# Population Decrease, Aging, and Japan's Long-Term Economic Outlook to 2050

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## Introduction

With Japan's population projected to decline and age until 2050, this paper examines how the macroeconomy will change in the context of the open economy. We present a baseline scenario for the economy, focusing on economic growth and the current account surplus.

That Japan's population will start to decline in the near future is a certainty. This poses serious problems for today's social and economic systems. Since most of them are implicitly conditioned on the sustained expansion of the population and economy, they may not function as effectively under a shrinking population and economy. Similarly, present corporate behavior patterns and individual values and attitudes, formed during an era of positive growth, will all need to adapt to the new era of negative growth, or even replaced.

To be sure, a declining population does not necessarily entail negative economic growth. Productivity growth can still boost GDP per capita, and if large enough, even overcome the effect of population decline.

In principle, by skillfully manipulating social policies, it is possible to boost the birth rate and slow the rate of population decline. In the sense that the future holds many possibilities, we need not summarily dismiss the possibility of averting population growth and the associated economic consequences.

But at the same time, the future is connected to both past and present. Modest changes in the birth rate will not immediately affect population trends; birth rate trends over the next two decades will not directly impact the labor force (persons at least age 15, and mostly those age 20 and above) nor real GDP growth rates. What will determine the number of new graduates entering the labor force in the next two decades is the birth rate during the previous two decades—which is why the labor supply's decline is unavoidable. Of course, the growing labor supply of women and elderly persons, growth in IT-related capital stock, and productivity improvements can help boost the economy's potential growth rate in the future. Nonetheless, these factors are not isolated from the present capital stock level, or from income and productivity levels relative to the rest of the world. In addition, economic factors are affected in varying degrees by population decline and aging.

When considering the reforms and innovations needed to build a better future, we should not assume that desired reforms and convenient conditions will occur naturally. We must not intentionally make optimistic expectations that would rule out the need for fundamental reforms, nor harbor overly pessimistic expectations that are unfounded. Our discussion should start by objectively determining how the economy, given its built-in autonomous mechanisms, will transform as the population declines under the present social system.

This paper focus specifically on the effects of population decline and aging, the possibility for capital stock growth, and Japan's interrelationship with foreign economies in the context of the open economy. After describing trends in the population and labor force, we consider their effect on the savings rate and capital stock accumulation, and present an outlook for economic growth over the next 50 years.

## 1. Demographic Trends in the World—History and Projections

### (1) Population Decline Due to Aging is Unprecedented

Population levels represent the most fundamental indicator of scale for societies and economies. The modern census can be traced back to Western Europe when England underwent an industrial revolution from 1760 to 1830. Until then, population growth and economic growth were not sustained in nature, but instead occurred sporadically whenever the level of cultivated land increased or new agricultural methods were discovered. From the first century AD to the mid 18$^{th}$ century, the world's population grew at an annual rate of approximately 0.1%. Occasionally, the population declined in countries due to famine, pestilence and war.

Pre-modern society, which depended entirely on land and labor, eventually transformed into modern society, where the widespread use and production of machinery made it possible to accumulate capital stock and grow productive capacity. Both the economy and population of modern societies have consistently grown ever since. After World War II, as international cooperation grew on both political and economic fronts and ushered in an era of peace, a population explosion occurred in many countries. As a result, the world's population, which stood at 2.5 billion in 1950, more than doubled in the next 50 years to 6.1 billion by 2000.

**Figure 1 Global Population Growth Through History**

| Year | Estimated population (millions) | Annual growth rate (%) |
|---|---|---|
| B.C. 7000～600 | 5～10 | |
| 1 A.D. | 200～400 | 0.0 |
| 1650 | 470～545 | 0.0 |
| 1750 | 629～961 | 0.4 |
| 1800 | 813～1,125 | 0.4 |
| 1850 | 1,128～1,402 | 0.5 |
| 1900 | 1,550～1,762 | 0.5 |
| 1950 | 2,521 | 0.8 |
| 1955 | 2,755 | 1.8 |
| 1960 | 3,022 | 1.9 |
| 1970 | 3,696 | 2.1 |
| 1980 | 4,440 | 1.7 |
| 1990 | 5,266 | 1.7 |
| 2000 | 6,055 | 1.3 |

Source: National Institute of Population and Social Security Research, *Selected Demographic Indicators for Japan (2000)*.

The history of population growth also reached a turning point. In Japan and industrialized countries in Europe, birth rates have persistently declined below the replacement level of the population in many countries. In the next 50 years, the populations of all industrialized countries are certain to decline.

Throughout history, populations have declined as the result of famine, pestilence, and war. With the exception of Hungary since the 1980s, no country, including those of Northern Europe, has ever experienced a sustained decline in population due to aging.[1] For Japan, the population decline will be the first one since a famine occurred in the 19th century.

### (2) Population Projections

According to the U.N.'s *World Population Prospects (The 2000 Revision)*, the world's population is projected to reach 9.3 billion in 2050 (medium variant). However, the population growth rate, which peaked in the 1970s at 2% per year, is currently 1.3%, and predicted to decline to 0.4% by 2050.

Although the projection reflects immigration flows, the total population of industrialized countries is predicted to peak in 2024.[2] Of these countries, the population will continue to grow until 2050 in the U.S., Canada, Australia, New Zealand and Ireland. Among the EU 15

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1 In Ireland, the potato famine of the mid 1800s triggered a mass emigration such that the population declined for almost one century. Also, Russia's population has continued to decline following the collapse of communism.

2 The report defines industrialized countries to include Europe, the U.S., Canada, Australia, New Zealand, and Japan.

countries, the population will start declining around 2009. In East Asian countries other than Japan, the population will start declining in Korea in 2037 and China in 2039.

According to the National Institute of Population and Social Security Research's *Population Projections for Japan: 2001-2050 (January 2002),* the medium variant projection calls for Japan's population to peak at 127.74 million in 2006, and subsequently decline 21% to 100.59 million in 2050. In the low variant projection, the population will peak at 127.48 million in 2004, and decline to 92.03 million in 2050.

**Figure 2 Population Projection for Japan and the World**

(Million)

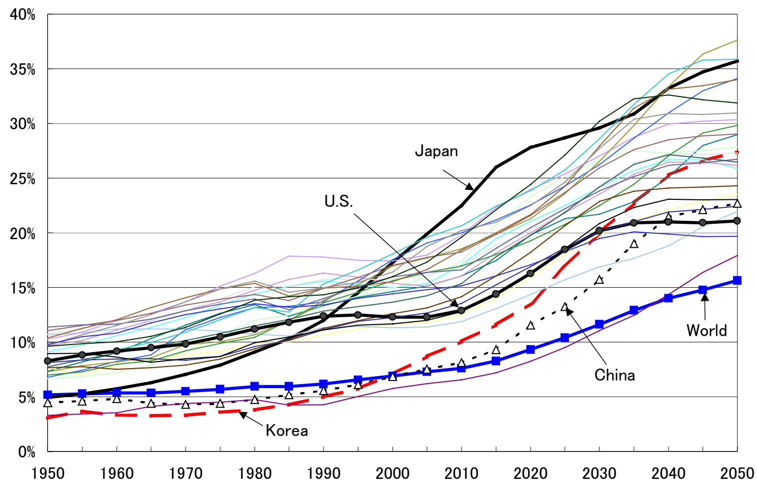
| Year | World | | Japan | |
|---|---|---|---|---|
| | Medium variant | Low variant | Medium variant | Low variant |
| 2000 | 6,056.71 | 6,056.71 | 126.93 | 126.93 |
| 2005 | 6,441.00 | 6,396.53 | 127.71 | 127.48 |
| 2010 | 6,825.74 | 6,702.33 | 127.47 | 126.67 |
| 2015 | 7,207.36 | 6,983.14 | 126.27 | 124.66 |
| 2020 | 7,579.28 | 7,241.11 | 124.11 | 121.61 |
| 2025 | 7,936.74 | 7,469.79 | 121.14 | 117.76 |
| 2030 | 8,270.06 | 7,650.94 | 117.58 | 113.30 |
| 2035 | 8,575.85 | 7,777.98 | 113.60 | 108.35 |
| 2040 | 8,854.66 | 7,854.66 | 109.34 | 103.03 |
| 2045 | 9,104.77 | 7,884.41 | 104.96 | 97.53 |
| 2050 | 9,322.25 | 7,866.07 | 100.59 | 92.03 |

Sources: U.N., *World Population Prospects: The 2000 Revision*; IPSS, *Population Projections for Japan (January 2002).*

The cause of the predicted population decline in industrialized countries is aging. The proportion of elderly persons (age 65 and over) in the world's population, which stood at only 6.9% in 2000, is predicted to reach 15.6% (medium variant) in 2050.

Until the mid 1980s, the proportion of elderly persons in Japan was low among industrialized countries. But as aging accelerated, the proportion shot up to 17.4% and became one of the highest. From around 2005 to 2030, Japan is predicted to have the highest percentage of elderly persons (age 65 and above) in the world. Japan will then continue to share the top position with Spain, Italy, and Switzerland, with a 35.7% proportion in 2050 (medium variant).

**Figure 3  Proportion of Persons Age 65 and Over (OECD & China)**




Sources: U.N., *World Population Prospects: The 2000 Revision*; IPSS, *Population Projections for Japan (January 2002).*

Moreover, aging is predicted to advance in Korea and China, both of whom are currently at the world's average level of 7% in 2000. Compared to Japan, whose elderly proportion doubled from 7% to 14% in the record time of 24 years, Korea's elderly proportion is predicted to double in 21 years, and China's in 26 years. In 2050, Korea will reach 27.4%, close to Europe's 29.2%. China will surpass the U.S. in 2039, and reach 22.7% in 2050. Meanwhile, the U.S. will have the lowest proportion among industrialized nations at 21.1%.

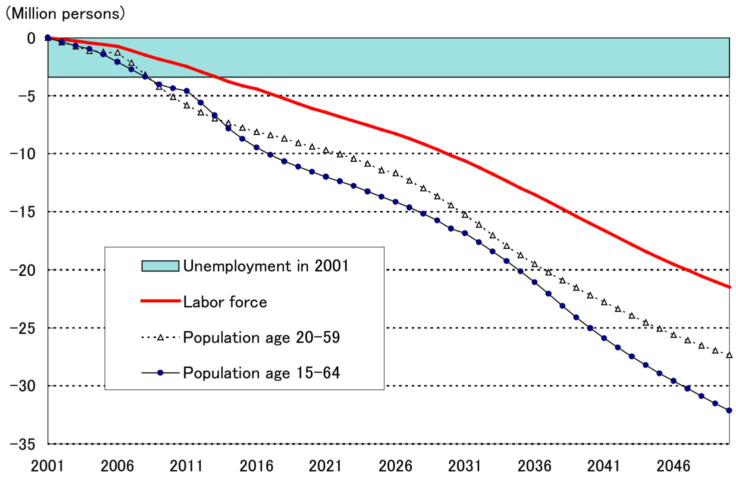
As we have seen, over the next 50 years, population decline and aging will progress not only in Japan but in Europe and East Asia. However, the extent and timing of the trends will vary considerably. In Japan, these trends will occur sooner and more rapidly than elsewhere, resulting in a substantial increase in the proportion of elderly persons.

After 2050, while Japan's population will continue declining, the elderly proportion will peak at 36.0% (medium variant) in 2055, and subsequently decrease to 32.5% in 2100. Thus the coming 50 years will truly be an ordeal for Japan as the population simultaneously declines and grows older.

### (3) Structure of Labor Force Participation Rate by Age Group

The IPSS projection also makes demographic projections by sex and age. Since the labor force participation rate and employment rate (employed and self-employed persons as a percentage of the population) differ by age group, a decline in core age groups of the labor force implies that the labor force and number of employed persons (including self-employed) will inevitably decline.

**Figure 4　Decline in Potential Labor Force (Difference from 2001)**

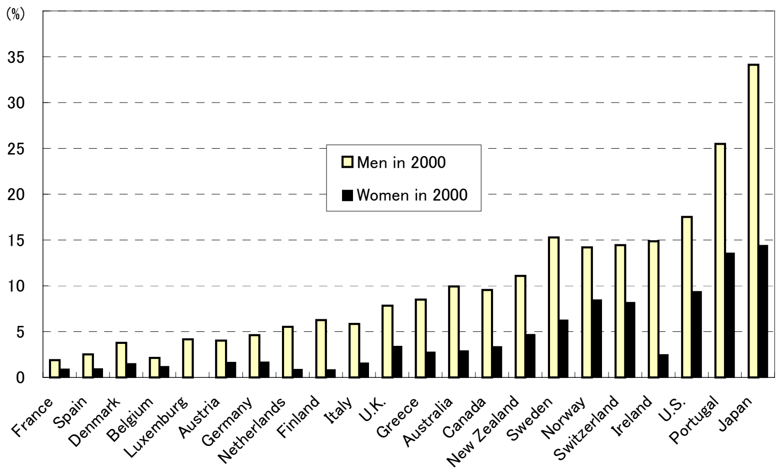



Source: IPSS, *Population Projections for Japan (January 2002)*.

Given the present 5% unemployment rate and 3.4 million unemployed persons in 2001, a labor shortage may be difficult to imagine. The main segment of the labor force (population age 20 to 59) is projected to decrease by 5.83 persons in the decade leading to 2011. Assuming that the participation rate remains unchanged by sex and age, this represents a labor force decrease of 2.49 million. Thus even if weak labor demand and mismatching problems persist, our calculation indicates that a considerable number of unemployed persons will be absorbed. Since mismatching problems will become less visible once the labor shortage emerges, it is important to address them now and create an environment with many diverse supply routes.

An international comparison of labor force participation rates by sex and age reveals some interesting characteristics for Japan. One is the exceptionally high participation rate among persons age 65 and over including self-employed persons.

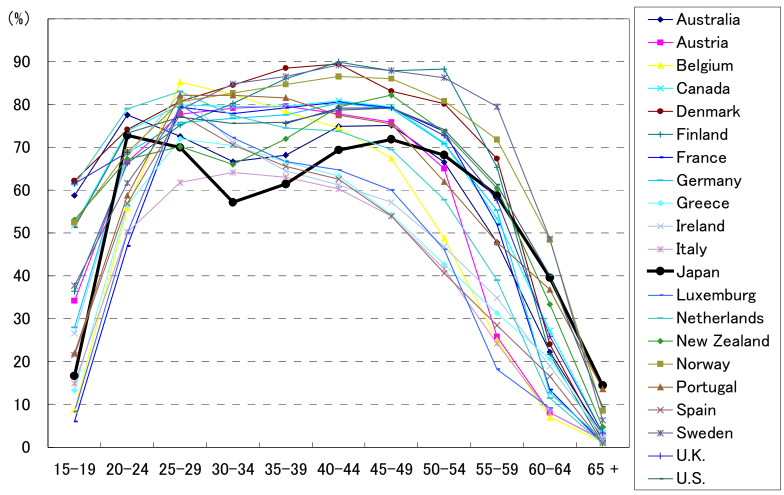
**Figure 5 International Comparison of Labor Force Participation Rates (Age 65+)**




Source: Compiled from OECD, *Labour Market Statistics*.

Another characteristic is that the participation rate of women dips during childbirth and child raising years, creating a so-called M-shaped curve. In 2000, participation rates for the age 25-29 and 30-34 segments were 72.7% and 69.9% for Japan, which are 8.3% and 25.4% lower respectively than for the three Northern European countries. Even so, Japan's rates have risen 8.5% and 5.5% respectively compared to the 1990s. Moreover, Japan's rate is 7.1% higher in the age 20-24 segment.

**Figure 6 Labor Force Participation Rate of Women by Age Group (2000)**




Source: Compiled from OECD, *Labour Market Statistics*.

From the perspective of equity and efficiency, creating a social environment that encourages both work and childbirth for women, and relieving women of sole responsibility in raising children are worthy goals in and of themselves.

As far as the effect on labor supply is concerned, boosting the women's participation rate during childbirth and child raising years will have a limited effect at best. Moreover, since the relevant age groups are shrinking in size, a significant increase in the labor force cannot be expected. Assuming that present participation rates by sex and age remain unchanged, the labor force will decline the sharpest in 2043 at a 1.2% annual rate. By comparison, if the participation rate to 2043 of women aged 25 to 44 reaches the same level as the 20-24 group, the labor force level will be larger at most by 600,000 persons per year, or 1.2% above the baseline case.

Thus boosting the participation rate of women in childbirth and child raising years should be regarded as having only a minor effect on the labor force. Meanwhile, we must not forget the underlying objective of providing women a free choice to participate in society.

### (4) Significance of Work Sharing

The same applies to work sharing, whose significance lies in providing alternative forms of employment so that persons with the desire and ability to work have more opportunities for self expression and income, and more freedom to allocate time between work, leisure and personal development.

Stated simply, if work sharing only involves replacing full-time employees with part-time workers, then total man hours and labor productivity will barely change. However, each form of employment has certain advantages and disadvantages that should be taken into account.

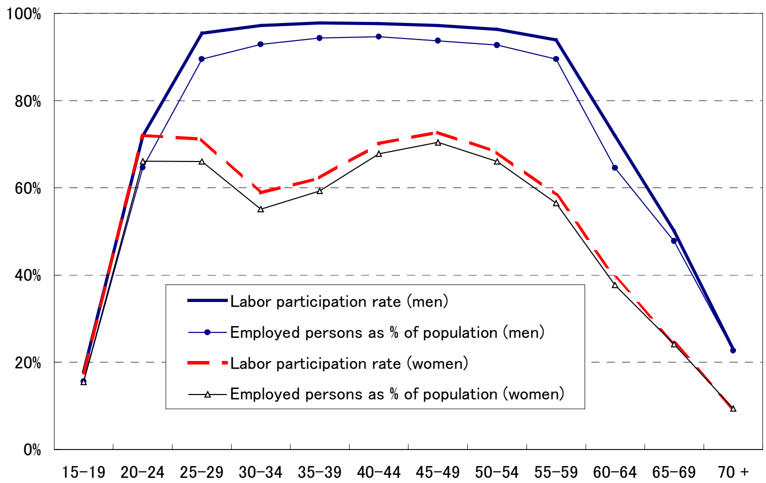
Even if total labor hours do not change for society as a whole, other effects occur when labor hours are averaged out across workers or over a person's lifetime. Clearly, nobody can use all 24 hours a day, 365 days a year. Averaging out labor hours increases the freedom to allocate one's time between leisure and personal development. Non-elderly persons would no longer have the problem of being unable to find leisure time, while others could regularly pursue personal development over their lifetime. This ties in with human capital accumulation.

### (5) Prospects for Japan's Labor Force and Number of Employed Persons

Based on the discussion above, we consider the case in which labor force participation rates by sex and age and the unemployment rate remain at present levels.

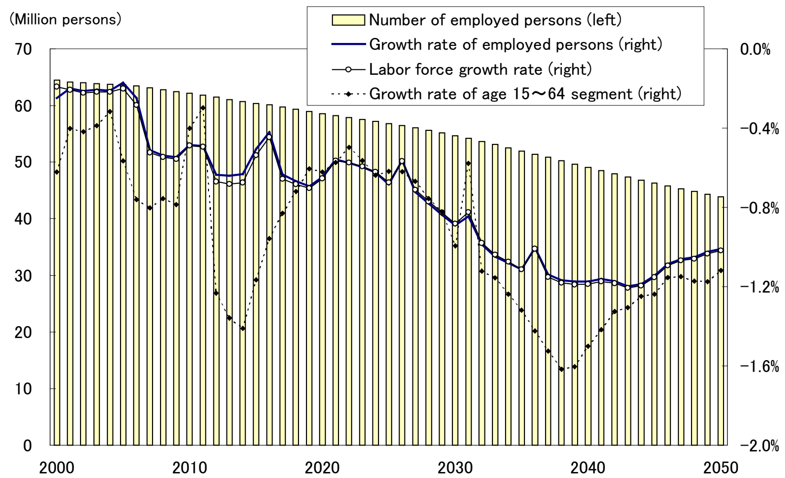
According to our calculations, the number of employed persons will decline from 64.13 million persons in 2001 to 43.89 million in 2050, or 32%. The average annual rate over the period is –0.8%.

**Figure 7　Employment Structure by Sex and Age (2001)**




Source: Ministry of Public Management, Home Affairs, Post & Telecommunications, *Labor Force Survey*.

**Figure 8　Number of Employed Persons to 2050**




## 2.　Sources of Economic Growth

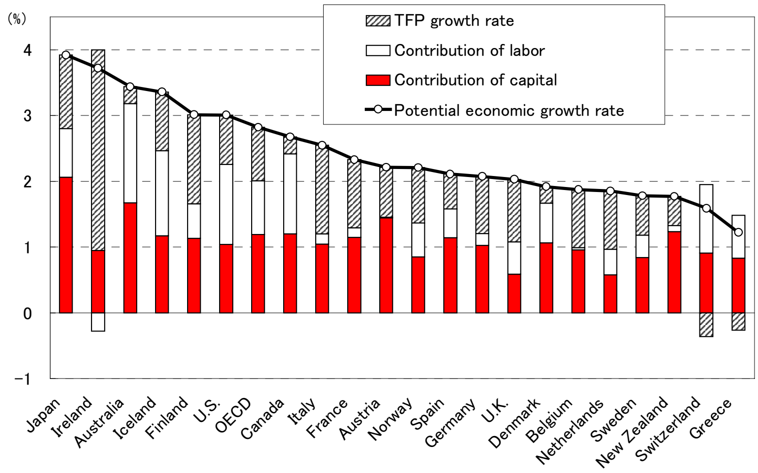
### (1) Relationship Between GDP and GDP Per Capita

The supply and demand sides of the economy are like the wheels of a car. In the short term, since supply does not change significantly, real GDP is determined mainly by the demand side. But over the long term, as the gap between supply and demand is alleviated in time, real GDP is determined by the supply side.

There are three sources of economic growth on the supply side: labor force, capital stock, and technology (total factor productivity). These comprise real GDP according to the following identity.

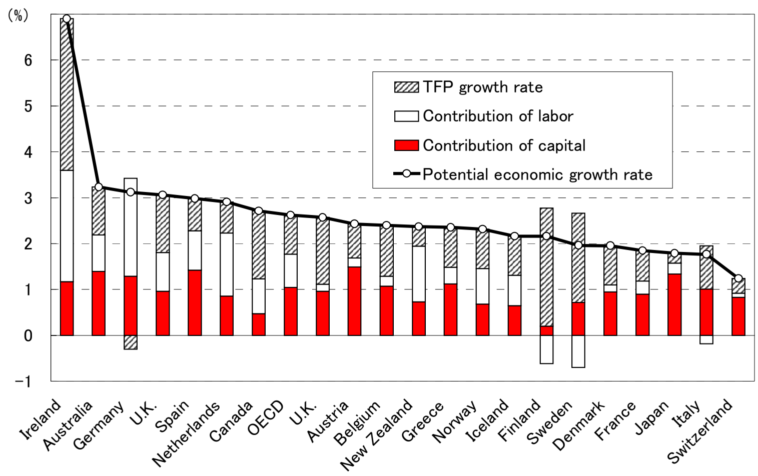
Real GDP growth rate = TFP growth rate
+ Labor share x Labor growth rate
+ Capital share x Capital stock growth rate (1)

**Figure 9 Growth Accounting in the 1980s**




Note: Labor hours are not reflected in the calculation of contribution of labor and rate of technological progress.
Source: Compiled from OECD, *Economic Outlook No. 71*.

**Figure 10 Growth Accounting in the 1990s**




In Japan's case, all three factors made high positive contributions during the 1980s, and real GDP growth was highest among OECD countries. On the other hand, in the 1990s, all factors were low, and real GDP growth was among the worst. From the late 1980s to early 1990s, the bubble and subsequent collapse of the asset market combined with real economic activities, disrupting capital investment and employment, and thereby derailing the economy from its steady growth path.

Excluding Ireland's strong performance and Japan's stagnation in the 1990s, growth rates in

OECD countries changed approximately 1% per year at most from the 1980s to 1990s. Thus among industrialized countries, Japan's dramatic supply side structural change over the decade is exceptional.

For convenience, we can separate real GDP into two parts—real GDP per capita and number of employed persons. At the level of the individual, living standards are directly tied not to real GDP, but to real GDP per capita.

First, as explained earlier, the number of employed persons is projected to decline 0.8% per year until 2050. As the demographic composition shifts toward elderly age groups with low participation rates, the overall labor participation rate will decline.

Regarding real GDP per capita, the growth accounting formula (1) can be rewritten as follows.

$$\text{Real GDP growth per capita} = \text{TFP growth rate} + \text{Capital share} \times \text{Capital stock growth per capita} \qquad (2)$$

That is, real GDP per capita can maintain a positive growth rate through TFP growth and capital deepening per capita. Moreover, if both growth components are large enough that the real GDP growth per capita exceeds the rate of decline in employed persons, the aggregate real GDP growth rate will also be positive.

A one percentage-point rise in the TFP growth increases real GDP by 1% on both an aggregate and per capita basis. However, since TFP depends on many factors—including improvement in production efficiency, R&D, education systems, and human capital accumulation—achieving continuous TFP growth is by no means an easy matter.

By comparison, capital deepening, which occurs through the introduction of new machinery and equipment, is more predictable. Increasing the capital stock per capita is a sure way to increase labor productivity, that is, real GDP per capita. However, since the capital share is 33%, increasing capital stock per capita by 1% will increase real GDP per capita by only 0.33%.

More importantly, capital stock per capita cannot possibly increase indefinitely. As capital stock per capita accumulates, its growth rate tends to approach zero. We examine this issue below.

### (2) Mechanism of Capital Accumulation

The accumulation of capital stock per employed person (capital-output ratio) is prescribed by (1) the gross savings rate, (2) growth in number of employed persons, and (3) outward foreign investment.

Capital stock increases when new investment exceeds the depreciation of existing stock. Similar to consumption (private and government) and net exports, investment (domestic aggregate fixed capital formation) is a demand side component of GDP.[3] Naturally, domestic investment is equal to GDP minus consumption and net exports. After subtracting consumption from GDP, what remains is gross savings including capital depreciation; net exports is equal to foreign financial transactions and the capital account deficit.[4] Thus domestic investment is equivalent to gross savings minus foreign investment. Based on these relationships, we can express growth in capital stock per capita as in the following equation.[5]

Growth in capital stock per capita = Real GDP per capita x Gross savings rate
– (Growth rate of employed persons + Depreciation rate of capital)
x Capital stock per capita
– Foreign investment per capita (3)

Clearly, capital deepening depends on the gross savings rate, growth rate of employed persons, and investment abroad.

Another important point is that the increase in level of capital stock in Equation (3) will decline over time and eventually become zero. If capital stock per capita grows, so too will real GDP per capita, only not by as much. That is, the increase in gross savings from real GDP per capita growth is not as large as the increase in capital depreciation from capital stock per capita growth, the incremental net increase in capital stock shrinks. Thus the higher the level of capital stock per capita becomes, the low its growth rate and the real GDP per capita growth rate become. This is what occurs when the economy matures.

Clearly, this mechanism explains Japan's postwar economic growth well.

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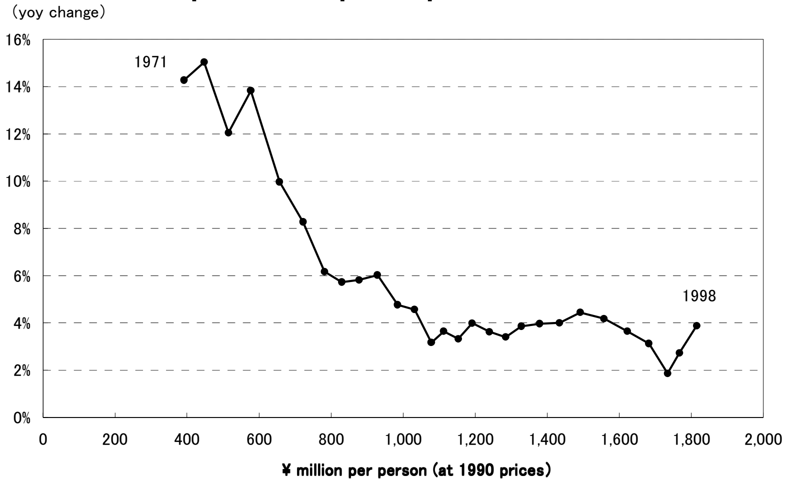
[3] For simplicity, we assume that inventory investment is zero.
[4] Strictly speaking, gross savings corresponds to GDP plus net factor income from abroad and net current transfers from abroad, minus consumption and statistical discrepancy. The capital account deficit and current account surplus correspond to net exports plus net factor income from abroad and net current transfers from abroad.
[5] We assume a Solow-type economic growth model extended to an open economy. For more information, see Tatsuya Ishikawa, "Economic Growth, Real Interest Rate and Saving-Investment Balance in a Solow-Type Two-Country Model," (in Japanese) in *Shoho*, NLI Research Institute, vol. 25.

**Figure 11 Capital Stock per Capita: Level and Growth Rate**




Source: Compiled from Cabinet Office, *Annual Report on National Accounts* (68SNA).

### (3) Origins of TFP Growth

If capital stock growth per capita declines to zero, then real GDP growth per capita will depend entirely on total factor productivity growth. While TFP growth contributes to economic growth regardless of the particular era or stage of economic development, it becomes all the more critical when the economy has matured and is slowing down.

In an economy with little accumulated capital stock and low labor productivity, high economic growth can be achieved through a *quantitative* expansion of capital stock input without TFP growth. But as capital deepening advances and the level of labor productivity rises, economic growth is no longer possible without a *qualitative* improvement.

The origins of TFP growth are not limited to the latest frontier of scientific discoveries and inventions. It also encompasses any improvements that lead to higher productivity, as well as measures to raise worker efficiency. While efforts to make improvements do not always result in TFP growth, such growth will not be achieved without persistent efforts.

### (4) Effect of Population Decrease and Aging

We return to the matter of capital stock per capita again to examine its relationship to population decrease and aging.

Population decrease and aging affect the growth of capital stock per capita through changes in the gross savings rate and growth of employed persons, as in Equation (3).

First, negative growth of employed persons positively affects capital stock growth per capita. That is, as the number of employed persons decreases, less total savings are needed to maintain capital stock per capita, so that what remains can go toward increasing capital stock per capita.

To take a simple example, if total capital stock remains unchanged while the number of employed persons declines, the capital stock per capita obviously increases. If the total capital stock can be used effectively without being idled, marginal productivity may decline, but average productivity per capita will increase.

It is not difficult to believe that population decline can cause labor productivity and wages to grow. This effect can be confirmed by historical cases such as the plague in 14$^{th}$ century Europe, famine in 19$^{th}$ century Japan, and mass emigration in 19$^{th}$ century Ireland. In these earlier times, land area per capita played the same role as capital stock per capita.

Of course, without TFP growth, an economy's total output will decline. In Japan today, if the number of employed persons were to decline 1%, capital stock per capita would increase 1%, and real GDP per capita would grow 0.33%. However, aggregate real GDP would decrease 0.67%. Thus even if the number of employed persons were to decline, aggregate real GDP would decline at a smaller rate.

On the other hand, aging does have a negative impact on the gross savings rate. Since retired persons are not are no longer involved in production but continue to consume as before, as the proportion of elderly persons increases, total savings in the economy will decline. The decline in savings implies a decline in funds available for investment. Thus the gross savings rate decline associated with aging directly reduces the amount of increase in capital stock per capita. If the gross savings rate declines significantly, the level of capital stock per capita could even decline. In that case, real GDP would decline on both an aggregate and per capita basis.

The question is thus to what extent the gross savings rate will decline. The gross savings rate (ratio of gross savings to GDP), which stood at 40% in 1970, declined to 28% by 2000. While factors other than aging have also played a part, the 12 percentage-point decline over the past three decades suggests that equally large changes may be in store.

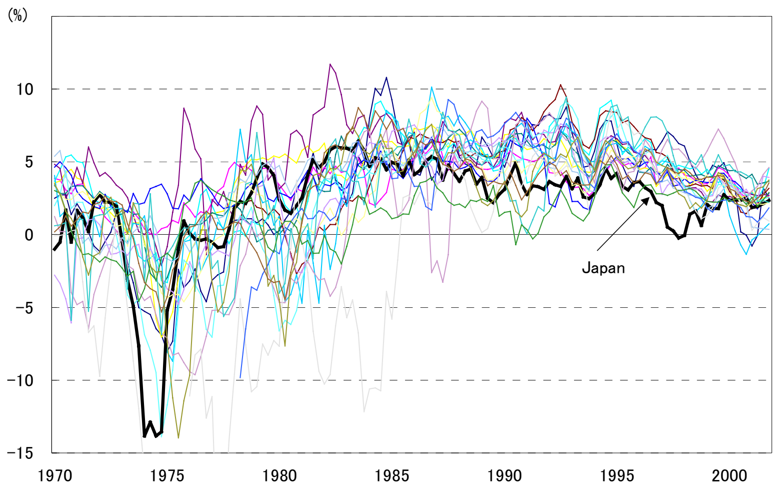
To summarize, real GDP per capita is negatively affected by aging, and positively affected by population decline. On the other hand, aggregate real GDP is negatively affected by both aging and population decline.

### (5) Relationship with Overseas Economies

Finally, we look at the impact on the relationship between Japan and overseas economies.

Except for the period of the two oil shocks, Japan has consistently maintained a current account surplus since the late 1960s. This means that a part of domestic savings has consistently been channeled into foreign investment, thereby constraining the increase in domestic capital stock. Stated differently, if Japan's savings rate were to significantly drop in the future, reduced foreign investment could mitigate the decline in domestic investment. And if the current account balance turns to deficit—that is, if funds flow into Japan from abroad—domestic investment could exceed domestic savings. The question is how to determine what causes the current account balance or savings-investment balance to change.

**Figure 12 Real Long-term Interest Rates in OECD Countries**




Notes: Quarterly basis. Shows long-term government bond yields adjusted with CPI. Effect of consumption tax rate hike has not been eliminated.
Source: Compiled from OECD, *Main Economic Indicators*; IMF, *IFS*.

Investment funds tend to flow to destinations—whether domestic or foreign—that offer better risk-adjusted returns. Since the 1980s, when financial deregulation spread worldwide and international capital movements became commonplace, real long-term interest rates have tended to converge among industrialized economies.

As a result, the relative return on investment is arbitraged in the global context, which links Japan's capital stock level, investment activity, and savings with those of foreign countries. At the global level, since overall savings are equal to overall investment, investment funds basically flow from countries with a high savings rate to those with a low savings rate.

Of course, the savings-investment balance is not determined only by differences in national savings rates. Still, if Japan's savings rate drops sharply relative to others, the outflow of funds should abate and fund inflows increase. And since savings rates reflect the status of each country's aging process, relative levels of domestic and foreign savings rates and external balances will change dramatically.

## 3. Macroeconomic Outlook to 2050

Based on the previous discussion, we present our macroeconomic outlook for Japan to 2050.

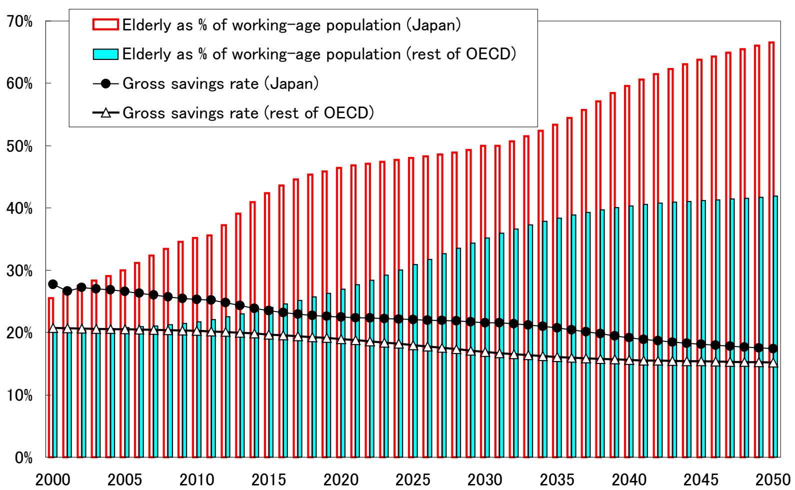
### (1) Assumptions

We assume that the TFP growth rate is 0.7%, the average of OECD countries in the 1980s and 1990s.[6]

Higher TFP growth rates might be achievable by more persistently and aggressively engaging in renewal of organizational practices associated with IT investment, R&D investment, and personal development of workers. However, we assume that these activities will be done at the same level as in the past.

Regarding the effect of aging on the gross savings rate, based on the econometric analysis of panel data of OECD countries, we assume that a 1% increase in the elderly dependency ratio (the ratio of elderly persons age 65 and over to the working-age population age 15-64) will cause a 0.25% decline in the gross savings rate (ratio of gross savings to GDP).

**Figure 13 Forecast for Domestic and Foreign Gross Savings Rates**




Sources: Ratio of elderly persons to working age population is from IPSS, *Population Projections for Japan: 2001-2050*; U.N., *World Population Prospects (The 2000 Revision)*.

Since the elderly dependency ratio in Japan is predicted to increase from 25.5% in 2000 to 66.5% in 2050, we assume that the gross savings rate will decline from 27.7% to 17.4%.

[6] For the simulation model, we assumed a 1% Harrod neutral technical progress rate and Cobb-Douglas production function. This converts into a total factor productivity growth rate of 0.7%.

### (2) Summary of Outlook

The major results of our macroeconomic outlook are shown in Table 14.

**Table 14 Macroeconomic Outlook to 2050**

| | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|
| Real GDP growth rate | 1.4% | 1.0% | 0.6% | 0.3% | −0.3% | −0.4% |
| Contribution of labor | −0.4% | −0.2% | −0.4% | −0.5% | −0.7% | −0.7% |
| Contribution of capital | 0.9% | 0.7% | 0.3% | 0.1% | −0.2% | −0.3% |
| TFP growth rate | 0.8% | 0.7% | 0.7% | 0.7% | 0.7% | 0.7% |
| Real GDP growth per employed person | 2.1% | 1.4% | 1.2% | 1.0% | 0.8% | 0.7% |
| Capital−output ratio | 2.28 | 2.58 | 2.69 | 2.68 | 2.58 | 2.45 |
| Current acct. bal. / GDP ratio | 2.5% | 0.6% | −1.3% | 0.4% | 0.7% | −0.5% |
| Gross savings / GDP ratio | 27.7% | 25.3% | 22.5% | 21.6% | 19.2% | 17.4% |
| Net savings / GDP ratio | 8.7% | 3.8% | 0.0% | −0.8% | −2.4% | −3.0% |

Notes: Calculated from supply side data. A separate forecast for fiscal 2002-2007, which also incorporates demand side data, predicts a real GDP growth rate of 0.8%. For more information, see "Medium-Term Economic Forecast (FY2002-2007)," in *NLI Research*, no. 020920.
Rates of change refer to average value for decade ending on date shown; ratios are for year shown.
Total labor hours are assumed to remain at present level.

The real GDP growth rate will decline gradually on both an aggregate and per capita basis. While real GDP growth per capita will remain positive throughout the forecast period, aggregate real GDP growth will turn negative in the 2030s. The decline in number of employed persons will be roughly offset by TFP growth, but this is because the contribution of capital stock will turn negative.

The ratio of capital stock to GDP (capital-output ratio) will increase modestly until the 2020s. The savings-investment balance—in other words, the current account balance—will turn to deficit in the mid 2010s, and capital inflows from abroad will help capital stock expand. Since aging will be more advanced in Japan than elsewhere until 2020, the savings rate will decline and the external balance will turn to deficit.

In the 2020s, aging in Japan will temporarily ease up, while aging and population decline will become full-fledged in other industrialized countries. As a result, Japan's external balance will turn positive again around 2030, and as Japan becomes a net provider of funds, capital deepening will slow down, and eventually reverse course.

After the 2030s, aging will progress in other industrialized nations, and accelerate once again in Japan. As a result, investment will be constrained due to a worldwide savings shortage. In the late 2040s, we predict that the current account balance will turn to deficit again.

## Conclusion

This paper represents an attempt to compile a baseline economic outlook that will promote informed discussions on future social systems and individual values and attitudes. As such, it can also be used to identify what is needed to achieve a different future from what has been predicted.

For the economy to achieve positive growth 50 years from now, considerable technological progress will be necessary. Of course, even in a low-growth society, there will always be markets and needs that are expanding, and taking advantage of such new opportunities will help sustain the society's vitality and improve efficiency.

However, social problems and competing interests can no longer be resolved through growth or expansion in size. Society and individuals will need to decide how to establish their priorities.

Since the economy's growth rate will decline, society will need not only to pursue prosperity in the form of higher income and consumption levels, but in the sense of providing the freedom of choice among a diverse range of options that respect the lifestyles of individuals and families.