Financial projection of the Japanese social security through macro simulation

Itaru Sato
Hisakazu Kato

1. Introduction

An aging population combined with a decreasing fertility rate has brought about a considerable increase in expenditure on social security benefits. The social security system has been innovated in various ways to secure the sustainability and efficiency of the system to accommodate this situation. According to the Population Projections for Japan updated in December 2006, the population aging and the decreasing fertility rate will accelerate compared to the Population Projection 2002. In these Projections, three types of fertility rate and mortality rate are estimated; high variant, medium variant, and low variant, giving us alternative scenarios of aging, and allowing us to analyze the influence on the social security system in detail.

We focus on the transition of the level of total benefits and contributions in the social security. In this paper, we use the word "contribution" as the insurance premium only. The level of benefit expenditures has constantly been greater than that of contributions. In 2004, the total benefit expenditure and the total contribution were 75.9 trillion yen and 49.2 trillion yen respectively, indicating a difference of 26.7 trillion yen. The reason for this difference widening so rapidly is that the increasing rate of the contribution level has been limited. This sluggish increasing rate is accounted for by a decrease in the working age population and the diminishing rate of economic growth.

Our paper analyzes not only macroeconomic factors, such as TFP and labor force ratios, but also changes in population projections by using the Population Projection 2006, all of which influence the social security and macro economy. This paper is organized as follows; the next section, Section 2, introduces the setup of our macro econometric model; in Section 3, we perform simulation on that model and describe our analysis of that simulation; Section 4 concludes our findings.

2. The model

2.1 Previous studies

Before explaining our model, we refer to some of the previous studies. Ishikawa, Sakura, and Fujikawa (2006) built the macro econometric model, analyzing how pension reform in 2004 influenced the demand side of the economy; especially, they focused on the household consumption and substitution effect for the factors of production. They assumed that the business firm substitutes three factors; capital, full-time workers, and short-time workers. The paper analyzed the effect of (1) an increase in the national subsidy ratio on the Basic Pension, (2) an increase in the pension contributions, and (3) the Employees' Pension Insurance (EPI) system being adopted for the short-time workers. From the result of the analysis, they concluded that it is desirable to use part of the consumption tax as subsidy for the Basic Pension. In addition to the substitution effect on the factors of production, although their influence is small, if the EPI system is adopted to the short-time workers, it will result in an increase in the gross domestic expenditures.

Inada, Ogawa, Tamaoka, and Tokutsu (1992) analyzed the effect of an aging population and the pension scale on the economic growth, based on the long-term model from the supply side point of view. They demonstrated that the path of the long-term growth changes depending on which method is taken for eliminating the capital shortfall. They also showed that it is necessary for the analysis paper to illustrate the consequences of various policies, introducing the model structure clearly.

Based on the macroeconomic model focusing on supply side, Kato (2001) predicted the performance of the macro economy, the public finance, and the social security system up to 2050. He built the model consisting of three blocks: the macroeconomic block, the labor block, and the fiscal and social security block. Then, he introduced three cases of simulations: the case of technology progressing at an accelerating speed; the case of pension reform not being introduced; and the case of moderate spending of government expenditures. According to the simulation result, the effect of the Employees' Pension Insurance Law revised in 1999 was large. He stated that it is essential to reform the social security system, in order to maintain the sustainable growth and to finance the resources for the social security system.

Kato (2006) constructed the macro econometric model to analyze the effect of the pension reform in 2004. This model consists of

four blocks; the macroeconomic block, the social security block, the fiscal block, and the labor block. He created the simulation up to 2050 to see the transitions of the various indices, such as the overall financial scale for the social security, the size of its contributions, the difference between the level of benefits and contributions, the national contribution ratio including tax portion, and the potential national contribution ratio including the financial deficit. He outlined the economic performance in the long run, trends in the financial aspect, the social security expenditures and the transition of the contributions.

Masubuchi, Matsuya, Yoshida, and Morito (2001) constructed "the social security model", including the major social security systems, such as the public pension, medical care, and long-term care, evaluating the effect of the social security system in an integrated manner. Especially, they focused on (a) the baseline estimation which is conforming to the financial recalculation in 1999 (the future estimation of the public pension), (b) analysis of the effect of the pension reform in 1999, and (c) the simulations on policies by the financial resource of the Basic Pension. Based on the analysis, they concluded that, as long as the potential economic growth is considered, one of the choices is of the entire Basic Pension being subsidized by state contribution, and of resources being financed by the consumption tax for pensions.

2.2 Abstract of the model

The characteristics of the model in this paper are: (1) emphasis on changes in population; and (2) comparing and contrasting the difference between the case of setting an upper limit on premium burdens and the case of the amount of contribution changes to maintain the same level of benefit when economic climate changes.

In this paper, we make our model simple so that it is controllable. We divided our model for the macroeconomic block and social security block, both of which are influenced by variables such as population, TFP and labor force ratios. We assume that the level of social security expenditure will influence the macro economy via a change in the savings rate, in which explains the integral relation between the two blocks.

The macroeconomic block is designed to be supply side-oriented; this is a long-term model that makes clear the relationship between the economic growth and the social security finance. We can replace exogenous variables such as population easily, and this enables us to perform various types of simulations.

2.3 Structure

Macroeconomic block

The macroeconomic block is focused on the supply side, since we analyze our model from a long-term perspective. The center of the model is the production function, where its variables such as capital and labor are determined as follows; (1) capital stock is calculated by gross capital stock of private enterprises; (2) gross capital stock of private enterprises is equal to the capital stock in the previous period plus facility investment in the private sector this period, minus depreciation of capital. The level of facility investment in the private sector depends on the level of savings. In this model, the household savings rate is influenced by the social security block. The labor supply is multiplying three entities: the working population, the unemployment rate, and the hours worked indices. Finally, real gross domestic product (GDP) is decided by the above-mentioned factors.

Social security block

The social security block is designed for its controllability rather than describing the complication of the system. We will discuss the contribution and the benefit of social security system (pension, medical care, and long-term care) which explain most of the financial aspects of the system, rather than considering the system as a whole. Therefore, this model does not contain the current information on the public assistance and social welfare. This approach is based on the concept of the social security funds defined in the System of National Accounts (93SNA). All equations are shown in the Appendix.

(1) Pension block

As for the benefit calculation, we estimate the EPI benefits and the National Pension benefits separately, and then calculate the total of public pension benefits from sum of the two. We estimate the number of insured for the EPI, then calculate their benefits amount in total, and simultaneously estimate the number of those insured persons who are self-employed persons, farmers, etc. (category one) for the National Pension, estimate the National Pension benefits and then determine the sum of the two. In addition, we create the equation for the EPI reserve funds.

(2) Medical care block

As for Medical care block, we estimate the general medical expenditure by age brackets, and then based on this estimation, we calculate the national medical expenditure. The total amount of medical care expenditure is calculated by the estimated number of the insured persons of government-

managed health insurance.

(3) Long-term care block
We are not able to obtain time-series data for the long-term care insurance system since the system has been run for only seven years. For this reason, we create four equations based on the parameters in "Report for the Situation of Long-term Care Insurance Service" in 2004, Ministry of Health, Labour and Welfare. First, we calculate the number of persons requiring support, and that of persons requiring long-term care certification, then calculate the public expenditure on long-term care and the cost of long-term care in total, based on the cost of long-term care per person and the rate of cost increase in the future. The public expenditure on the long-term care was calculated by the average contribution amount and others.

(4)Social security benefits and contributions
We estimate social security benefits and contributions for the public pension, the medical care, and the long-tem care.

3. Simulation

We take the medium variant of the mortality rate as a baseline case; and also include the low variant of the mortality rate. As a reference, we take the medium variant in the projection of 2002. Moreover, we analyze some changes in the assumptions of economic factors: TFP, and the labor force ratio.

3.1 Baseline case

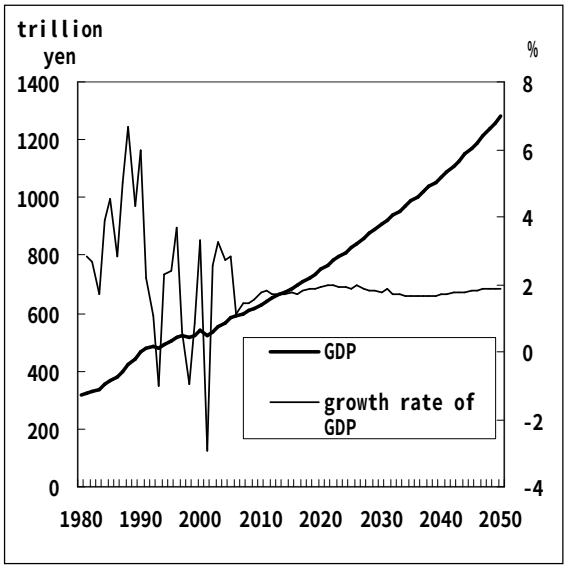
GDP and growth rate

Figure 1 shows GDP and its growth rate. The level of GDP is 1281.4 trillion yen in 2050; its growth rate is about 2%. However, it may underestimate the effect of the decrease in the working population on the GDP growth rate since the labor distribution rate was undervalued at 57%.

Contributions and benefits for pension

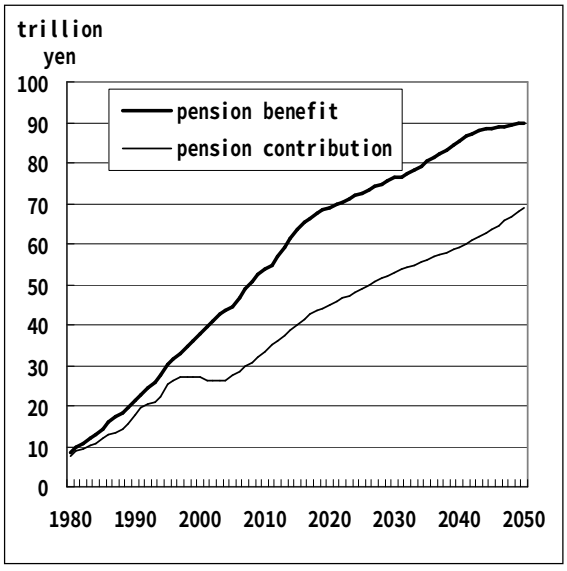
Figure 2 shows the pension contributions and benefits. The diagram shows that the pension benefits will increase as the elderly population increases. Pension contributions increase constantly, but the difference between contribution and benefits becomes larger; in 2050, the difference becomes 20 trillion yen. This needs to be compensated by either tax or by the pension reserve fund, but in this model we cannot introduce how this difference is to be made up. We need to analyze whether we use tax or the reserve funds and the consequences of this in some another opportunity.

Figure 1 Gross domestic products and its growth rate



Source: by author

Figure 2 Pension contributions and benefits



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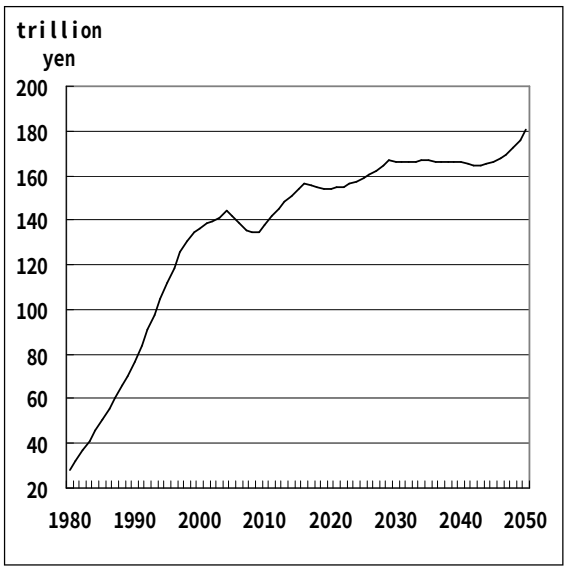
EPI reserve fund

Figure 3 shows the EPI reserve fund. The EPI reserve fund will increase, though its rate of increase will slow down, and it will reach about 180.5 trillion yen in 2050. However, this result is based on the model disregarding the liquidation of the reserve fund, based on the limited balance method adopted in 2004. Therefore, it should be pointed out that the result may change when we include the limited balance method in the model, introducing the case where withdrawing pension reserve fund by fixed schedule. If the limited

balance method is introduced in this model, the influence will be as follows. On the one hand, if the pension reserve fund will be invested somewhere, and become a part of the capital accumulation, there will be a possibility that this liquidation will interrupt the capital accumulation, which in turn will be a negative influence on the economic growth. On the other hand, when this liquidation prevents a decrease in the level of benefits as well as tax burden, then, this will increase the savings rate and enhance the capital accumulation. Therefore, the overall consequences of introducing the limited balance method are still unknown, so this point needs to be further investigated.

Figure 3 EPI reserve funds



Source: by author

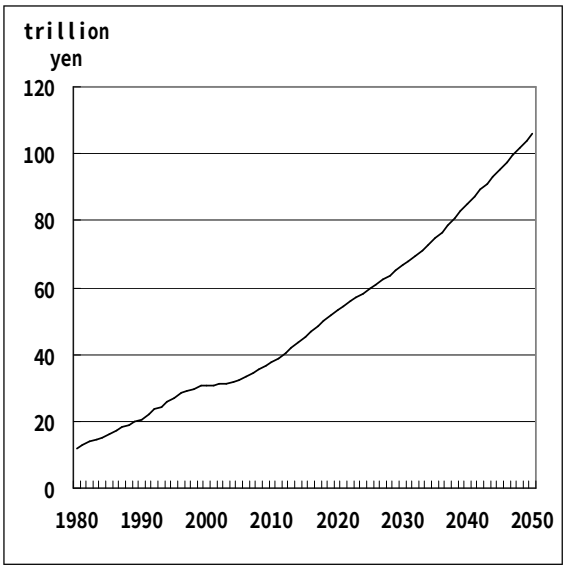
Social security benefit expenditure and contribution

Figure 5 shows the transition of the social security benefit expenditures and contributions. As we mentioned above, in this paper, we use the word "contribution" as the insurance premium only. In 2004, the difference between the benefit expenditures and contributions was 28.8 trillion yen, which accounted for 36.7% of the social security benefit expenditures. In 2050, this difference will become 90.0 trillion yen; that is, 46.0% of the benefit expenditures. It should be pointed out that difference between benefit expenditures and contributions increased rapidly after 1990, and this will increase even more. This accounts for a decrease in the working age population as well as a decrease in the rate of economic growth that started since 1990s.

National medical expenditure

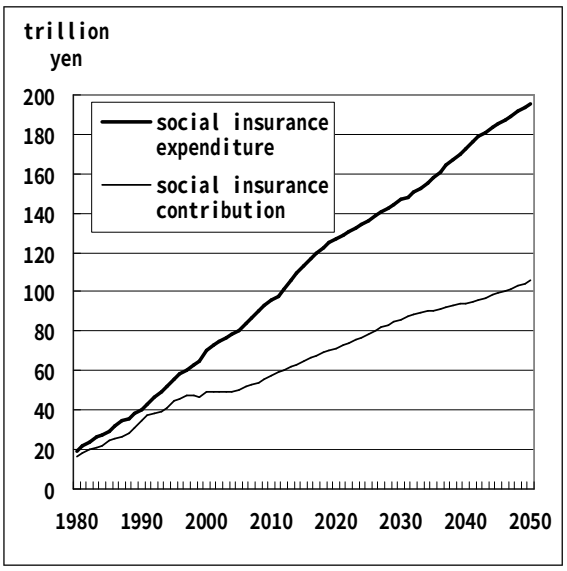
Figure 4 shows the national medical expenditure. It is apparent that the medical expense for the elderly accounts for a large share of the entire national medical expenditures; the ratio of the medical expenditure for the elderly to the total is 36.9% as of 2003. From this ratio, we can assume that the rapid aging of the population will induce an increase in the national medical expenditure. We can confirm this scenario in our simulation; that is, the national medical expenditure will become 100 trillion yen in 2048.

Figure 4 National medical expenditure



Source: by author

Figure 5 Social security benefit expenditure, and contribution



Source: by author

3.2 Variation cases

We analyze how the social security systems and macro economy have been influenced by change in TFP, the labor force ratio, and the population projections. Simulation cases are summarized in Table 1. The result of estimating parameters is shown in the Appendix.

As mentioned above, Population Projection 2006 covers not only the fertility rate, but also changes in the assumptions on the mortality rate: high, medium, and low. In our simulation, we set our baseline case as both fertility rate and mortality rate as the medium variant in 2006; in addition, we calculate the case where mortality rate is the low variant. Furthermore, we show another statistical transition scenario based on the Population Projection 2002. In this way, we can see how change in the population projection would influence the estimation.

Table 1 Cases of the simulation

Case	contribution	TFP	labor force ratios	Population Projection 2006	
				fertility rate	mortality rate
baseline				medium variant	medium variant
case 2	same as baseline case	increase 0.5% every year	1.1 times baseline case	medium variant	medium variant
case 3	same as baseline case	same as baseline case	same as baseline case	medium variant	low variant
case 4	same as baseline case	increase 0.5% every year	1.1 times baseline case	medium variant	low variant
case 5	same as baseline case	same as baseline case	same as baseline case	Population Projection 2002 medium variant	————
case 6	calculate contribution	same as baseline case	same as baseline case	medium variant	medium variant

In case 5, we use Population Projection 2002.
Source: by author

Pension benefits and pension contributions

First, we will show you the transition of pension benefits and contributions. Figure 6 and 7 show pension benefits and pension contributions. In all cases, both benefit expenditures and contributions increase constantly. In case of benefit expenditures, we can see that this is affected by a change in the mortality rate; the benefit expenditure is smaller for the medium variant compared to the low variant.

As for the pension contribution, it is affected by macroeconomic indices, primarily the labor force participation rate or TFP. The most affected and those maintaining the highest contribution amount are case 2 and case 4. The trend of the baseline case and case 3 showed a similar movement respectively.

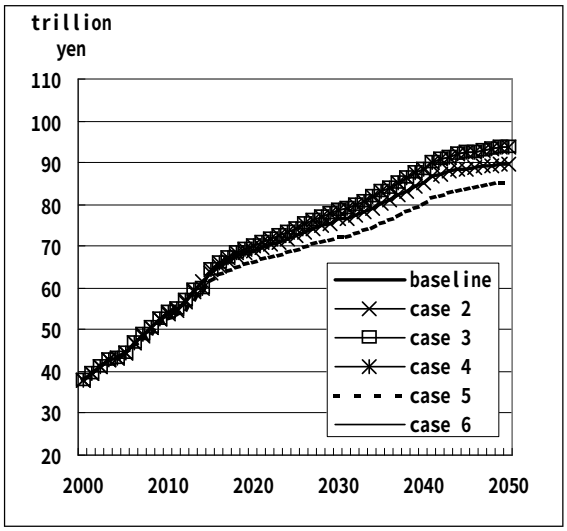
Although different population projections are given, these two groups maintain the same conditions for the labor participation ratio and TFP. The effect on the level of pension contributions induced by changes in the mortality rate can be seen around 2025, though this influence is relatively minor. On the other hand, an increase in the labor force participation rate or increase in TFP would result in a large effect on pension contributions.

Since Japan introduced the system that sets an upper limit on premium burdens, when per capita income or labor force participation rate increases, the total contribution will increase. Increase in the labor force participation rate is synonymous to an increase in the working age population, which brought about the increase in contribution amount in total, given that per capita contribution remained unchanged. Moreover, the increase in TFP will drive up per capita income, pushing up the total contributions.

In addition, we made a case where the consequences were given by only change in the population projection; that is, case 5 based on Population Projection 2002. Following is the discussion which compares and contrasts case 5 with each other case.

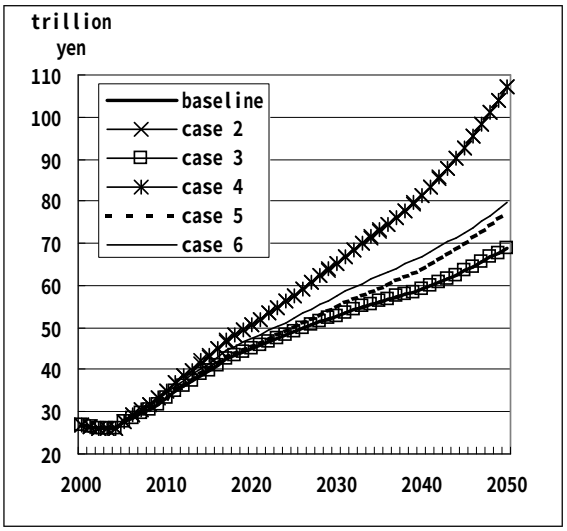
When we compare case 5 with the baseline case, the pension contribution in total is much higher in case 5. The total amount of pension contribution is larger when using the Population Projection 2002 compared to the projection of 2006, since the former predicted that the declining fertility rate is more gradual; that is, the number of working age population-who make the pension contributions-decreases to a smaller extent. Within the entire period, the total contribution amount is larger compared to case 5, if TFP and labor force participation rate increase.

Figure 6 Pension benefit



Source: by author

Figure 7 Pension contribution



Source: by author

EPI reserve fund

Next, we will analyze the transition of the EPI reserve fund. Figure 8 shows the EPI reserve fund. As we have shown in the previous figure, an increase in the labor force participation rate and in TFP will result in an increase in the pension contribution level in total.

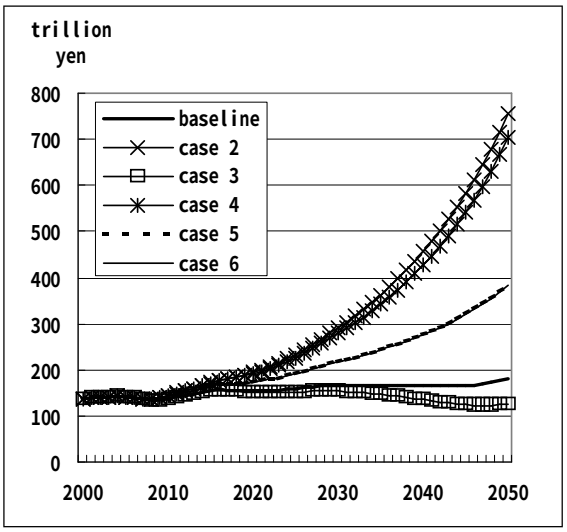
As in the previous case of the total pension contributions, we can categorize these cases for case 2 and case 4; and baseline case and case 3.

In the case where both TFP and labor force participation rate increase, the pension reserve fund will increase. Likewise, if Population Projection 2002 is adopted, the pension reserve would not decrease. However, as for the baseline case, or case 3 (baseline case with the condition of a change in the mortality rate), the reserve fund remains almost the same, or gradually decreases.

Medical care contribution

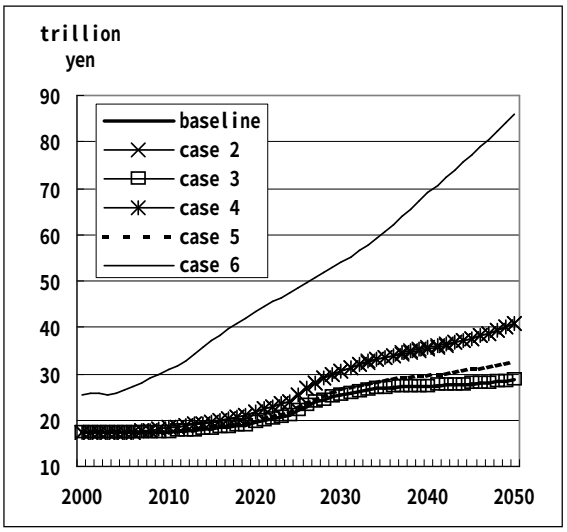
Figure 9 shows the medical care contribution. In every case, the medical care contribution will increase. Although the medical care contribution will increase, the benefit expenditure also increases due to the aging population when looking at the increased national medical expenditure. Thus, the difference between the medical care benefit and contribution will be larger. Unless the contribution rate, etc. is not changed, it is necessary to compensate by tax, etc.

Figure 8 EPI reserve fund



Source: by author

Figure 9 Medical care contribution



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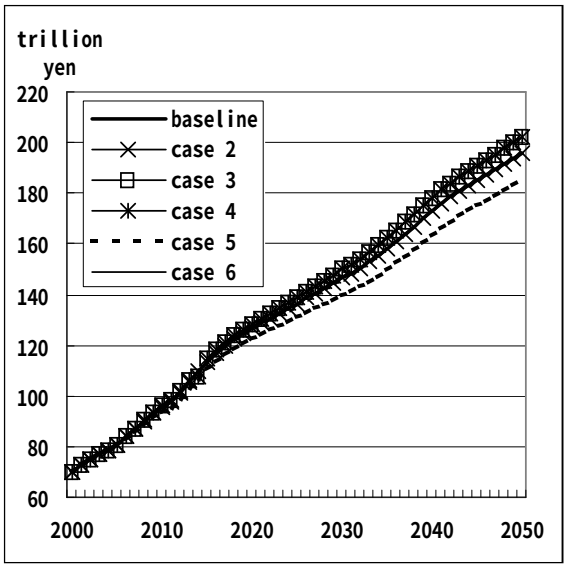
Social security benefit expenditures and contributions

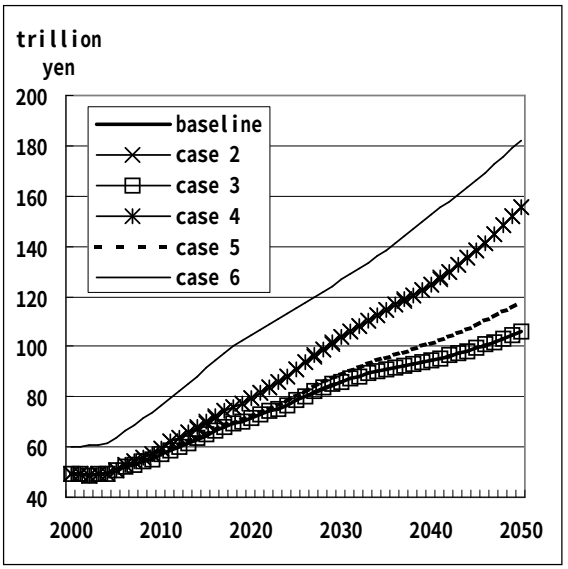
We will analyze the transition of the social security benefit expenditures and contributions. Figure 10 and 11 show social security benefit expenditures and social security contributions. Both benefit expenditures and contributions are calculated as the sum of the pension, the medical care, and the long-term care factors; we can assume that the results would be the same as individual factors. Like the pension and the medical care factors, total benefits and contributions are influenced by changes in population projections; an aging population would increase the social benefit expenditures. Similarly, the social security benefits would be influenced by change in the mortality rate, while contributions are hardly affected.

Figure 10 Social security benefit expenditures



Source: by author

Figure 11 Social security contributions



Source: by author

Effect of the increase in the contribution

When we take a look at the baseline case, etc., it is apparent that the financial balance of the pension, the medical care, and the long-term care will deteriorate. This can be compensated by an increase in the level of contributions or by tax. Thus, we make simulations on our models with the level of benefit constant while only the level of the contribution increases.

In case 6, we set the level of the EPI reserve fund equal to case 5 as for the contribution for EPI. We design the fiscal status of both systems to be balanced for every period as for the rate of contribution for the medical care and for the long-term care insurance[i]. In this model, an increase in the contribution rate would not influence the level of benefit, but only influence improvement of the fiscal status.

As for the baseline case, the contribution rate for EPI increases to 18.3%, and then becomes stable. However, if the level of contribution is constant, the level of pension reserve fund cannot be maintained at the some level, since the total contribution amount decreases due to the declining fertility rate, while the benefit expenditures increase. Based on the 2002 prediction, if the same level of reserve fund is to be maintained, then the pension contribution should be increased by 25.4% at 2050. Figure 12 shows the contribution rate for EPI. Likewise, the fiscal balance for the medical care system cannot be balanced if the contribution rate remained at 12.0%. In order to balance the fiscal status by only raising contribution rate of medical care, it should be 48.7%. Figure 13 shows contribution rate for the Government Managed Medical Care.

Figure 12 Contribution rate for EPI

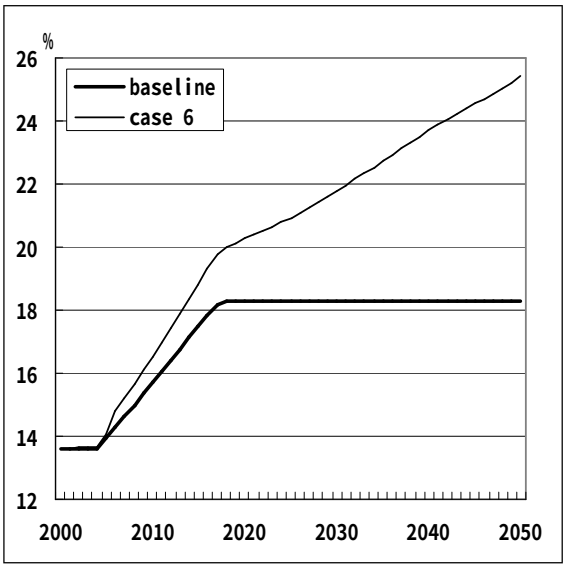


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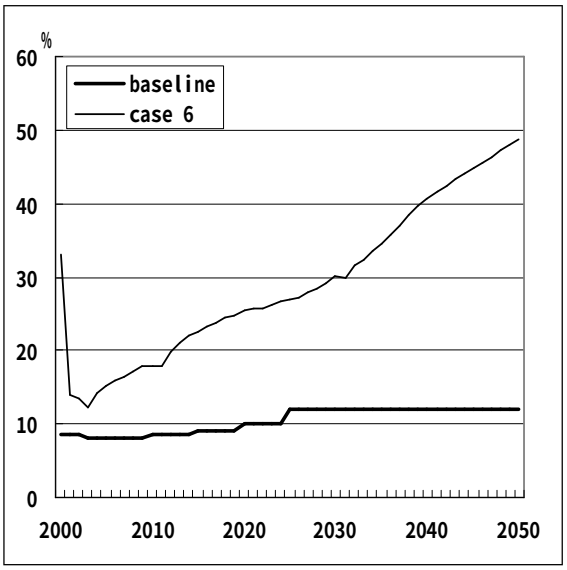
Figure 13 Contribution rate for the Government Managed Medical Care



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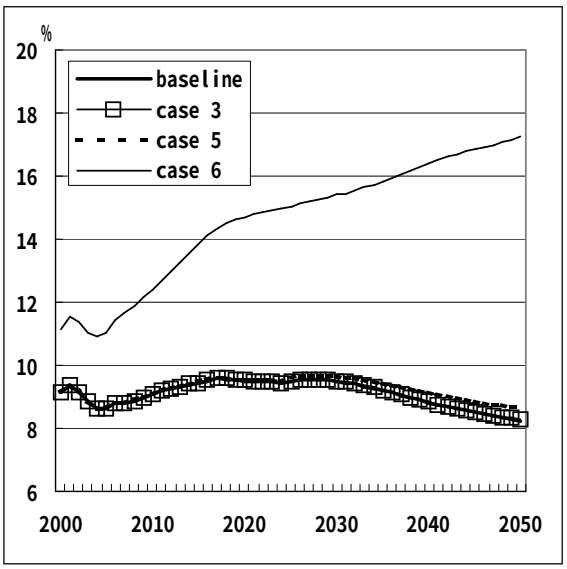
As observed above, it is understood that if the level of contribution rate increases, then the social security cost increases. In relation to GDP, the social security burden will become 8.3% in case 5, whereas this will become 17.2% maintaining the same level of pension reserve based on projection 2002, and balancing the fiscal status of medical care and long-term care insurances. Figure 14 shows the social security burden ratio to GDP.

Figure 14 The social security burden ratio to GDP



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4. Concluding remarks

In this paper, we conducted a simulation analysis on how macro economy or financial status of the social security system is influenced by change in TFP, labor force participation rate, or population structure. In sum, we mainly find the conclusions as follows.

First, the difference between the benefit expenditures and contributions will be expanding by three times in nominal value, from about 30 trillion yen (37% of the total expenditure) in 2004 to 90 trillion yen (46%) in 2050. Second, in order to keep the amounts of reserved funds sustainable predicted by the estimated population in the year of 2002, the contribution premium should be increased up to approximately 25% and 50% by

about two and five times than the current premium, for the public pension and medical care insurance, respectively. In conclusion, the ratio of the social security burden to GDP will become larger more than double by about 17% from 8% in the baseline case. Therefore, the level of the contribution rate currently assumed is not enough to maintain the aging society. Increases in the contribution rates and/or tax level are inevitable, for preserving the level of benefits currently expected.

However, if the level of contribution is raised too far, the burden will become larger, which will affect the macro economy in a negative way. Thus, a draw on the reserve fund is inevitable for the public pension system to lessen the large burden. In this context, the limited balance method adopted in 2004 is meaningful. If a draw on the reserve fund proceeded with the limited balance method, then even if the financial status deteriorates through the aging population, both increases in burden and decreases in benefit will be slowed down. However, the level of reserve fund will remain equal or show a downward tendency unless the economy experiences an increase in TFP or in the labor participation rate. This means that the amount of withdrawal from the reserve fund is limited. Consequently, in addition to drawing on the reserve fund, the level of the contribution also needs to be increased to deal with the increased life expectancy and low fertility.

Note

[i] The level of reserve fund is calculated by the schedule of benefits and contributions in the baseline case. Thus, the rate of contribution is determined to realize the same level of the reserve fund, setting the same level of contribution rate in the baseline case. This is the reason why we perform the simulation, trying to set the level of the pension reserve fund equal to case 5.

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Itaru Sato (National Institute of Population and Social Security Research)
Hisakazu Kato (Meiji University)

Appendix to Financial projection of social security through macro simulation

EQUATIONS

Final consumption expenditure of households (C_H)

C_H = YD_H - SAV_H

Consumption of fixed capital (DELTA)

Sample: 1981 ～ 2003

DELTA = 11759.8 + 0.083829 * KIPIN(-1)
(3.764138) (21.21814)

Adjusted R-squared = 0.953312, Durbin-Watson stat = 0.206052

Insured person of government-managed health insurance (GCONTP)

Sample: 1981 ～ 2003

GCONTP = 235.7338 + 0.004258 * D((POPM1544
(0.509006) (4.374113)
* LPRATE1544M * R1544M * LD)
+ (POPM4564 * LPRATE4564M
* R4564M * LD) + (POPF1544
* LPRATE1544F * R1544F * LD) +
(POPF4564 * LPRATE4564F * R4564F
* LD)) + 0.9817 * GCONTP(-1)
(40.02687)

Adjusted R-squared = 0.987651, Durbin-Watson stat = 1.278043

Gross domestic product (real) (GDP)

Sample: 1980 ～ 2004

$GDP = 0.001639 * (KIPIN * CU)^{0.427929} * LL^{(1.0 - 0.427929)}$
(6.79642) (8.041357)
* EXP(0.004387 * TREND)
(1.74277)

Adjusted R-squared = 0.993492, Durbin-Watson stat = 0.878127

Growth rate of GDP (GDPDOT)

GDPDOT = (GDP - GDP(-1)) / GDP(-1) * 100

Gross domestic product (nominal) (GDPN)

GDPN = GDP * PGDP / 100

Medical care public contribution (GOVPMED)

Sample: 1980 ～ 2003

GOVPMED = 2006.029 + 1.858023 * (MENA *
(9.730383) (27.79289)
(1 * FUTAN / 100))

Adjusted R-squared = 0.971049, Durbin-Watson stat = 0.596868

Investment for plant and equipment of private sectors (IP_F)

Sample: 1980 ～ 2003

IP_F = -21115.03 + 0.64616 * ((SAV_P +SAV_GOV)
(-3.027792) (8.655555)
/ PGDP * 100) + 0.07305 * KIPIN(-1)
(16.5643)

Adjusted R-squared = 0.925318, Durbin-Watson stat = 0.675079

Gross Capital Stock of Private Enterprises (KIPIN)

Sample: 1981 ～ 2003

KIPIN = 13946.26 + 1.031845 * (KIPIN(-1) +
(1.923026) (111.9075)
IP_F - DELTA)

Adjusted R-squared = 0.998246, Durbin-Watson stat = 1.204961

15 to 44 years old working population, female (L1544F)

L1544F = POPF1519* LPRATE1519F
+ POPF2024 * LPRATE2024F
+ POPF2529 * LPRATE2529F
+ POPF3034 * LPRATE3034F
+ POPF3539 * LPRATE3539F
+ POPF4044 * LPRATE4044F

15 to 44 years old working population, male (L1544M)

L1544M = POPM1519 * LPRATE1519M
+ POPM2024 * LPRATE2024M
+ POPM2529 * LPRATE2529M
+ POPM3034 * LPRATE3034M
+ POPM3539 * LPRATE3539M
+ POPM4044 * LPRATE4044M

45 to 64 years old working population, female (L4564F)

L4564F = POPF4549 * LPRATE4549F
+ POPF5054* LPRATE5054F
+ POPF5559 * LPRATE5559F
+ POPF6064 * LPRATE6064F

45 to 64 years old working population, male (L4564M)

L4564M = POPM4549 * LPRATE4549M
+ POPM5054 * LPRATE5054M
+ POPM5559 * LPRATE5559M
+ POPM6064 * LPRATE6064M

Aged 65 or older working population, female (L65OVF)

L65OVF = POPF65OV * LPRATE65OVF

Aged 65 or older working population, male (L65OVM)

L65OVM = POPM65OV * LPRATE65OVM

Working population (LABOR)

LABOR = (L1544M + L4564M + L65OVM) +
(L1544F + L4564F + L65OVF)

Labor supply (LL)
LL = (1 - U / 100) * LABOR * LTIME

General medical expenditure (ME)
ME = (ME14P * (POPM0014 + POPF0014)
+ ME1544P * (POPM1544 + POPF1544)
+ ME4564P * (POPM4564 + POPF4564)
+ ME65P * (POPM65OV + POPF65OV))
/ 1000

0 to 14 years old per person general medical expenditure (ME14P)
Sample: 1981 ～ 2003
LOG(ME14P) = -18.84862 + 0.356706 * LOG(NI
(-1.707593) (1.8245)
/ (POPM + POPF))
+ 1.779528 * LOG(HOS(-1)) + 0.598036
(1.720022) (2.561556)
* LOG(ME14P(-1))
- 1.589343 * (FUTAN / 100)
(-1.297101)
Adjusted R-squared = 0.984784, Durbin-Watson stat = 1.920752

15 to 44 years old per person general medical expenditure (ME1544P)
Sample: 1981 ～ 2003
LOG(ME1544P) = -2.37085 + 0.182624 * LOG(NI
(-0.951134) (1.64514)
/ (POPM + POPF))
+ 0.362744 * LOG(HOS(-1))
(1.425589)
-1.193821 * (FUTAN / 100)
(-1.461039)
+0.56961 * LOG(ME1544P(-1))
(3.767423)
+ 0.038329 * DBUB
(2.197894)
Adjusted R-squared = 0.933876, Durbin-Watson stat = 2.24289

45 to 64 years old per person general medical expenditure (ME4564P)
Sample: 1981 ～ 2003
LOG(ME4564P) = 1.623989 + 0.32529 * LOG(NI
(4.71239) (3.193846)
/ (POPM + POPF))
- 0.681931 * (FUTAN / 100)
(-2.492751)
+ 0.641882 * LOG(ME4564P(-1))
(7.432961)
Adjusted R-squared = 0.98331, Durbin-Watson stat = 1.853675

Aged 65 or older per person general medical expenditure (ME65P)
Sample: 1981 ～ 2003
ME65P = 18.70897 + 0.714815 * ME65P(-1)
(0.677724) (8.810623)
+ 46.74032 * (NI / (POPM + POPF))
(2.095495)
Adjusted R-squared = 0.97869, Durbin-Watson stat = 2.32572

National medical expenditure (MENA)
Sample: 1980 ～ 2003
LOG(MENA) = -2.061765 + 1.227538 * LOG(ME)
(-4.770221) (28.25844)
+ 0.068644 * D85_BF
(2.461158)
- 0.040821 * DBUB
(-2.094592)
Adjusted R-squared = 0.990929, Durbin-Watson stat = 1.401594

Persons requiring support, persons requiring long term care (NINTEI)
NINTEI = (POPM65OV + POPF65OV) * NINTEIR

National Pension Basic Pension benefit (NPBKISO)
Sample: 1986 ～ 2003
NPBKISO = -2211.105 + 1.054943
(-11.34121) (40.97025)
* (NPBKISOAPER * NPBNUMA
* 12 / 1000000)
Adjusted R-squared = 0.989968, Durbin-Watson stat = 0.263876

Per person National Pension Basic Pension benefit (NPBKISOPER)
Sample: 1987 ～ 2003
NPBKISOAPER = 3574.012 + 0.950476
(1.485625) (18.12162)
* (NPBKISOAPER(-1)
* (1 + CPI_D))
Adjusted R-squared = 0.953406, Durbin-Watson stat = 2.172724

Basic Pension recipients (NPBNUMA)
Sample: 1986 ～ 2003
NPBNUMA = -8186.571 + 1.090289
(-13.09026) (32.28319)
* (POPM65OV + POPF65OV)
Adjusted R-squared = 0.983935, Durbin-Watson stat = 0.236636

Public pension insured person (NSUB)
Sample: 1980 ～ 2003
NSUB = -20479.02 + 1.14918

(-1.87359) (8.145246)
* (POPM2064 + POPF2064)
- 3364.149 * D85_BF
(-3.512658)
Adjusted R-squared = 0.949622, Durbin-Watson stat = 0.630198

First insured person (NSUB1)
NSUB1 = NSUB * NSUB1_R

Employees' Pension Insurance insured person (NSUBWP)
Sample: 1980 ～ 2003
NSUBWP = 9509.751 + 0.004364
(3.133218) (7.352933)
* ((POPM1544 * LPRATE1544M
* R1544M * LD)
+ (POPM4564 * LPRATE4564M
* R4564M * LD) + (POPF1544
* LPRATE1544F * R1544F * LD)
+ (POPF4564 * LPRATE4564F
* R4564F * LD)) - 1431.959
(-2.021797)
* D85_BF
Adjusted R-squared = 0.905997, Durbin-Watson stat = 0.432014

Change rate of GDP deflator (PGDPDOT)
PGDPDOT = (PGDP - PGDP(-1)) / PGDP(-1)
* 100

Population of female (POPF)
POPF = POPF0014 + POPF1544 + POPF4564
+ POPF65OV

Population of female from 0 to 14 years old (POPF0014)
POPF0014 = POPF0004 + POPF0509 + POPF1014

Population of female from 15 to 44 years old (POPF1544)
POPF1544 = POPF1519 + POPF2024
+ POPF2529 + POPF3034
+ POPF3539+ POPF4044

Population of female from 20 to 64 years old (POPF2064)
POPF2064 = POPF2024 + POPF2529
+ POPF3034 + POPF3539
+ POPF4044 + POPF4564

Population of female from 45 to 64 years old (POPF4564)
POPF4564 = POPF4549 + POPF5054
+ POPF5559 + POPF6064

Population of male (POPM)
POPM = POPM0014 + POPM1544
+ POPM4564 + POPM65OV

Population of male from 0 to 14 years old (POPM0014)
POPM0014 = POPM0004 + POPM0509
+ POPM1014

Population of male from 15 to 44 years old (POPM1544)
POPM1544 = POPM1519 + POPM2024
+ POPM2529 + POPM3034
+ POPM3539 + POPM4044

Population of male from 45 to 64 years old (POPM4564)
POPM4564 = POPM4549 + POPM5054
+ POPM5559 + POPM6064

Population of male from 20 to 64 years old (POPM2064)
POPM2064 = POPM2024 + POPM2529
+ POPM3034 + POPM3539
+ POPM4044 + POPM4564

Balance of saving and investment of government (PUBDEF)
Sample: 1980 ～ 2003
PUBDEF = -19023.4 + 0.928189 * SAV_GOV
(-14.43585) (11.93277)
- 34233.42 * D98
(-5.597769)
Adjusted R-squared = 0.894874, Durbin-Watson stat = 0.328114

Long term interest rate(R)
Sample: 1981 ～ 2003
R = 4.587649 + 1.075067 * PGDPDOT + 6.633516
(12.59954) (7.369315) (0.922957)
* (PUBDEF / GDPN)
Adjusted R-squared = 0.852724, Durbin-Watson stat = 1.34292

Saving of government (SAV_GOV)
Sample: 1980 ～ 2003
SAV_GOV = 3899.086 + 1.049173 * (TAX1
(4.901419) (39.97895)
+ TAX2 - CG) - 838.1156 * TREND
(-17.71251)
Adjusted R-squared = 0.990682, Durbin-Watson stat = 0.542202

Saving of households (SAV_H)
SAV_H = (SAVR_H / 100) * YD_H

Saving of private sectors (SAV_P)
Sample: 1980 ～ 2003
SAV_P = 29935.7 + 0.38545 * SAV_H + 736.817
(9.14556) (4.131653) (9.66699)
* TREND
Adjusted R-squared = 0.811033, Durbin-Watson stat = 1.855624

Saving rate of households (SAVR_H)
Sample: 1980 ～ 2003
SAVR_H = 22.79795 + 0.000115 * YWV - 0.000291
(5.21756) (2.622563) (-0.938627)
* SSC - 0.000638 * SSB
(-2.506823)
- 0.000176 * TAX2 + 0.928134
(-3.586405) (1.751104)
* TREND0
Adjusted R-squared = 0.938852, Durbin-Watson stat = 1.428234

Social security benefit expenditure (SSB)
Sample: 1980 ～ 2003
LOG(SSB) = 0.184867 + 0.987723 * LOG(SSBP
(3.48954) (201.4198)
+ SSBE + SSBK) + 0.021043
(4.443232)
* D85_BF
Adjusted R-squared = 0.999796, Durbin-Watson stat = 1.055803

Social security medical care benefit expenditure (SSBE)
Sample: 1980 ～ 2003
LOG(SSBE) = -0.0728 + 0.989758 * LOG(MENA)
(-0.321197)(44.22097)
- 0.038729 * D85_BF
(-2.417173)
Adjusted R-squared = 0.996256, Durbin-Watson stat = 0.538507

Social security long term care benefit expenditure (SSBK)
SSBK = (KAIPERC / 10000 * NINTEI) * 0.9

Social security pension benefit (SSBP)
Sample: 1980 ～ 2003
SSBP = 3050.995 + 1.139898 * (SSBPWP + SSBPNP)
(7.098378) (54.62844)
Adjusted R-squared = 0.992349, Durbin-Watson stat = 0.170767

National Pension benefit (SSBPNP)
Sample: 1986 ～ 2003
SSBPNP = 3533.329 + 0.849066 * NPBKISO
(118.9494) (174.8828)
Adjusted R-squared = 0.999444, Durbin-Watson stat = 1.536684

Employees' Pension Insurance benefit (SSBPWP)
Sample: 1981 ～ 2003
SSBPWP = 3115.324 + 0.744004
(12.63655) (49.19135)
* (WPBF + WPIZOKU) - 1518.227
(-6.109676)
* D85_BF

Adjusted R-squared = 0.995501, Durbin-Watson stat = 0.600813

Social security burden (SSC)
Sample: 1980 ～ 2003
LOG(SSC) = 0.52205 + 0.958423 * LOG(SSCP
(13.89185) (263.9371)
+ SSCE + SSCK)
Adjusted R-squared = 0.999656, Durbin-Watson stat = 0.346239

Contribution of social security medical care (SSCE)
Sample: 1981 ～ 2003
SSCE = 531.3173 + 0.343754 * D(WAGEPERN
(1.802424) (2.511691)
* 12 / 1000000 * HOKENR * GCONTP)
+ 0.810728 * SSCE(-1)
(13.8363)
Adjusted R-squared = 0.994799, Durbin-Watson stat = 1.185037

Contribution of social security long term care (SSCK)
SSCK = KAIPERH1 * (POPM65OV
+ POPF65OV) / 100000 + KAIPERH2
* (POPM4564 + POPF4564) / 100000

Social security pension contribution (SSCP)
Sample: 1980 ～ 2003
SSCP = 1458.953 + 1.149106 * (SSCPWP
(8.728896) (112.3917)
+ SSCPNP)
Adjusted R-squared = 0.998182, Durbin-Watson stat = 0.502125

Contribution of National Pension (SSCPNP)
Sample: 1980 ～ 2003
SSCPNP = 255.3774
(5.287854)
+ 0.690229 * (FEENP * (1 + CPI_NP)
(29.62552)
* 12 / 1000 * NSUB1 * NOFU / 100)
+ 346.5867 * D85_BF
(11.99103)

Adjusted R-squared = 0.978847, Durbin-Watson stat = 1.027798

Employees' Pension Insurance contribution (SSCPWP)
Sample: 1980 ～ 2003
SSCPWP = -2674.967
(-4.803541)
+ 0.998325 * (WAGEPERN * 12
(34.63508)
/ 1000000 * FEEWP / 100 * NSUBWP)
+ 958.2251 * D85_BF
(2.38462)
Adjusted R-squared = 0.991966, Durbin-Watson stat = 0.574093

Taxes on production and imports (TAX1)
Sample: 1980 ～ 2003
TAX1 = -3634.234 + 0.163109 * C_H
(-3.477659) (36.32884)
Adjusted R-squared = 0.982859, Durbin-Watson stat = 0.445863

Wage per person (WAGEPERN)
WAGEPERN = 137359.1 + 1.162435 * YWV
(15.3691) (18.90834)
- 1360.142 * TREND
(-3.033391)
Adjusted R-squared = 0.988765, Durbin-Watson stat = 0.252203

Old-age Employees' Pension Insurance benefit (WPBF)
WPBF = WPBPER * 12 / 1000000 * WPBNUMA

Old-age Employees' Pension Insurance recipients (WPBNUMA)
Sample: 1980 ～ 2003
WPBNUMA = -2756.216 + 0.519066
(-11.08027) (38.65591)
* (POPM65OV + POPF65OV)
- 432.0984 * D85_BF
(-3.215288)
Adjusted R-squared = 0.992874, Durbin-Watson stat = 2.027835

Survivors' Employees' Pension Insurance recipients (WPBNUMIZ)
Sample: 1981 ～ 2003
WPBNUMIZ = -518.6254 + 0.649248
(-4.482004) (26.91212)
* POPF75OV + 168.3811 * D85_BF
(2.143755)
Adjusted R-squared = 0.982265, Durbin-Watson stat = 1.778649

Per person old-age employees' pension insurance benefit (WPBPER)
Sample: 1981 ～ 2003
WPBPER = 6827.808 + 0.968245 * (WPBPER(-1)
(0.820547) (17.78727)
* (1 + CPI_D - M_SLIDE))
- 2079.142 * D85_BF
(-0.648515)
Adjusted R-squared = 0.966714, Durbin-Watson stat = 2.0822

Employees' Pension Insurance reserve fund (WPFUND)
Sample: 1986 ～ 2003
WPFUND = 1423.833 + 0.981887 * (WPFUND (-1)
(2.348873) (176.2421)
* (1 + R / 100) + SSCPWP
- NPBKISO * KISO_TAX
* (SSBPWP / SSBP)
* WPFUND_KISOAD - SSBPWP)
Adjusted R-squared = 0.999453, Durbin-Watson stat = 1.316355

Survivors' Employees' Pension Insurance benefit (WPIZOKU)
WPIZOKU = WPIZOKUPER * 12 / 1000000
* WPBNUMIZ

Per person Survivors' Employees' Pension Insurance benefit (WPIZOKUPER)
Sample: 1981 ～ 2003
WPIZOKUPER = 21041.74 + 0.39001 * WPBPER
(5.706536) (16.37934)
- 5829.539 * D85_BF
(-4.122156)
Adjusted R-squared = 0.971296, Durbin-Watson stat = 1.317399

Disposable income of households (YD_H)
Sample: 1980 ～ 2003
YD_H = 14736.25 + 1.547497 * (YWV + SSB
(0.568135) (6.148279)
- SSC - TAX2) - 4249.329 * TREND
(-2.265572)
Adjusted R-squared = 0.940915, Durbin-Watson stat = 0.157851

Compensation of employees (YWV)
Sample: 1980 ～ 2004
YWV = 201.6276 + 0.532302 * GDPN
(0.04876) (56.1896)
Adjusted R-squared = 0.992453, Durbin-Watson stat = 0.433434