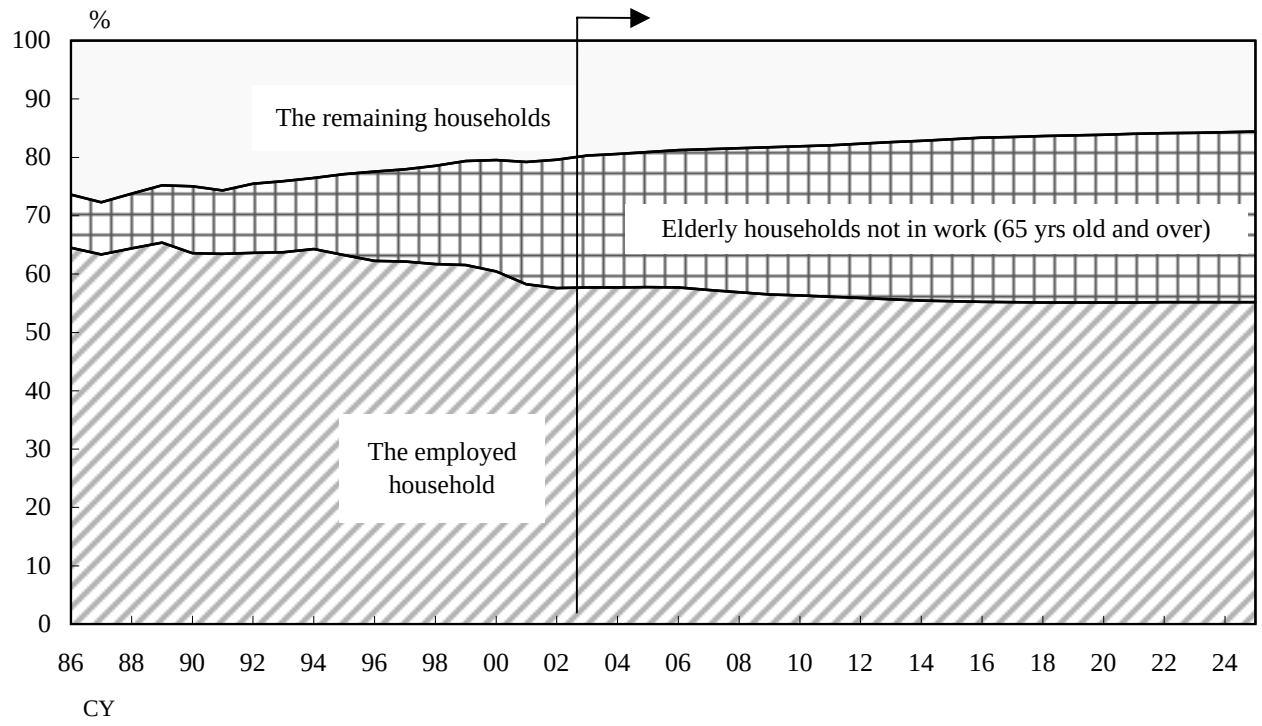
Notes: 1. Distribution of household head is the age distribution of the employed household head in the Family Income and Expenditure Survey. The figures are not shares of household heads in the population in each age group.

2. Distribution of population is indicated for 20 years old and over.

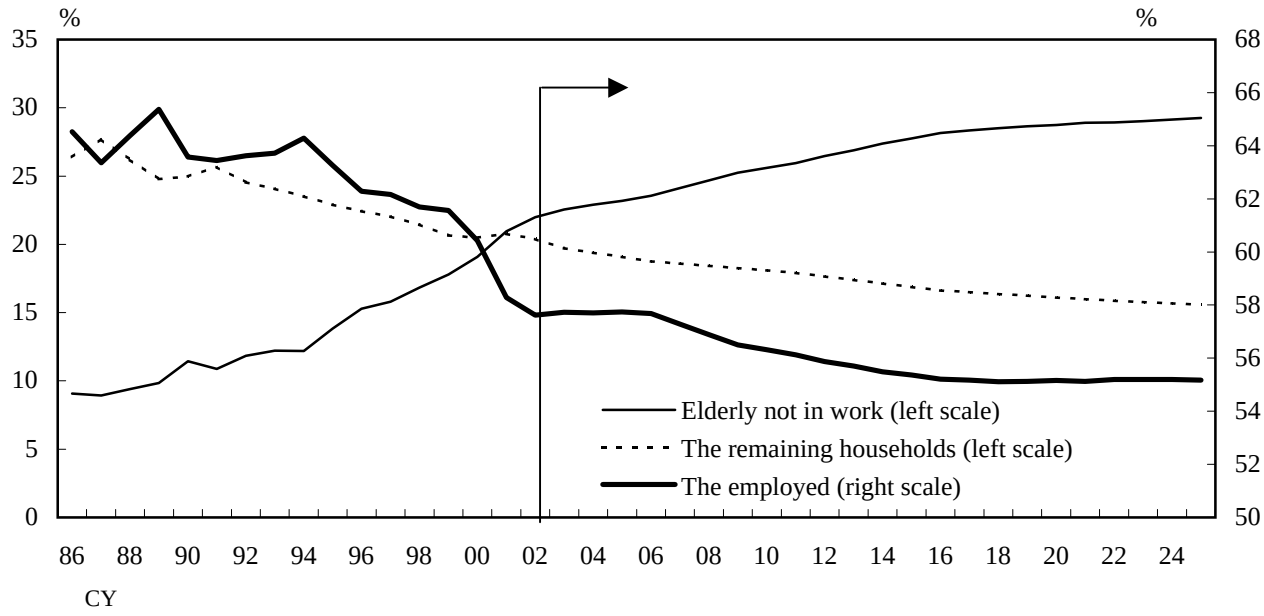
Sources: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Family Income and Expenditure Survey," etc.

Weight of Households

(1) Composition



(2) Weight of households

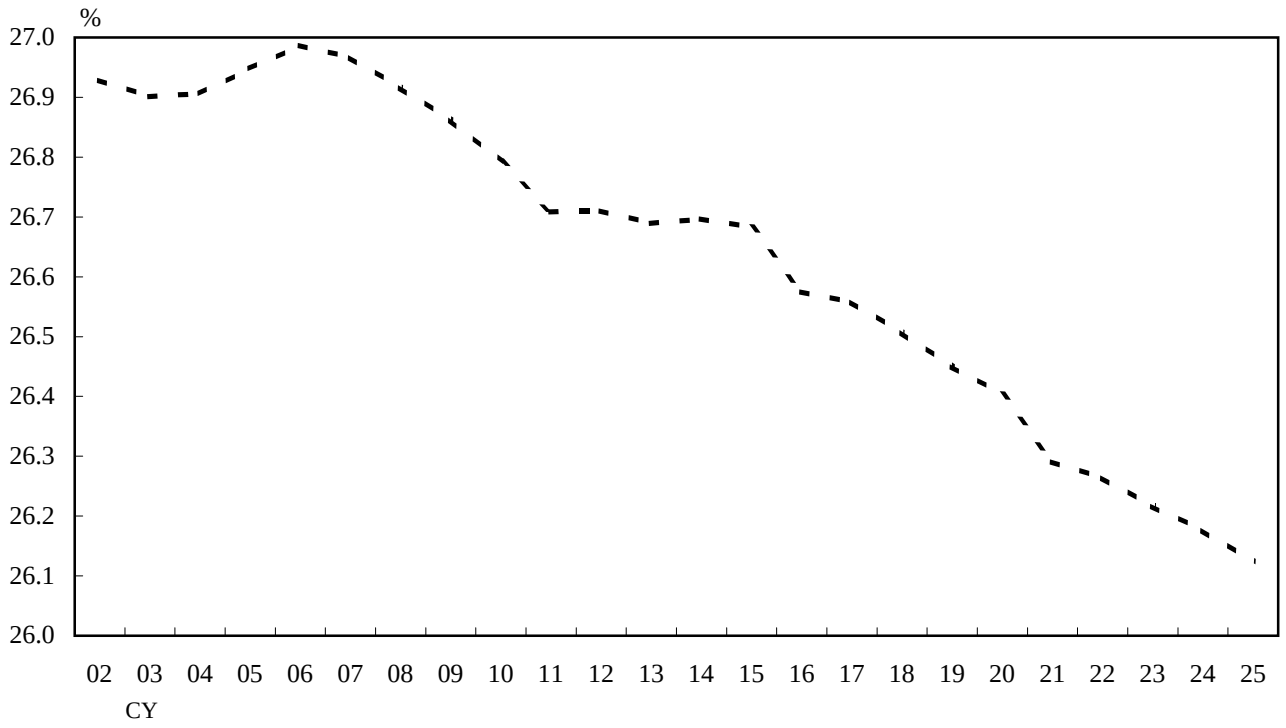


Note: Households here are those with more than two persons

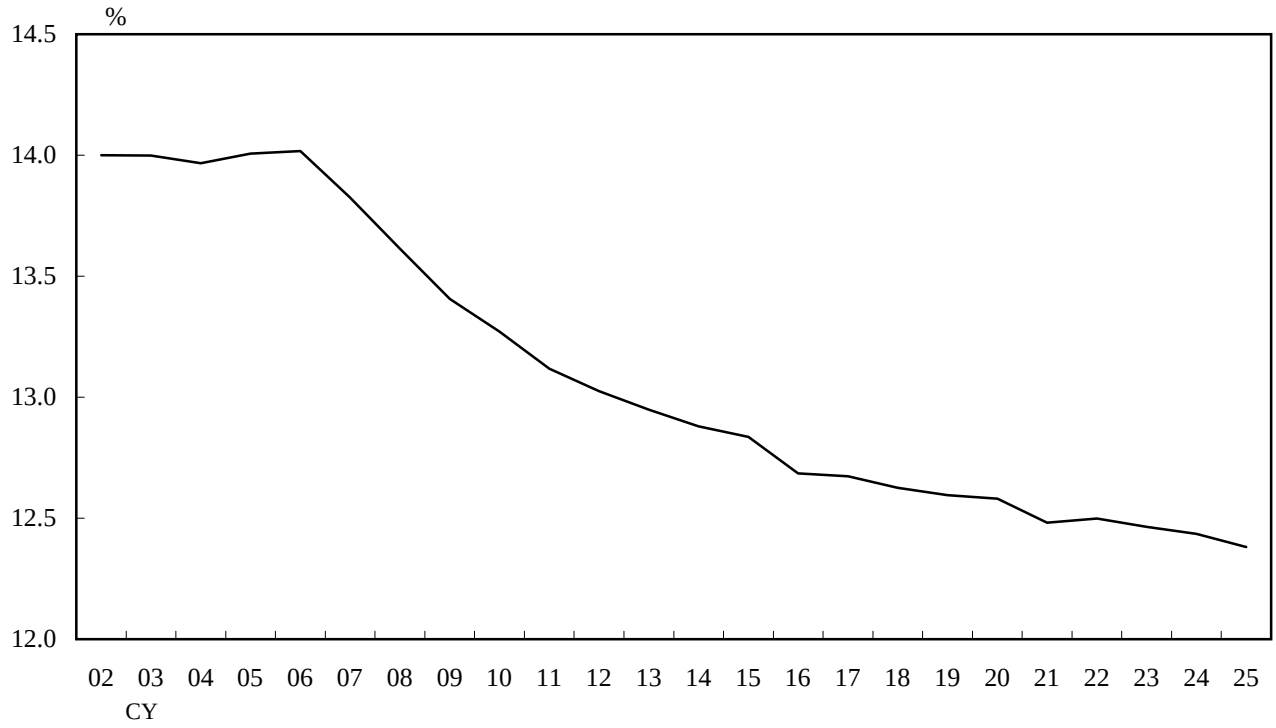
Sources: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Family Income and Expenditure Survey," etc.

Outlook for the Saving Rates

(1) Saving rate of the FIES: the employed households



(2) Adjusted saving rate based on the SNA

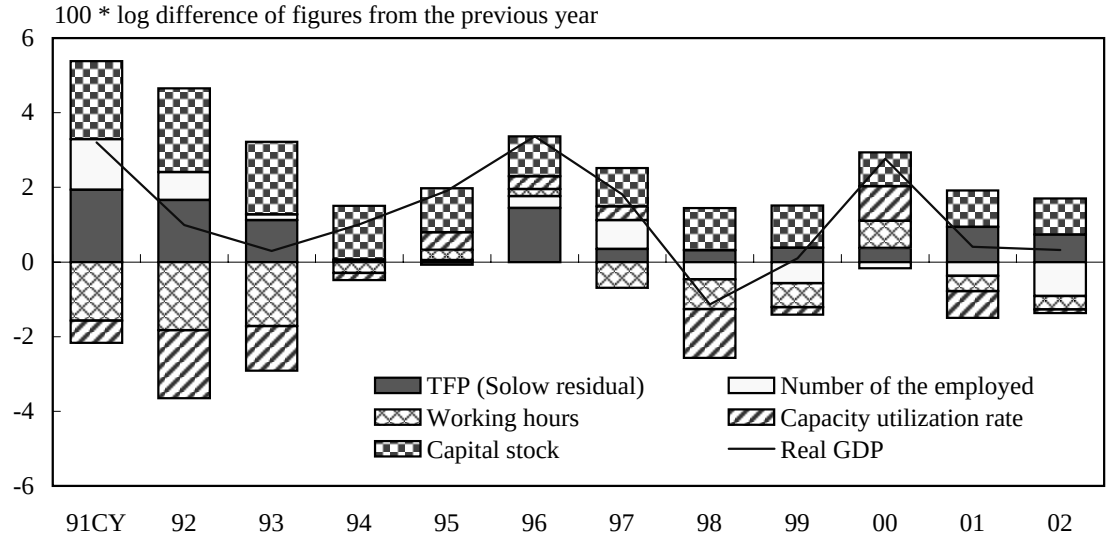


Note: Adjusted saving rate is the saving rate excluding imputed rent, the same definition as shown in the Chart 44.

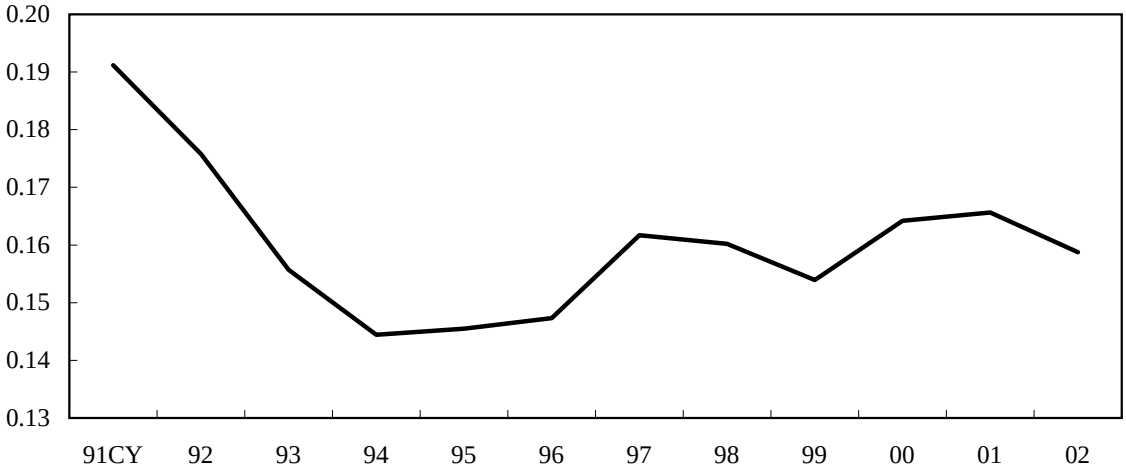
Sources: Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Family Income and Expenditure Survey (FIES)," etc.

Main Variables in a Simple Model (1)

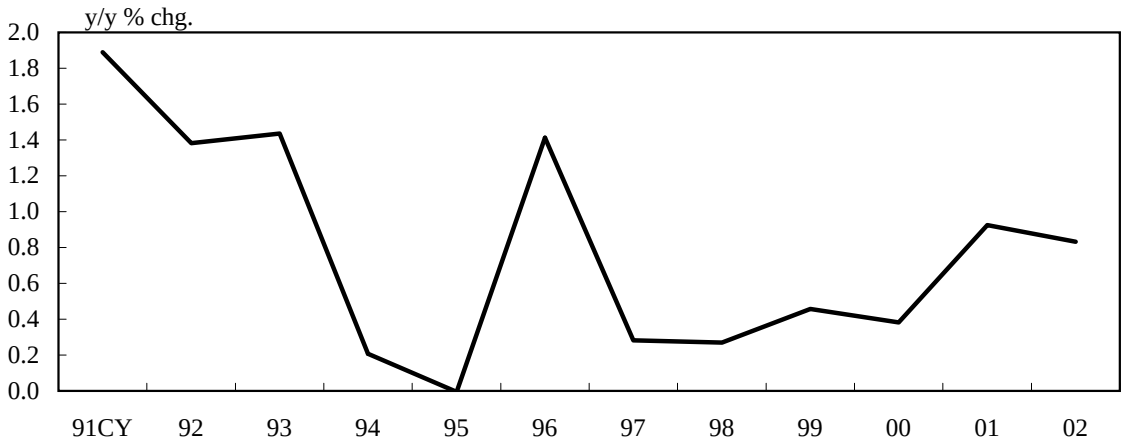
(1) Breakdown of factors of the real GDP growth rate



(2) Real capital spending-to-GDP ratio



(3) Growth rate of the TFP (= Solow residual)

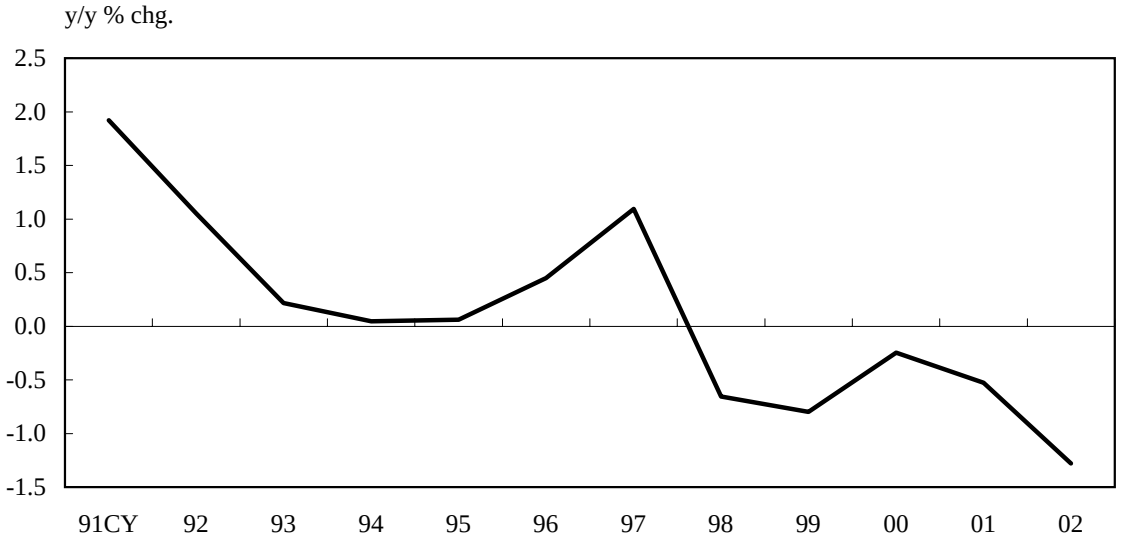


Notes: 1. The actual figures are calculated using the 1995 base year.
2. A is calculated by using the following formula: $\ln(Y)=\ln(A)+0.71\cdot\ln(L)+0.29\cdot\ln(K)$.

Sources: Cabinet Office, "National Accounts," etc.

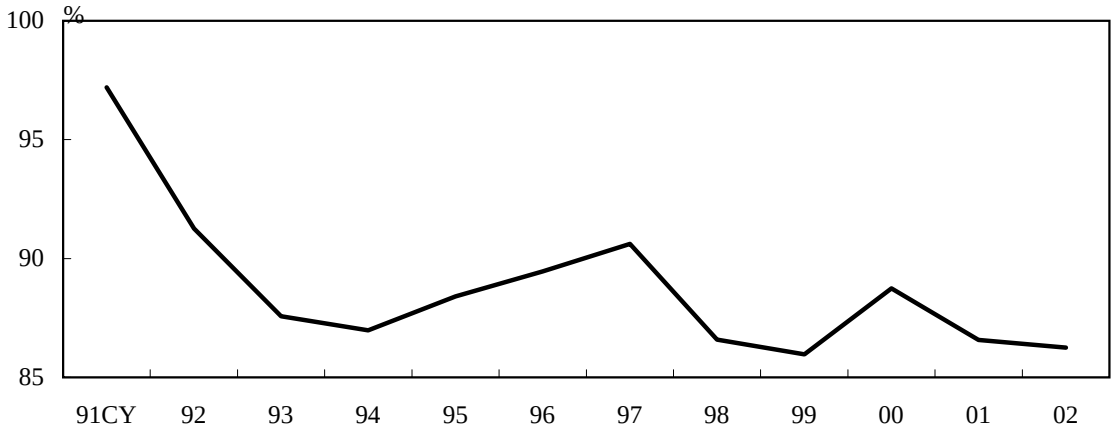
Main Variables in a Simple Model (2)

(4) Growth rate in the number of those in employment



(5) Growth rate of total working hours per worker

(6) Capacity utilization rate

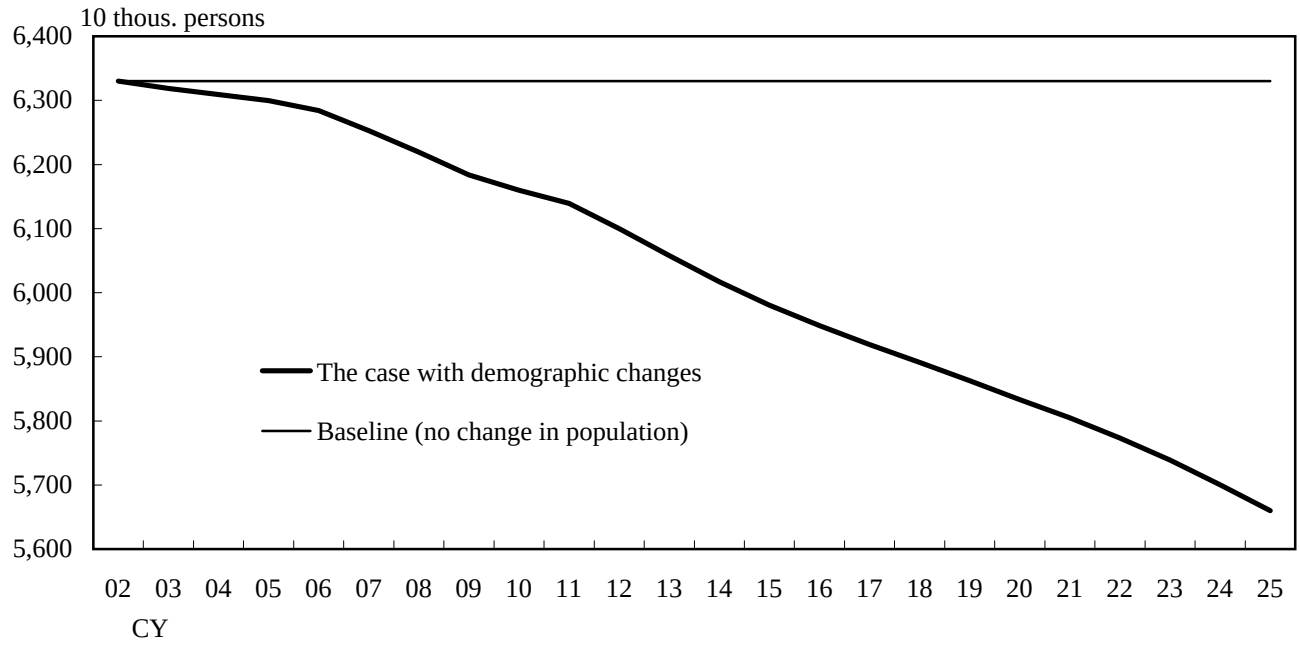


Note: Capacity utilization rate = (operating manufacturing capital stock + operating non-manufacturing capital stock) / total capital stock. The base year is 1995 for the capacity utilization rate of manufacturing. The capacity utilization rate of non-manufacturing was calculated following Kamada and Masuda (2001).

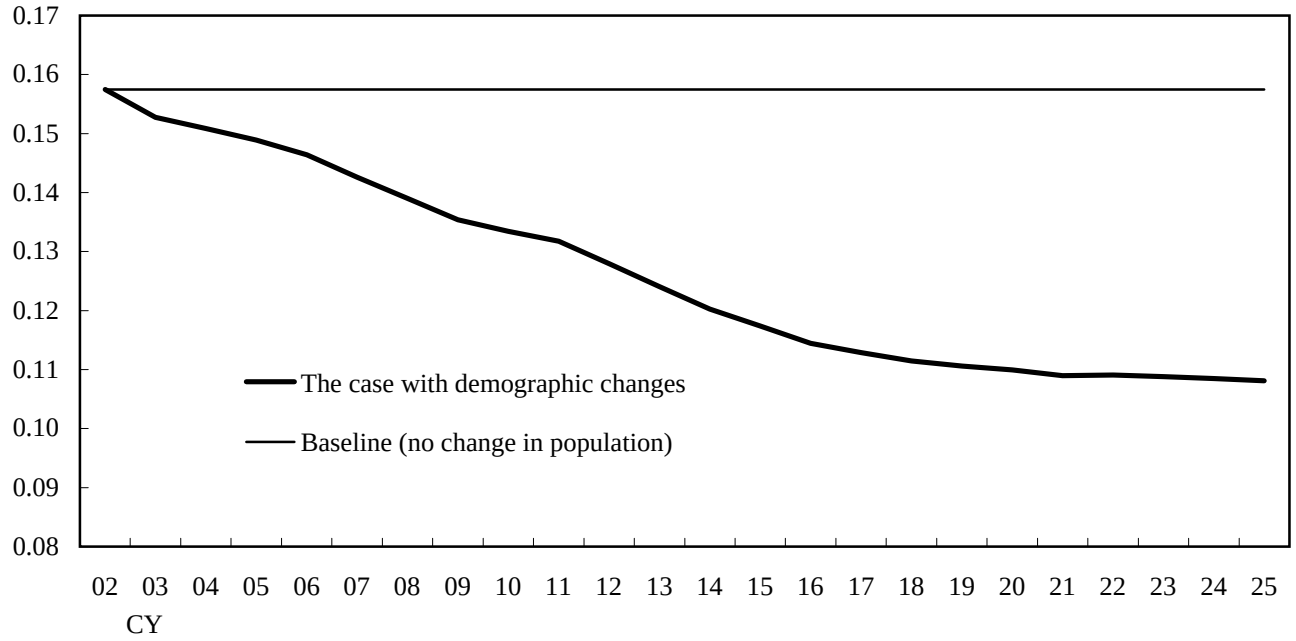
Sources: Cabinet Office, "National Accounts"; Ministry of Economy, Trade and Industry, "Indices of Industrial Production," etc.

Outlook for Main Variables: Comparison with the Baseline

(1) Outlook for L: labor factor

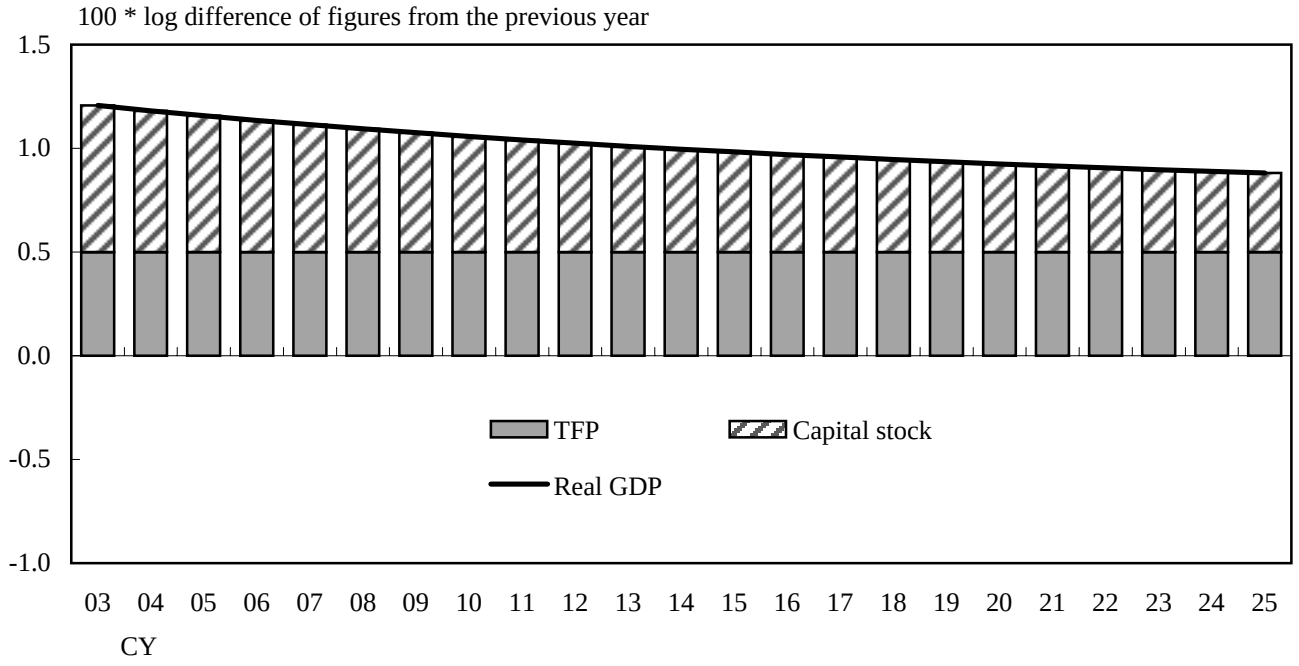


(2) Outlook for s=I/Y; social security and households' saving rate factors



Simulation of Economic Growth

(1) Baseline: no changes in population



(2) The case with demographic changes

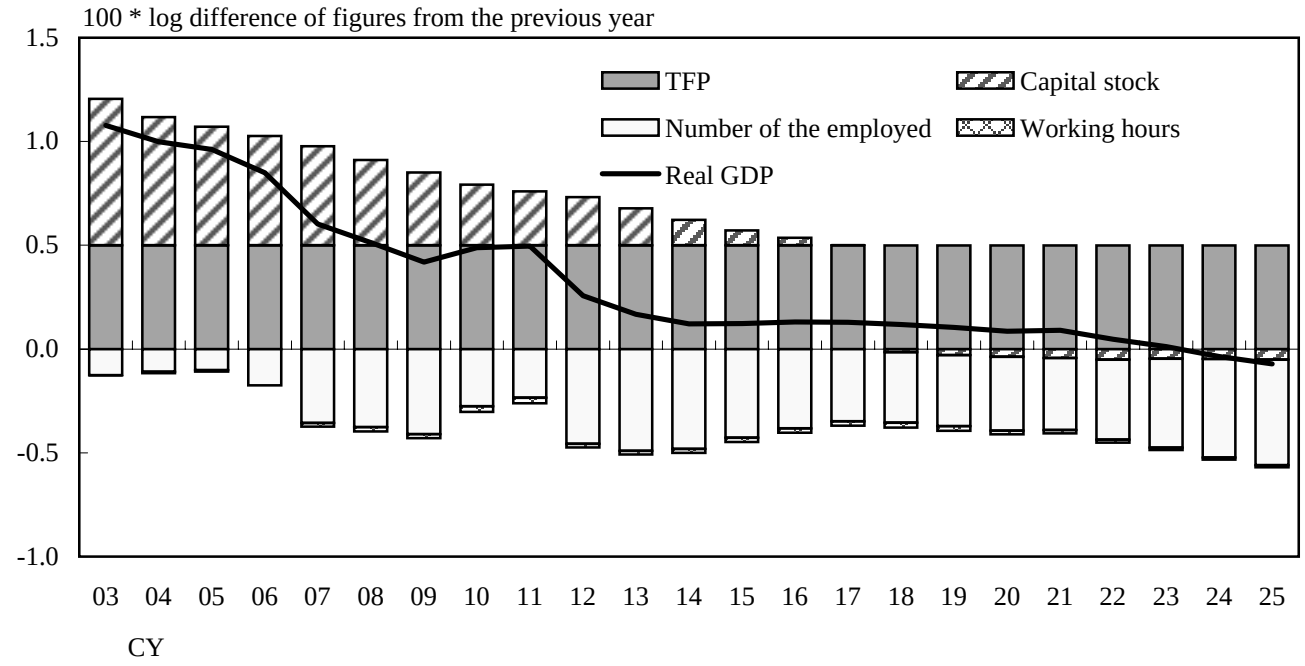
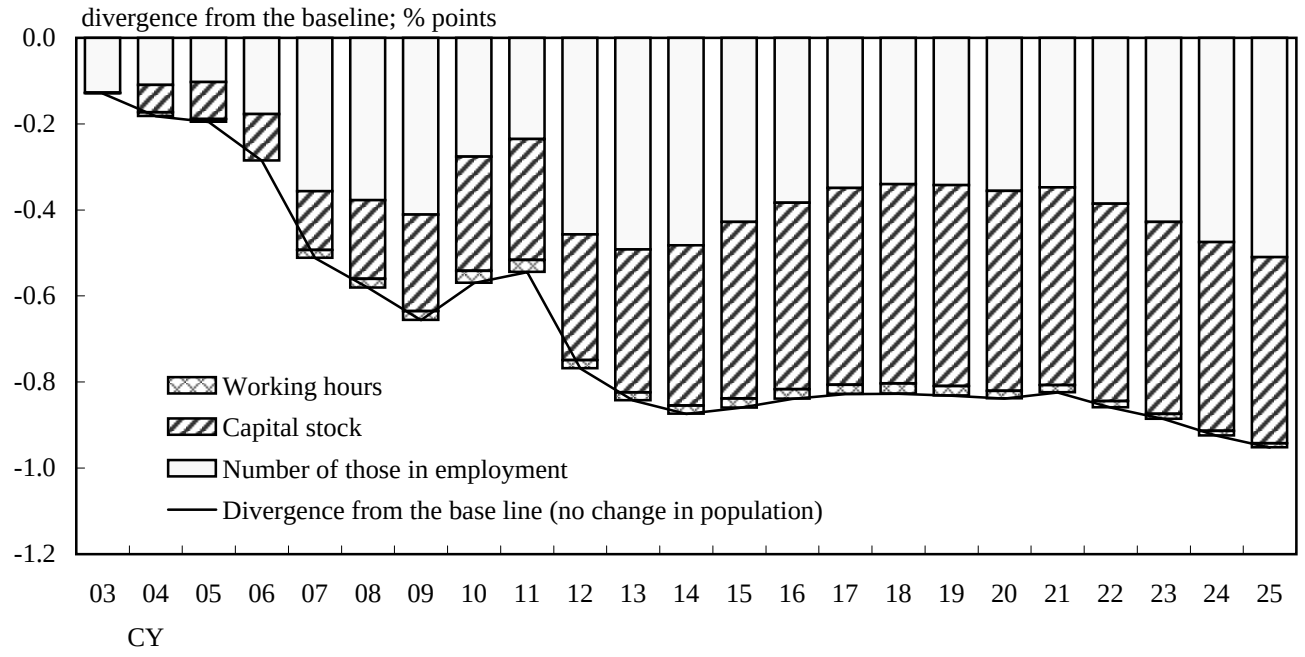


Chart 54

Divergence from the Baseline

(1) Economic growth rate



(2) GDP growth rate per worker

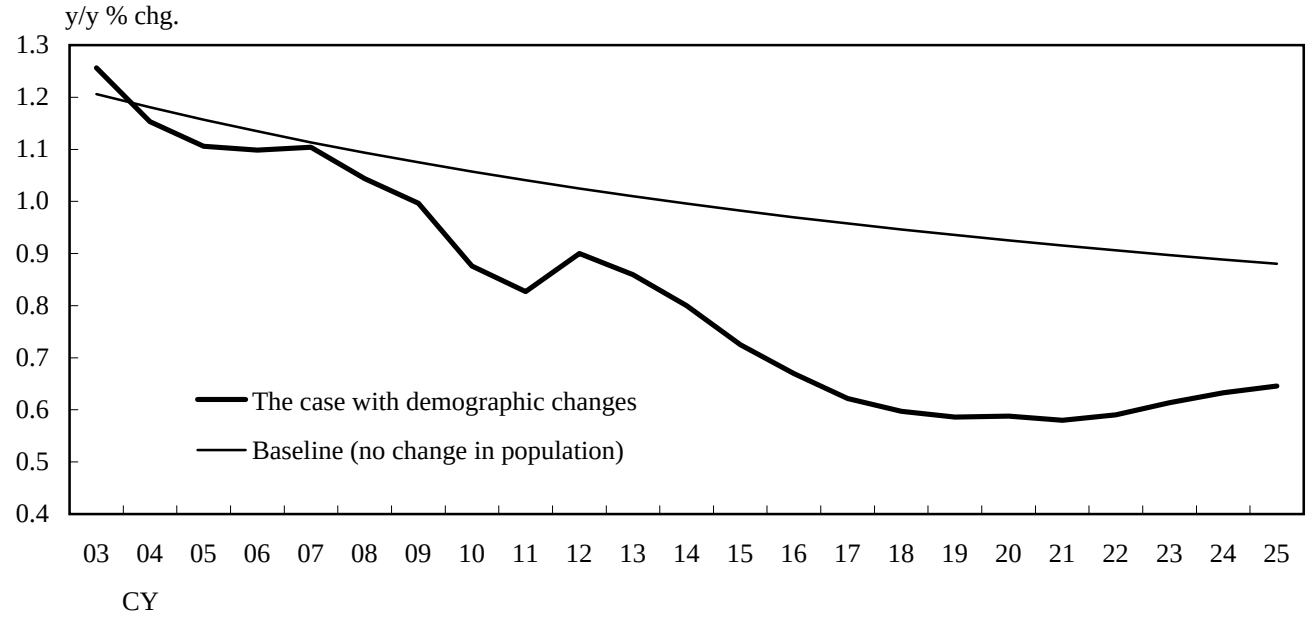
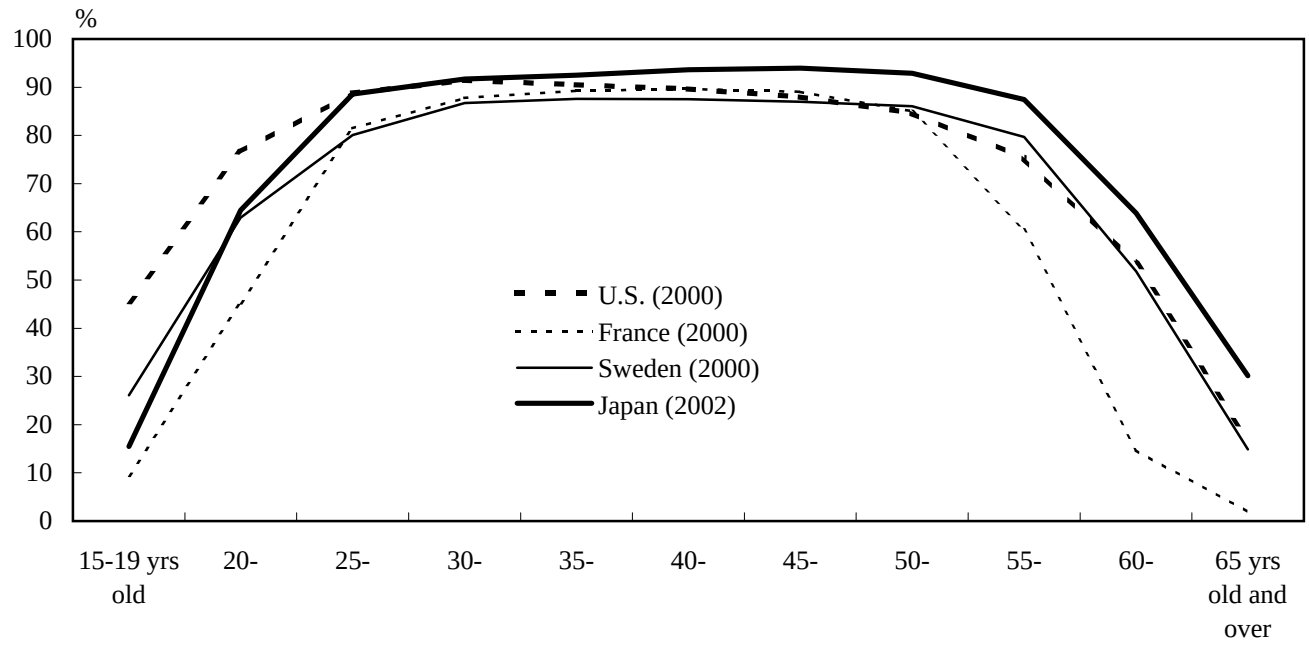


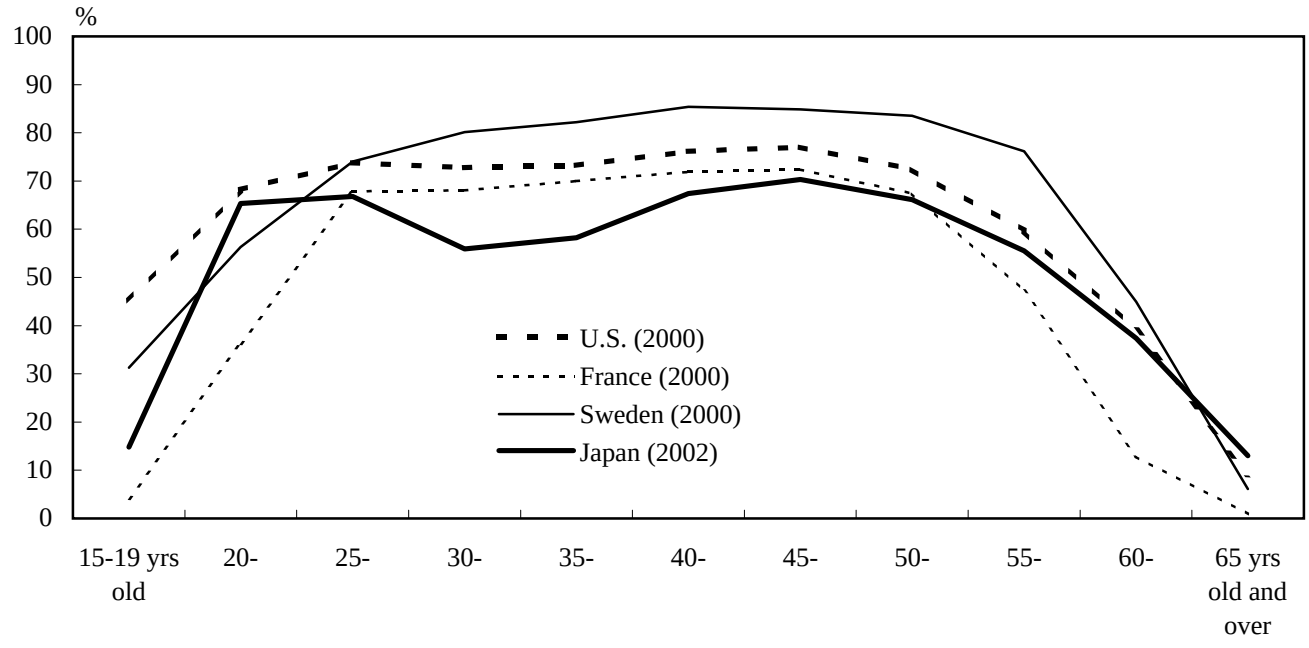
Chart 55

International Comparison of the Rate of Employment

(1) Men



(2) Women

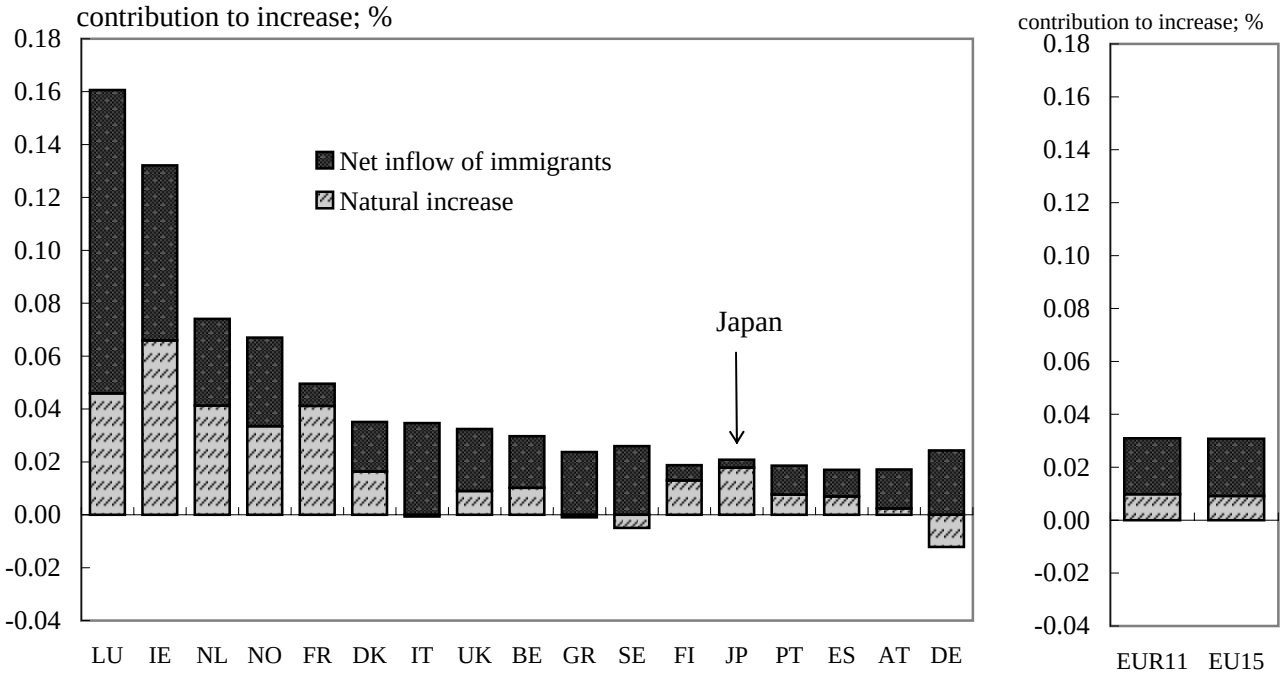


Sources: OECD,"Labour Force Statistics"; Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Labour Force Survey."

Chart 56

Immigrants of EU, U.S., and Japan

Contribution of immigrants to the increase in population



Estimates of the European Union and U.N.

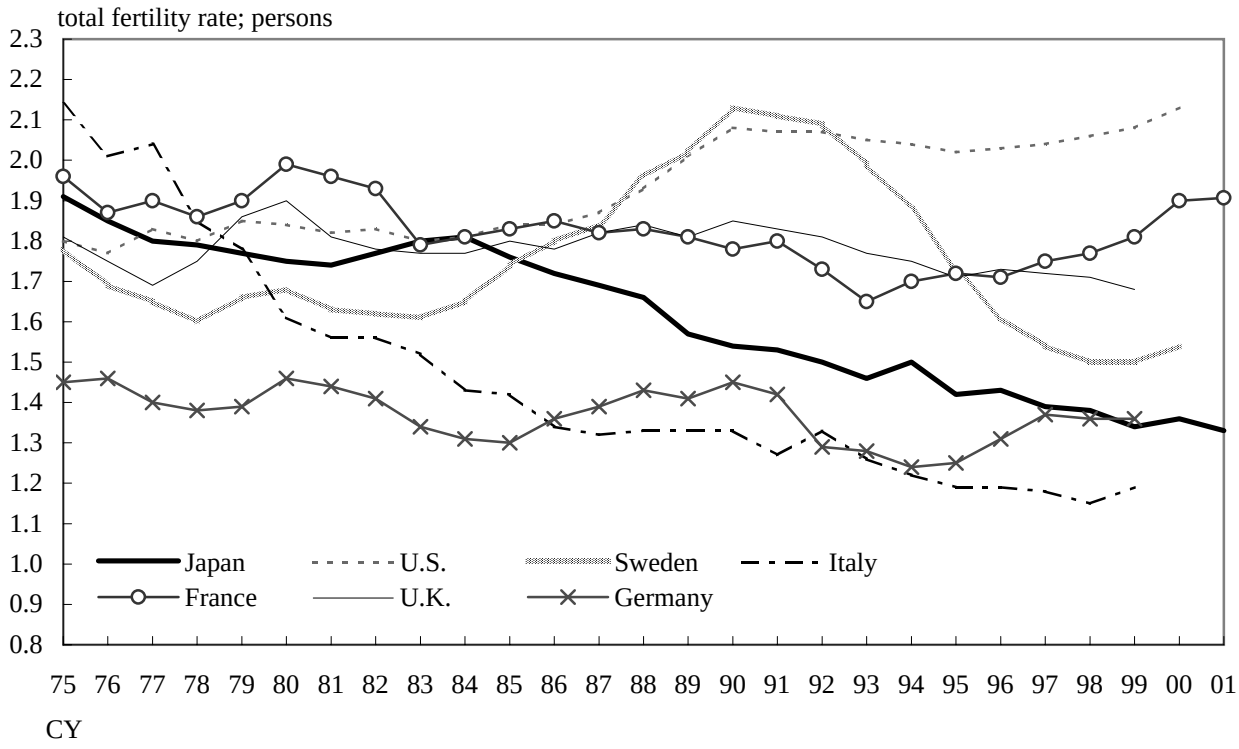
	Net immigration (10 thous. persons)	Population (10 thous. persons)	Net immigration / Population (%)
EU15	81.6	37,646	0.22
Japan	3.8	12,693	0.03
United States	66.0	27,537	0.24

Notes: 1. Data indicate changes throughout 2001.
EUR11: Austria (AT), Belgium (BE), Finland (FI), France (FR), Germany (DE), Ireland (IE), Italy (IT), Luxembourg (LU), Holland (NL), Portugal (PO), Spain (ES)
EU15: EUR11 + Greece (GR), United Kingdom (UK), Sweden (SE), Denmark (DK)
2. Data for immigration are of 2000, excluding the U.S. (1998 data).
3. Data for the U.S. are based on the gross number of immigrants.

Sources: Eurostat, United Nations, Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Population Estimates."

Chart 57

Fertility Rates in Europe and the U.S.



Source: National Institute of Population and Social Security Research, "The Developments in Population, Japan and the World, Statistics on Population 2001-2002" in Japanese.

Fertility Rate in Sweden

(1) Details of childcare leave allowance

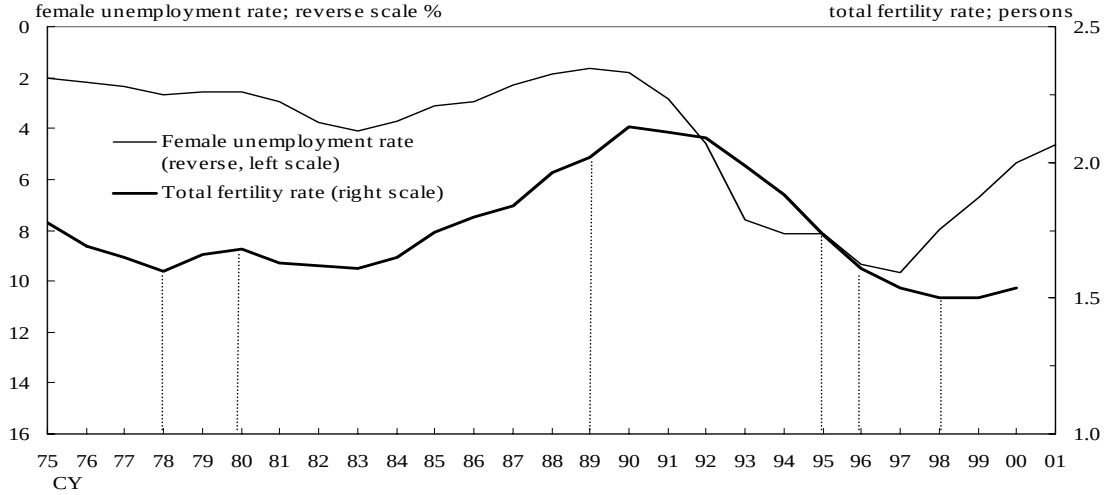
Characteristics of family benefits in Sweden

Moving in tandem with income: Apparent link with the income level; Must have a regular job prior to child-bearing in order to receive full benefits.
Receiving benefits for a long period: Can receive benefits by dividing them on a long term basis until the child turns 8 years old.
Speed premium: With a short spacing of births, parents can hold the same allowance condition for the following child.

Parental Insurance

Prerequisite	Parents with children
Birth by order	From the first birth
Allowance level and duration	- 450 days - 80% of income * 360 days + 60 kronor (about 780 yen) * 90 days - Non-working parents are entitled only to the latter amount. - Parents can choose to work flexibly out of the following four: 8 hrs full time, 3/4 of a day (6 hrs), half a day (4 hrs), and 1/4 of a day (2 hrs); and the insurance benefits may be divided while working part-time. - One year can be divided into 3 terms at the most (parents can fully return to their former job or take a full leave of absence from work repeatedly)
Period	Until the child turns 8 years old.
Speed premium	By giving birth to the next child within 2.5 years from the previous child, parents can receive the parental insurance based on the same condition as that of the previous child. Hence, if they do not give birth to the next child within this period, they would need to work for a certain period to obtain equivalent income in order to get the same right again.

(2) Developments in the total fertility rate



Allowance level

1978	90% *	8 months + fixed rate * 1 month
80	90% *	9 months + fixed rate * 3 months
89	90% *	12 months + fixed rate * 3 months
95	80% *	12 months + fixed rate * 3 months
96	75% *	12 months + fixed rate * 3 months
98	80% *	12 months + fixed rate * 3 months

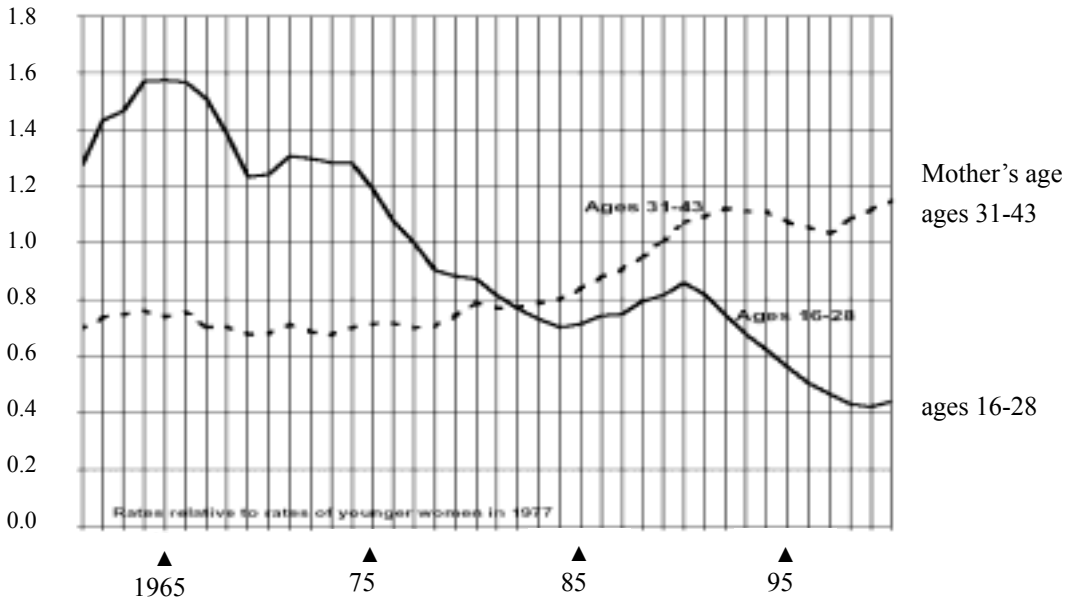
Speed premium period

1974-79	12-18 months
80-85	24 months
86	30 months

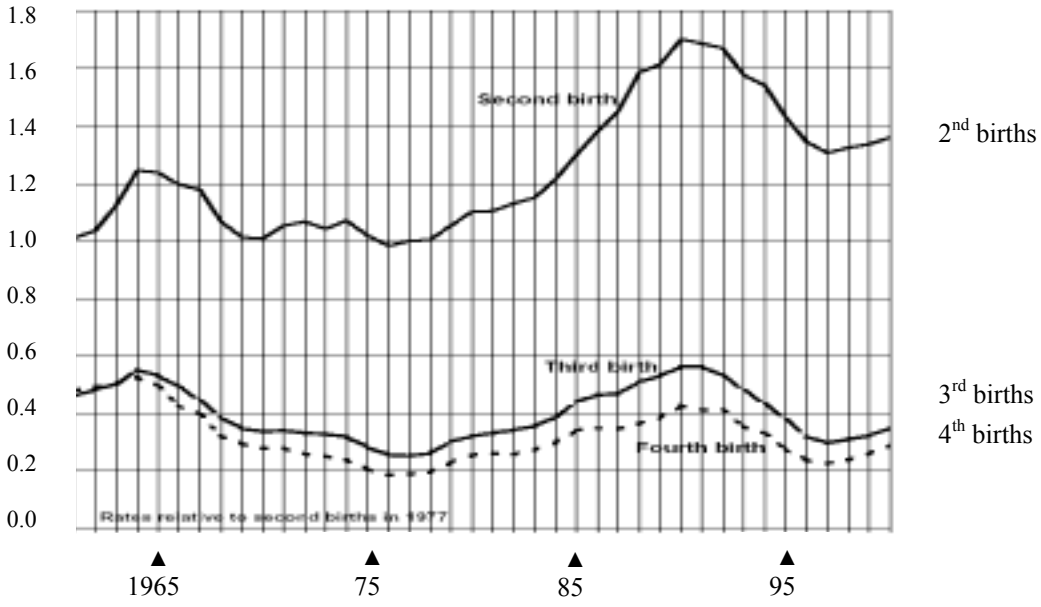
Note: Vertical lines show the years when there was a system reform in the childcare leave allowance.

Fertility Rate in Sweden: Details

First-birth rates



Second-, third-, and fourth-birth rates



Average interval between births

Year	1st →2nd
1974	35 months
82	32 months
91	29 months

Ratio of students among women in their 20s

	1989	1996
Ages 21-24	14.1%	40.7%
Ages 25-28	9.1%	21.7%

Note: First birth rates are shown as relative levels to the total fertility rate of mothers aged 16-28 in 1977 standardized to 1. Second, third, and fourth birth rates are indexed to the second-birth rate in 1977.

Sources: Andersson et al. (2001), etc.

Fertility Rate in France

(1) Details of childcare leave allowance

Characteristics of family benefits in France

France gives great benefits to families with many children.
From 1995, the coverage of APE (Allocation parentale d'education) has been expanded allowing the 2nd child and also part-time work. Until 1994, it had been allowed only from the 3rd child and working was prohibited.

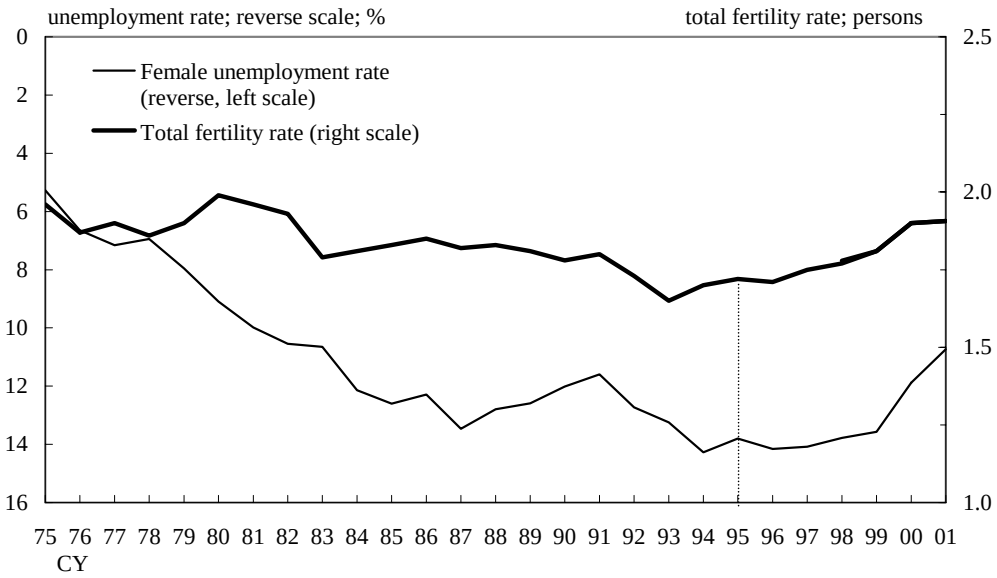
Parent allowance (APE)

Prerequisite	Either of the parents who have worked for 2 years and over in the past 5 years.
Birth by order	From the 2nd child.
Allowance level	Monthly allowance Stopped working 3,060.62 franc (about 49,600 yen) Working 50 % or lower 2,038.37 franc (about 33,000 yen) Working 50-80 % 1,530.31 franc (about 24,800 yen)
Period	Until the child turns 3 years old.

Family allowance (AF: allocation familiales)

Prerequisite	All households with 2 or more children.
Allowance level	No. of children — Monthly allowance 1 child — 0.00 franc 2 children — 686.55 franc (about 11,000 yen) 3 children — 1,567.13 franc (about 25,400 yen) 4 children — 2,447.70 franc (about 39,600 yen) Additional per child from 5 children — 880.58 franc (about 14,300 yen)

(2) Developments in the total fertility rate



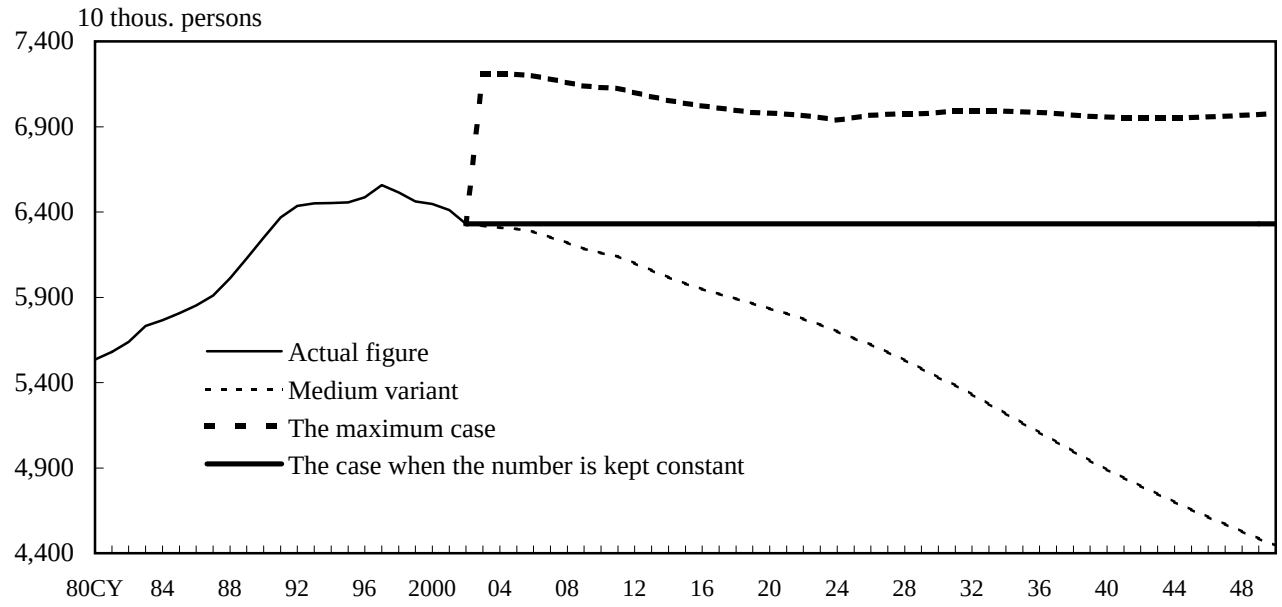
Note: The vertical line shows the year when there was a system reform in the childcare leave allowance.

Source: (for charts 58-60) OECD "Labour Force Statistics"; National Institute of Population and Social Security Research, "The Developments in Population, Japan and the World, Statistics on Population 2001-2002" in Japanese.

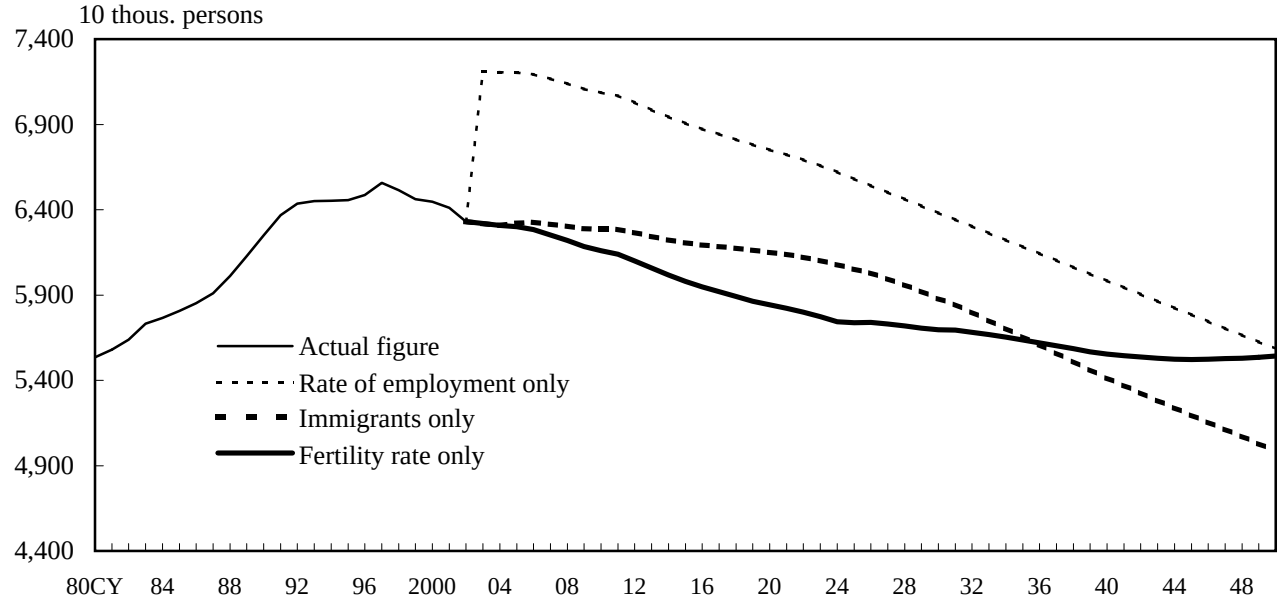
Chart 61

The Number of those in Employment when Preconditions are Changed

(1) Number of those in employment with multiple conditions



(2) Number of those in employment with single condition

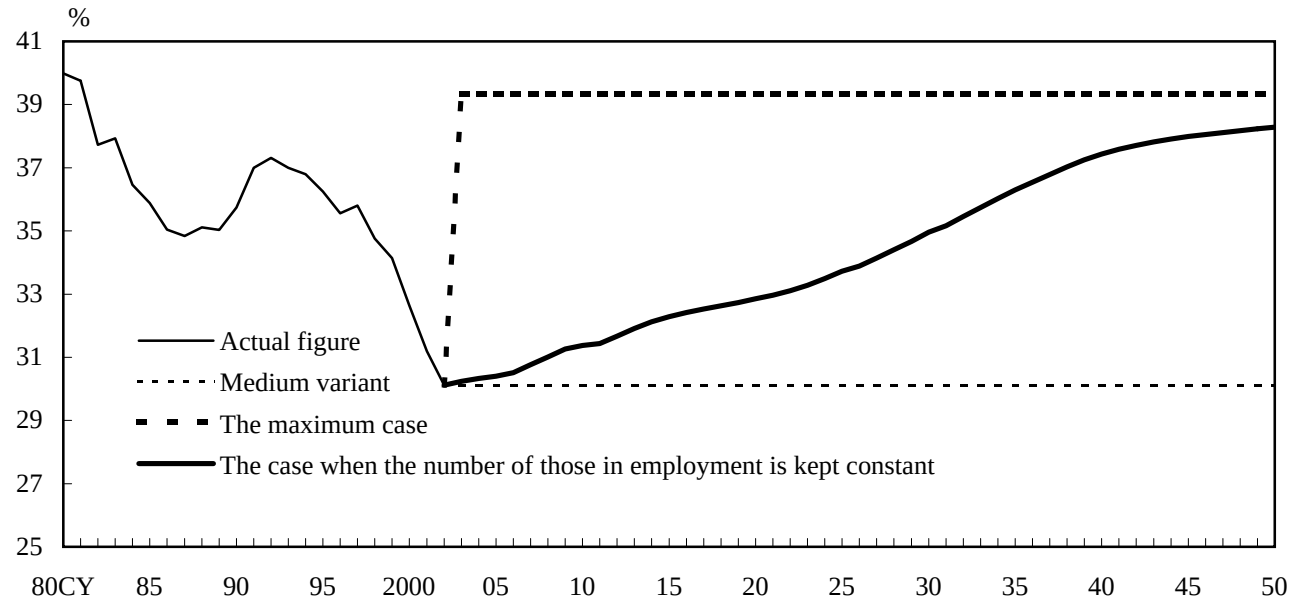


Sources: National Institute of Population and Social Security Research, "Population Projection for Japan," etc.

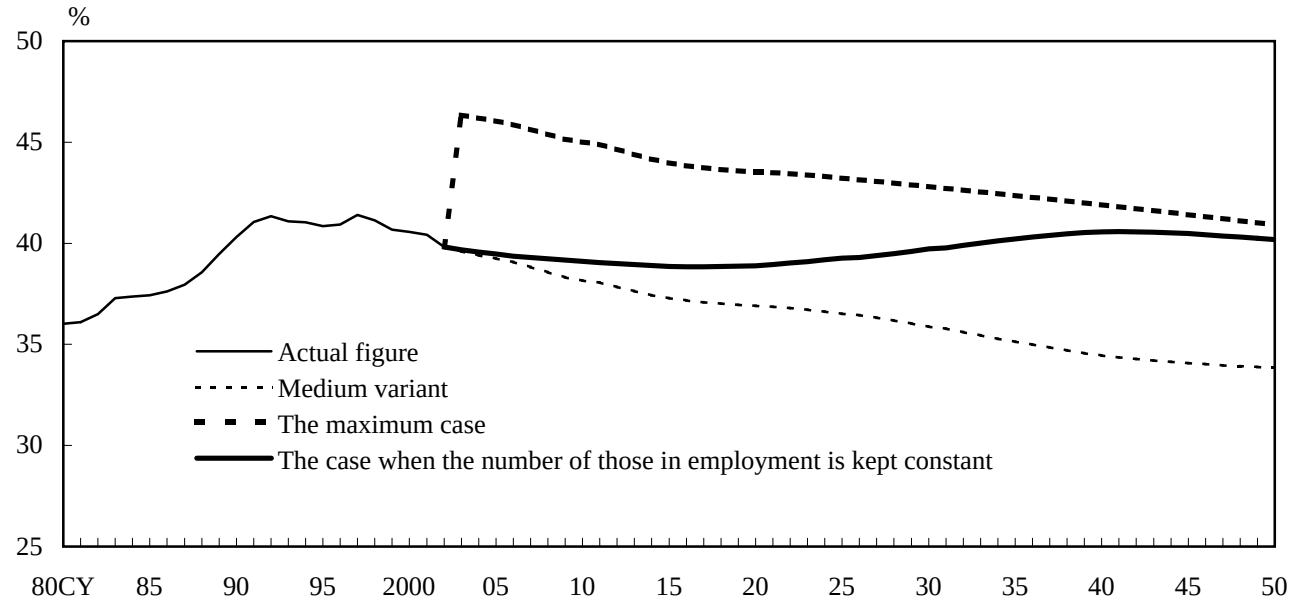
Chart 62

Precondition for Neutralization (1)

(1) Rate of employment for men; 65 years old and over



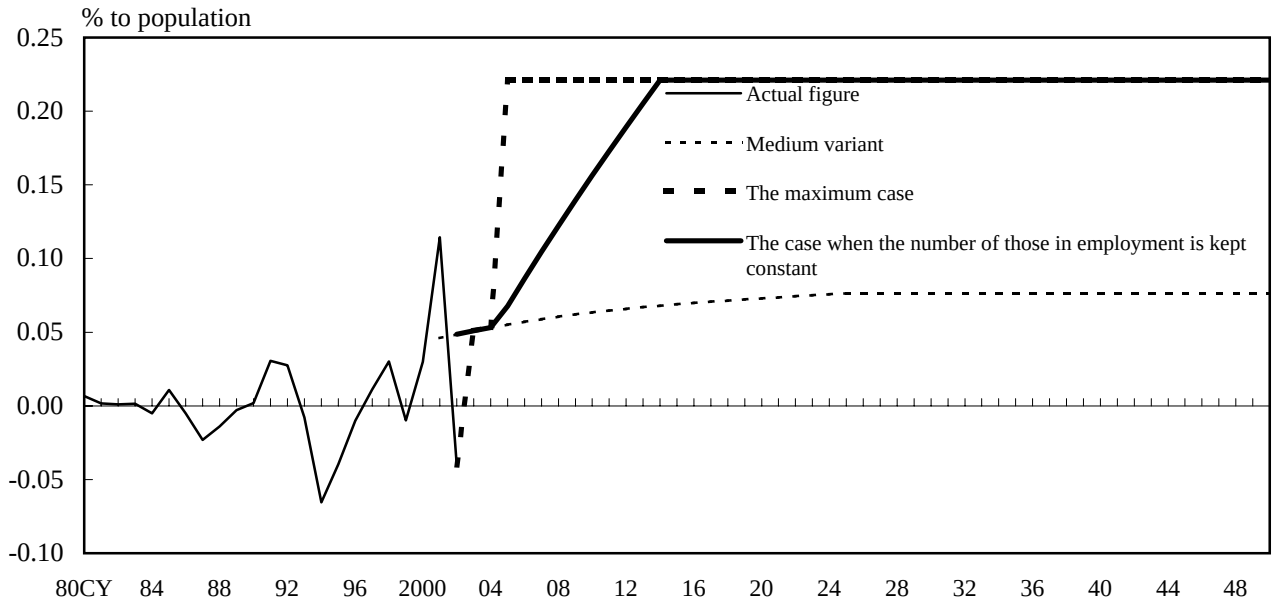
(2) Rate of women in employment



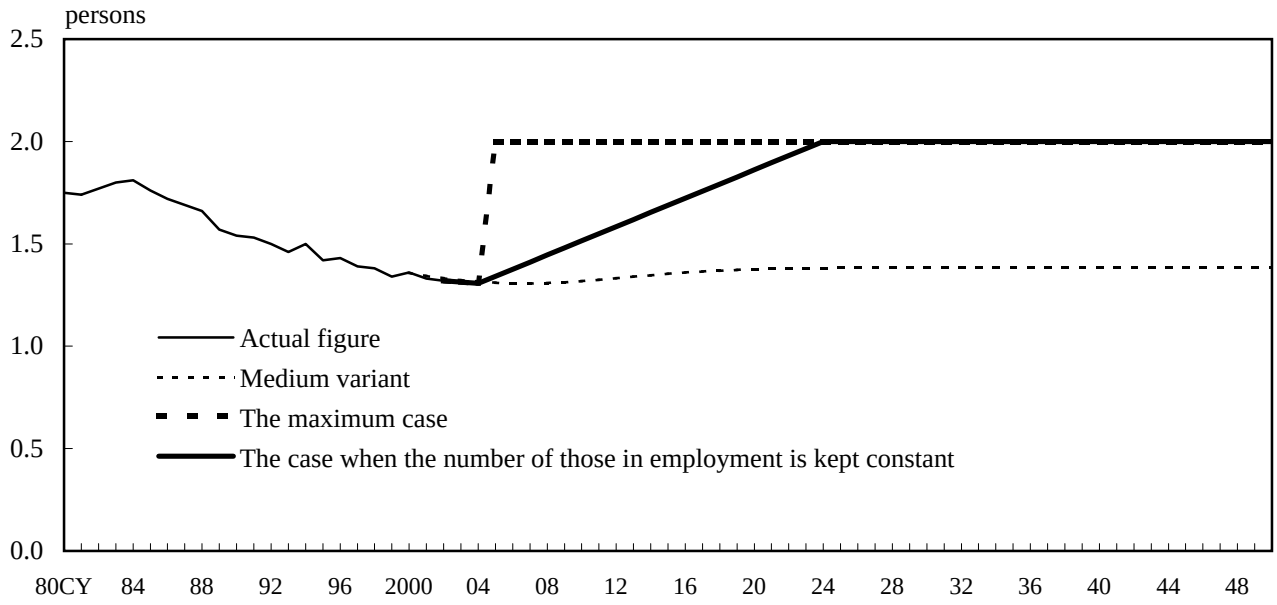
Sources: National Institute of Population and Social Security Research, "Population Projection for Japan," etc.

Precondition for Neutralization (2)

(3) Rate of immigrants allowed



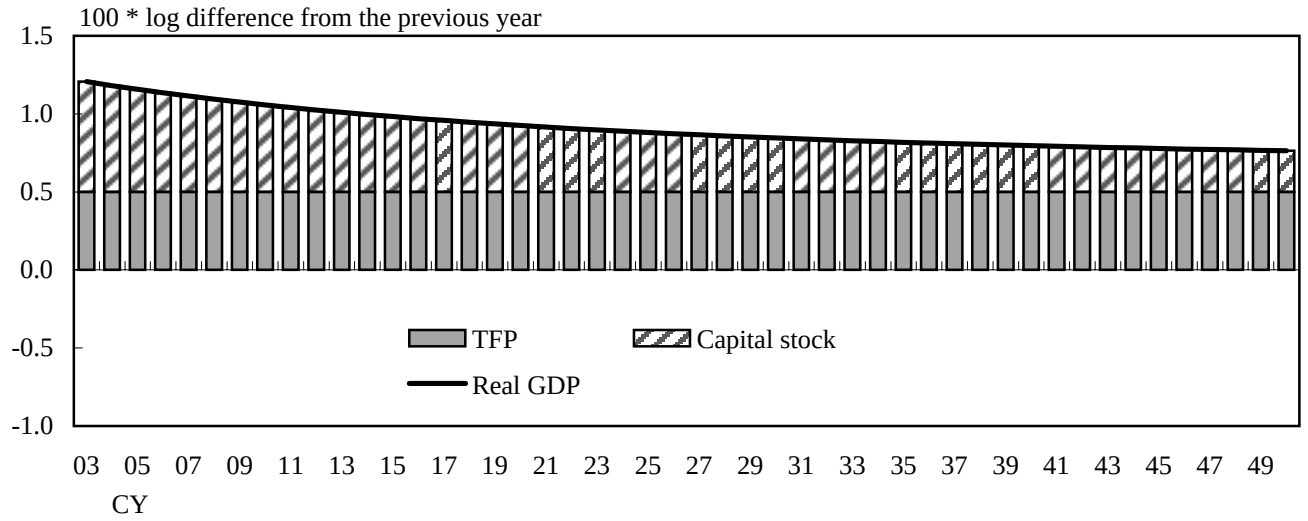
(4) Total fertility rate



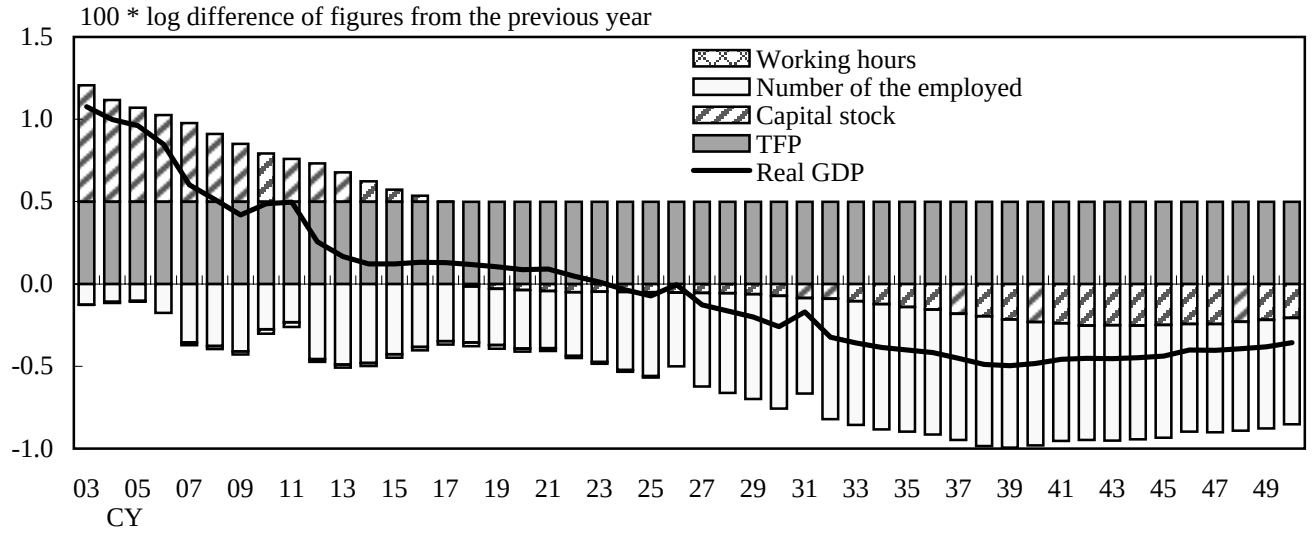
Sources: National Institute of Population and Social Security Research, "Population Projection for Japan," etc.

Simulation of Economic Growth

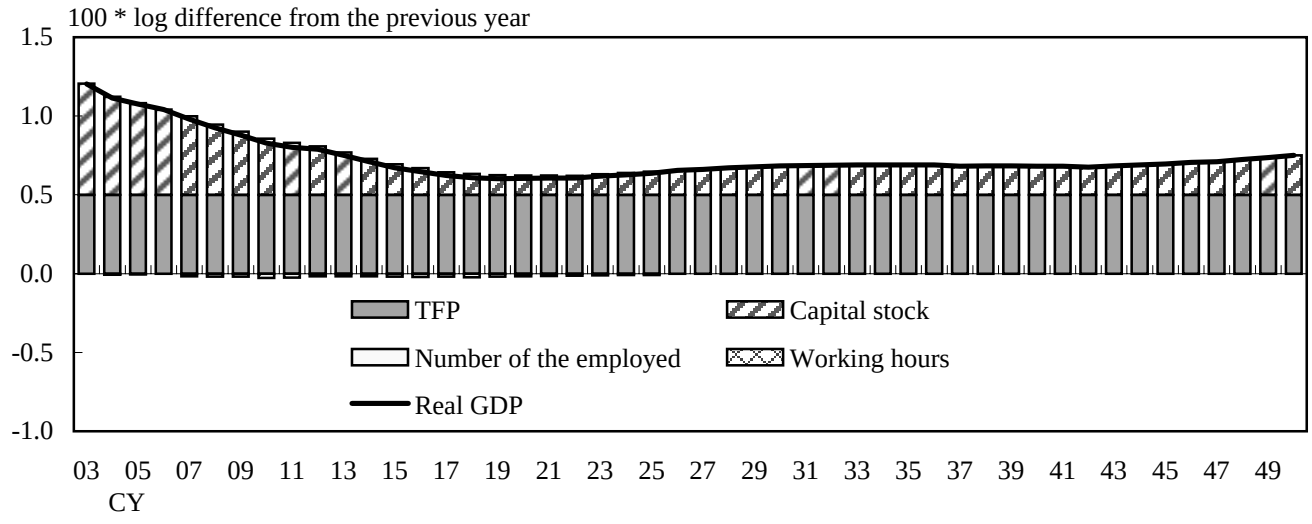
(1) No changes in population



(2) The case with demographic changes



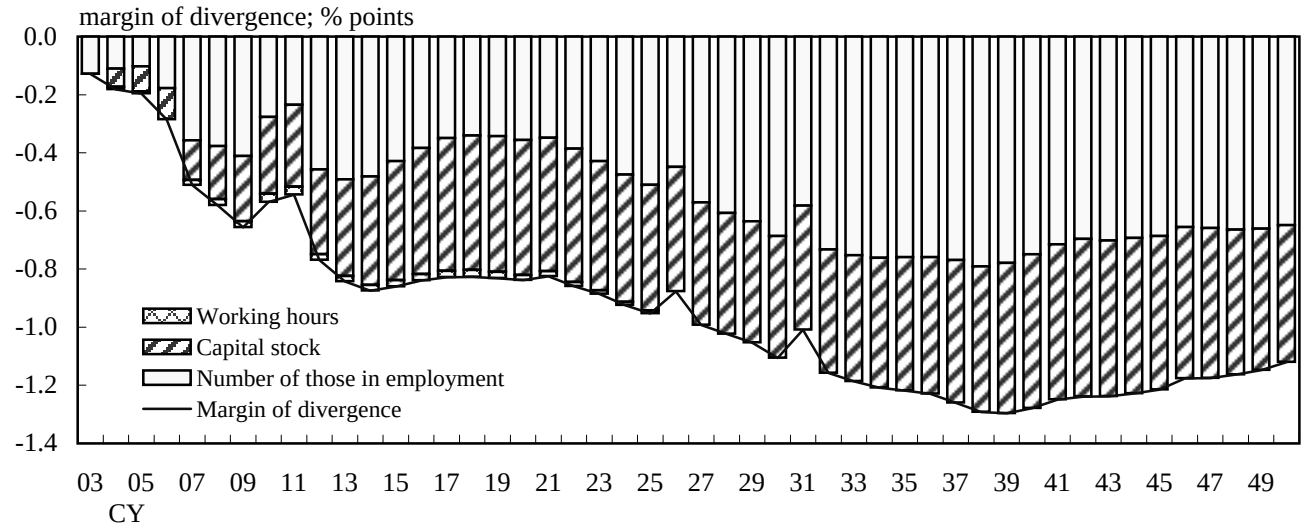
(3) Neutralizing case



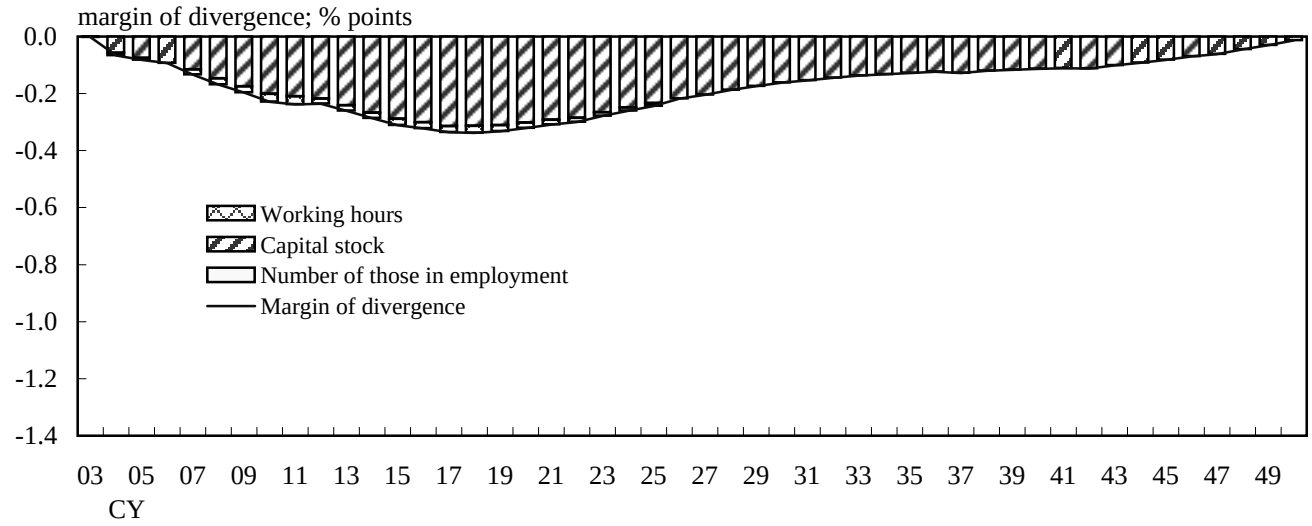
Sources: National Institute of Population and Social Security Research, "Population Projection for Japan," etc.

Margin of Divergence among the Three Cases

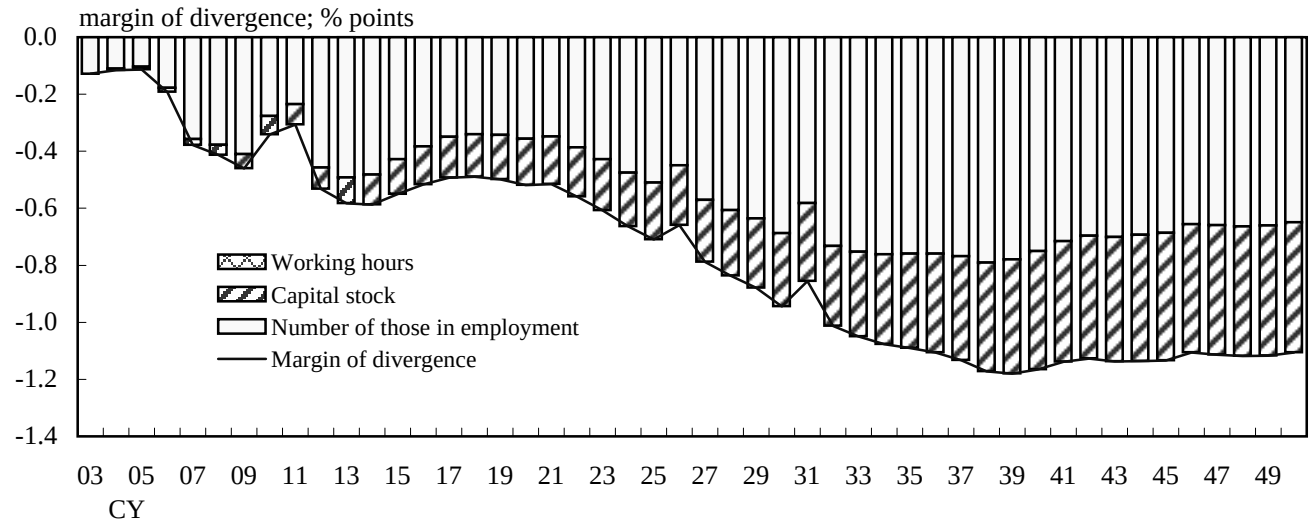
(1) "The case with demographic changes" minus "No changes in population"



(2) "Neutralizing case" minus "No changes in population"



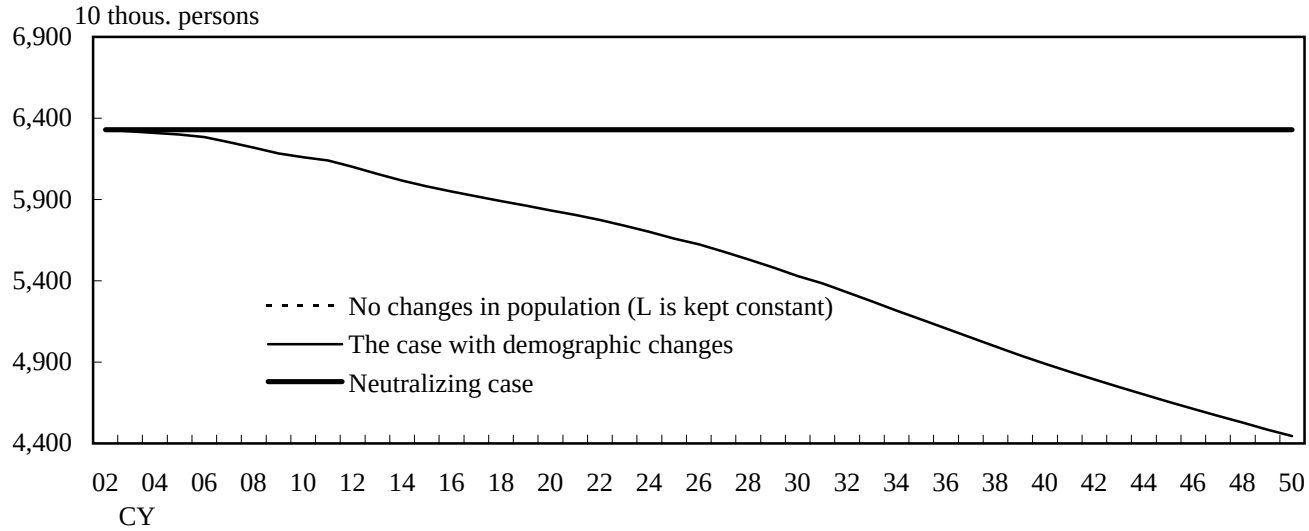
(3) "Neutralizing case" minus "The case with demographic changes"



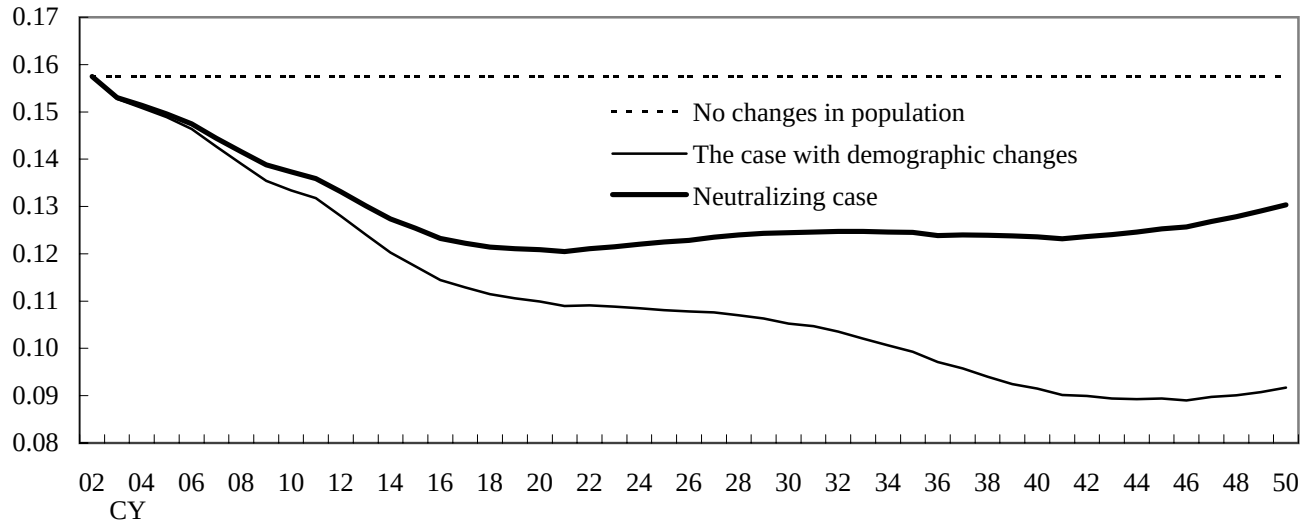
Sources: National Institute of Population and Social Security Research, "Population Projection for Japan," etc.

Outlook for Main Variables

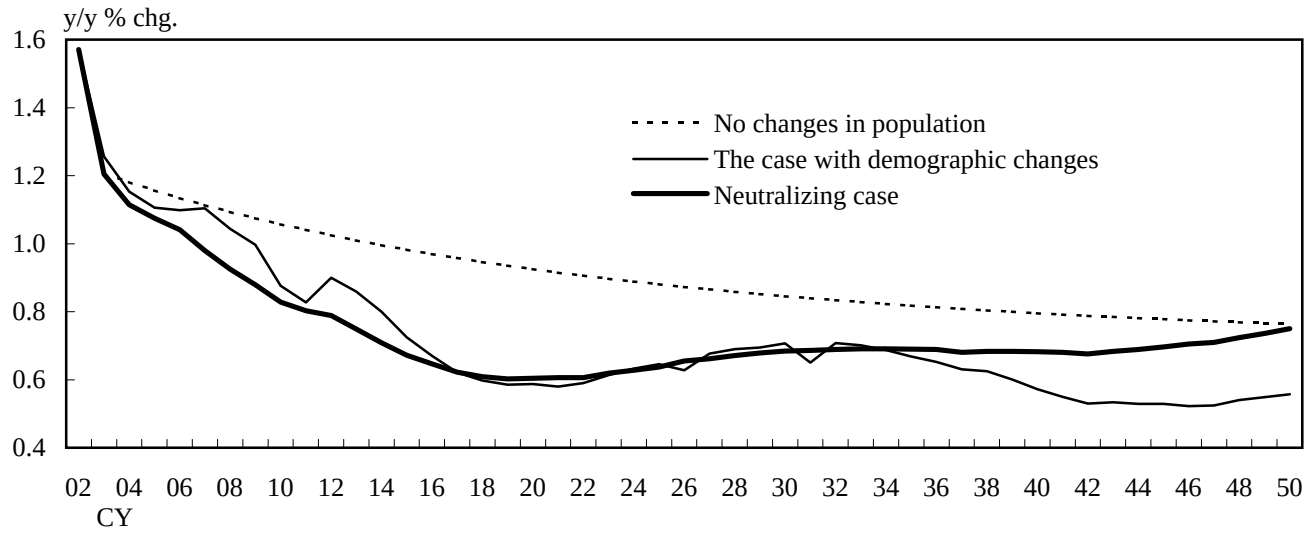
(1) Outlook for L: labor factor



(2) Outlook for s=I/Y: social security and households' saving rate factors



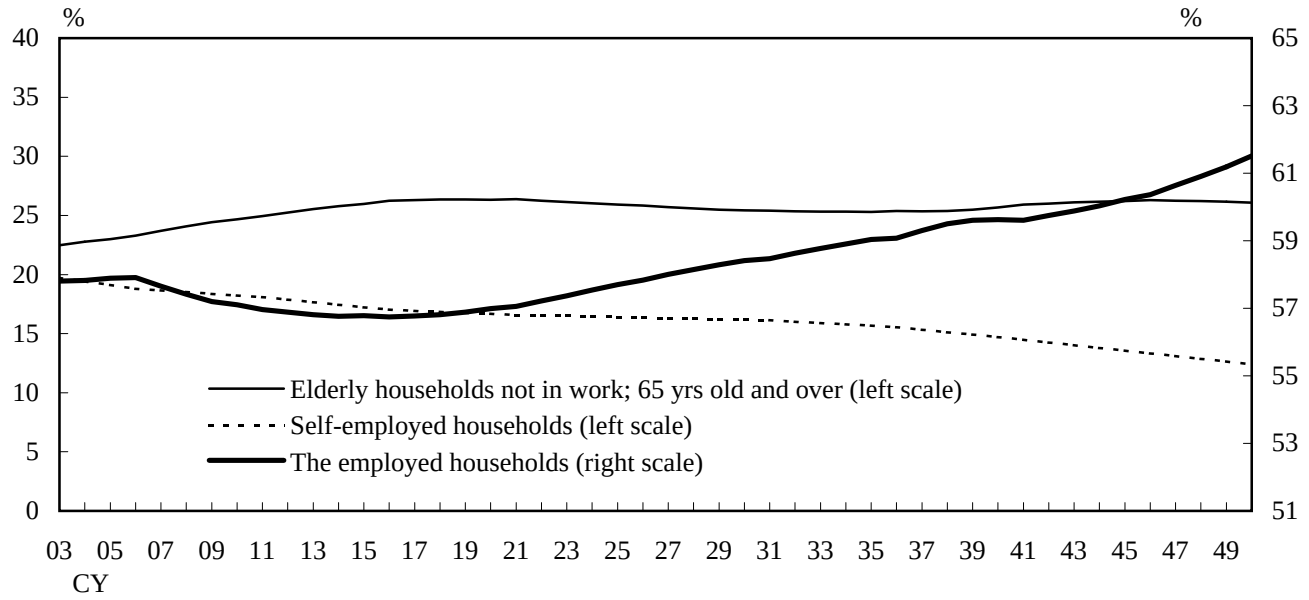
(3) GDP growth rate per worker



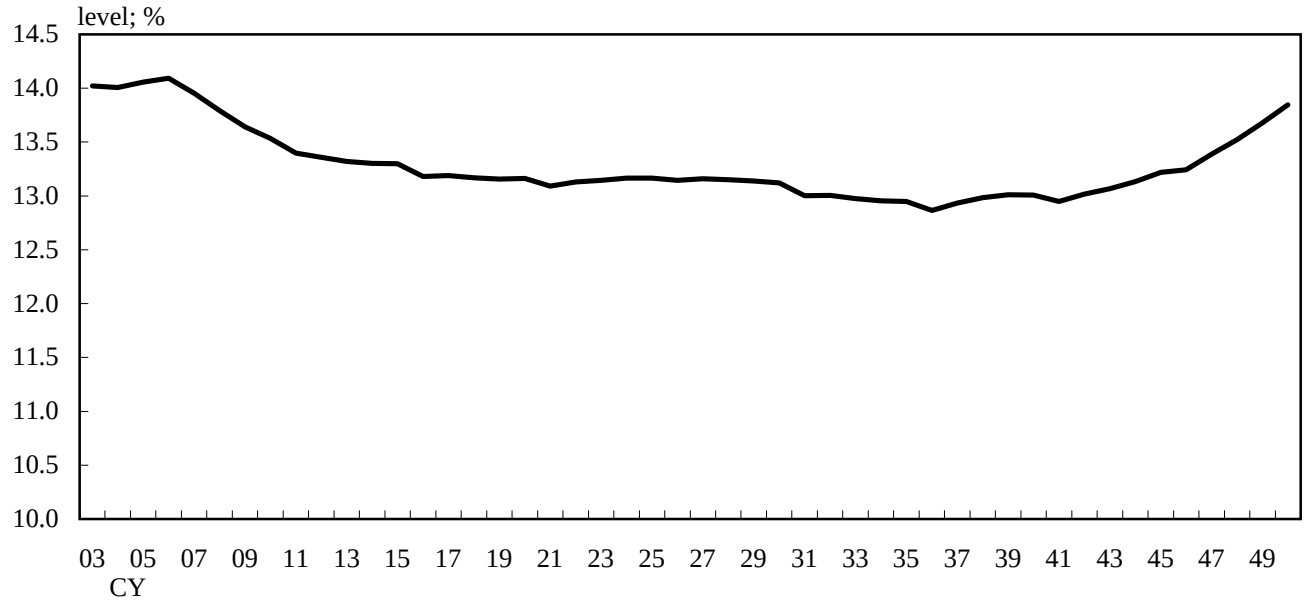
Sources: National Institute of Population and Social Security Research, "Population Projection for Japan," etc.

Households' Saving Rate in the Neutralizing Case

(1) Composition of households



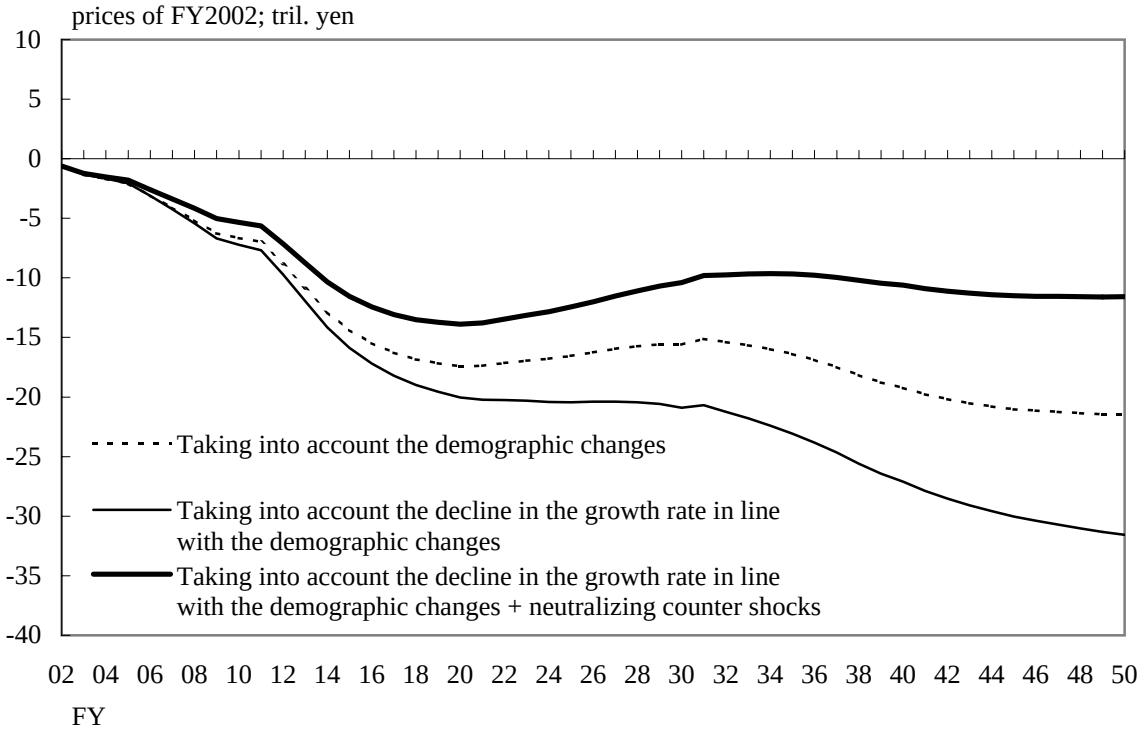
(2) Households' saving rate; excluding imputed rent



Sources: National Institute of Population and Social Security Research, "Population Projection for Japan," etc.

Neutralizing Case: Gap Between Pension Benefits and Contributions

Premium rates are flat

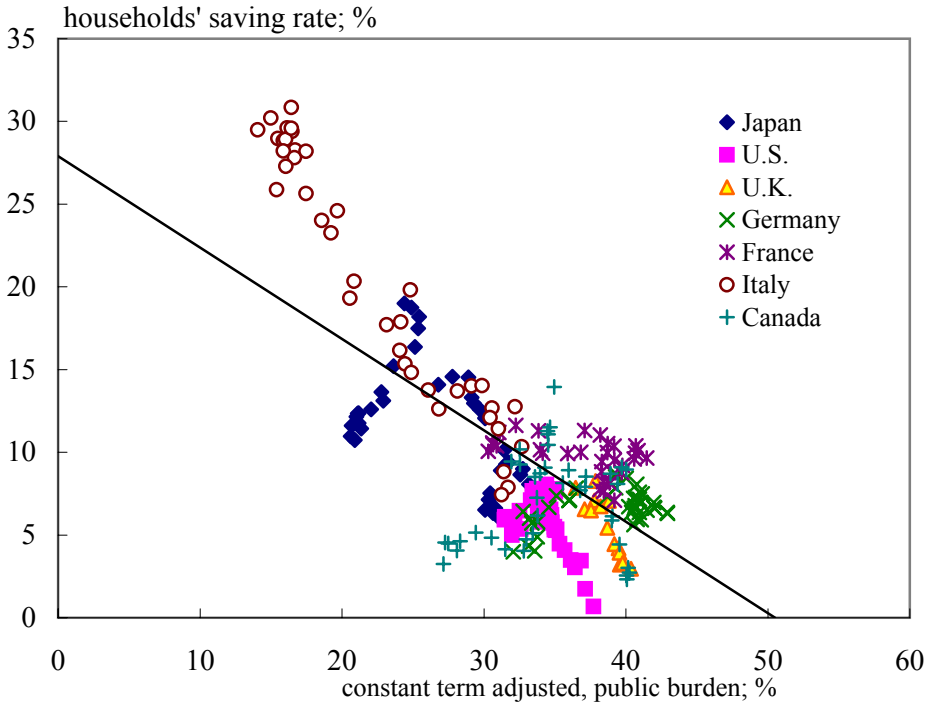


Notes: 1. Evaluated based on prices of FY2002.

2. "Taking into account the decline in the growth rate in line with the demographic changes" reflects the real growth rate obtained from the simulation of economic growth instead of using the assumption by Ministry of Health, Labour and Welfare.

3. As for "taking into account the decline in the growth rate in line with the demographic changes + neutralizing counter shocks," the rate of employment and the fertility rate are raised and immigrants are accepted so that the number of those in employment remain constant.

Relationship Between the Public Burden and Households' Saving Rates: G7



Public burden = (direct tax + indirect tax + social security contributions) / nominal GDP
Households' saving rate = households' savings / disposable income

Panel estimation 1: Households' saving rate = constant + β * public burden

Level

	Pooling	**Fixed effect**	Random effect
β	-0.18**	-0.55**	-0.54*
Adj.R^2	0.04	0.77	0.77
D.W.	0.02	0.11	0.10
Obs.	248	248	248

1st difference

	Pooling	Fixed effect	Random effect
β	-0.21**	-0.19**	-0.20*
Adj.R^2	0.02	0.04	0.04
D.W.	1.71	1.79	1.75
Obs.	241	241	241

Panel estimation 2: Households' saving rate (indirect tax deducted from disposable income) = constant + β * public burden

Level

	Pooling	Fixed effect	**Random effect**
β	-0.14**	-0.59**	-0.58**
Adj.R^2	0.02	0.77	0.77
D.W.	0.02	0.11	0.11
Obs.	248	248	248

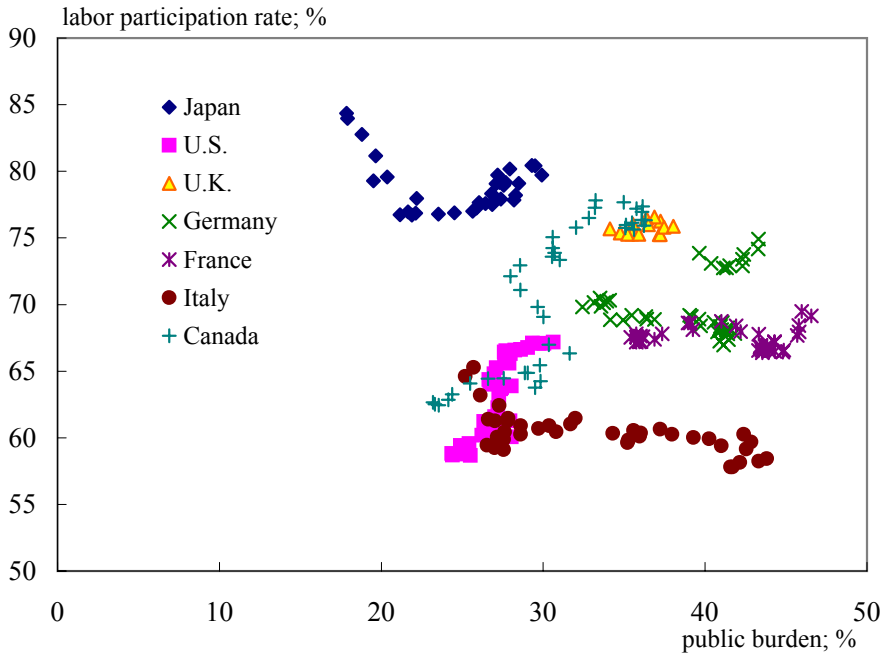
1st difference

	Pooling	Fixed effect	Random effect
β	-0.19*	-0.17	-0.18*
Adj.R^2	0.01	0.03	0.03
D.W.	1.69	1.76	1.72
Obs.	241	241	241

Notes: 1. Sample period: 1961-2000, unbalanced.
2. The level of significance is indicated as ** for 1 percent and * for 5 percent.
3. "Pooling" in bold shows that the OLS of the pooled data was chosen over the fixed effect model, as a result of the F-test. "Fixed effect" and "random effect" in bold indicate that each model was chosen as a result of the Hausman test.
4. The graph is based on the panel estimation 1 above (Level).

Source: OECD, "Economic Outlook."

Relationship Between the Public Burden and Labor Participation Rate: G7



Public burden: (direct tax + indirect tax + social security contributions) / nominal GDP
Labor participation rate: labor force / 15-64 year old population

Panel estimation: Labor participation rate (1st difference) = constant + β * national contribution ratio (1st difference)

Total men and women:

	Pooling	Fixed effect	**Random effect**
β	-0.03	-0.02	-0.03
Adj.R^2	-0.02	0.06	0.07
D.W.	1.31	1.44	1.41
Obs.	239	239	239

Men:

	Pooling	Fixed effect	**Random effect**
β	0.01	0.01	0.01
Adj.R^2	-0.00	0.05	0.06
D.W.	1.62	1.76	1.72
Obs.	214	214	214

Women:

	Pooling	Fixed effect	**Random effect**
β	0.03	0.03	0.03
Adj.R^2	-0.00	0.04	0.05
D.W.	1.74	1.88	1.85
Obs.	214	214	214

Notes: 1. Sample period: 1961-2000, unbalanced.
2. The level of significance is indicated as ** for 1 percent and * for 5 percent (figures without an asterisk mean no significance).
3. "Random effect" in bold shows that the random effect model was chosen over fixed effect model as a result of the Hausman test.
4. The graph is based on the level of total men and women.

Source: OECD, "Economic Outlook."