Applying Swedish Automatic Balance Mechanism to Japanese Population

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Masaaki ONO, F.I.A.J.
Certified Pension Actuary in Japan
Mizuho Pension Research Institute
Main Issue of the paper

Does the Swedish Automatic Balance Mechanism work well under the severely decreasing population like Japan?

If it doesn’t, which conditions would be required?

I have not yet find the appropriate answer to the second issue.
Discussions in 2004 Pension Reform in Japan

Review of “Automatic Balance Mechanism” in Swedish PAY-GO Pension Scheme

Pension Scheme Projection Model for Japanese Population

Projection Results and its Analysis
Balance Sheet of Japanese Pay-Go State Pension Scheme (EPI)

<table>
<thead>
<tr>
<th>PV of Sources for Payment</th>
<th>PV of Future Benefits</th>
</tr>
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<tbody>
<tr>
<td>Total \1,710 trillion</td>
<td>Total \1,710 trillion</td>
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</table>

- **Contributions** \1,200 tril.
  - Future appreciations of contribution rate are considered
- **Buffer Fund** \160 tril.
- **Past Service** \150 tril.
- **Future Service** \190 tril.
- From General Account: \340 tril.

- **Benefits for Past Service** \740 tril. (For retirees \350 tril.)
- **Benefits for Future Service** \970 tril.

Future Service 2004
Past Service 2004

Assumed interest rate (3.2%) is the expected rate of return on Buffer Fund.
Automatic Balance Mechanism:
If the balance ratio goes down to less than 1, the indexation is automatically adjusted so that the ratio be recovered to 1.

Balance Sheet of Swedish PAY-GO Pension Scheme (Inkomstpeng pension)

Buffer Funds (F) 858
Contribution Asset (CA) 5,945
Total 6,803

Pension Liability (PL) 6,703
Accumulated Surplus 100
Total 6,803

Balance Ratio((F+CA)/PL) at year end 2006 = 1.0149

Source: ORANGE RAPPORT Pensionssystemets årsredovisning 2006
Review of “Automatic Balance Mechanism” in Swedish PAY-GO Pension Scheme

Theoretical Background for the Balance Sheet

Assuming “Steady State”

\[ l_x = \frac{L_x}{L_0} = e^{-\delta x} \]

- \( \delta \): Fertility driven population growth rate
- \( l_x \): Life table at age \( x \)
- \( L_x \): Population in age group \( x \)
- \( L_0 \): Initial population
- \( \delta \): Wage growth rate
- \( \varphi \): Adjustment factor for pension indexation
- \( m \): Minimum age
- \( \omega \): Limiting age
- \( r \): Retirement age
- \( x \): Age

Average wage: \( \bar{W} \)
Average wage of age group \( x \): \( W_x \)
Rate of number pensioners to population in age group \( x \): \( R_x \)
Participation rate in age group \( x \): \( A_x \)
Work Force
Pensioners
Theoretical Background for the Balance Sheet

Definition of “Turnover Duration”

\[ \bar{x}_a = \frac{\int_{0}^{\omega} x \cdot l_x \cdot e^{-\delta x} \cdot A_x \cdot W_x \, dx}{\int_{0}^{\omega} l_x \cdot e^{-\delta x} \cdot A_x \cdot W_x \, dx} \]

\[ \bar{x}_p = \frac{\int_{0}^{\omega} x \cdot e^{-(\delta + \phi)x} \cdot l_x \cdot R_x \, dx}{\int_{0}^{\omega} e^{-(\delta + \phi)x} \cdot l_x \cdot R_x \, dx} \]

money(wage) - weighted average age for active participants

money(pension) - weighted average age for pensioners

\[ TD = \bar{x}_p - \bar{x}_a \]

Turnover Duration (32.04812)
Theoretical Background for the Balance Sheet

Actuarial Liability \( V = PVFB - PVFC \)

\[
V = \int_0^\omega L_x \cdot l_x \cdot e^{-\delta x} \int_{x-u}^\omega p_x \cdot e^{-(\delta+\rho)(u-x)} \left[ R_u \cdot k \cdot \bar{W} \cdot e^{\rho(u-x)-\phi(u-r)} - A_u \cdot c \cdot \bar{W} \cdot W_u \cdot e^{\rho(u-x)} \right] du dx
\]

\( \delta + \rho \) : assumed interest rate

\( k \) : constant representing benefit level

Annual Contributions (C)

\[
C = \int_0^\omega L_x \cdot l_x \cdot e^{-\delta x} \cdot A_x \cdot c \cdot \bar{W} \cdot W_x dx
\]

Rate of Contributions (c)

\[
c = \frac{k \cdot \int_0^\omega l_x \cdot e^{-\delta x - \phi(x-r)} \cdot R_x dx}{\int_0^\omega l_x \cdot e^{-\delta x} \cdot A_x \cdot W_x dx}
\]

\[
V = \frac{V}{C} = \bar{x}_p - \bar{x}_a = TD
\]

\[
V = C \cdot TD
\]

It may be assumed that the scheme can expect future contributions as an inter-generational wealth transfer insofar to “Steady State Pension Liability”. Steady State Pension Liability can be easily calculated by using the above equation.
Present Population Structures

There seems to be no big difference.
Population Projection in Japan

Generation Y will not create any baby boom.
Population Projection in Japan
Difference from “Steady State Population”
Assumptions for the Projection

- Fertility and Mortality rates: NIPSSR* 2002 Projection (moderate)
  - the total fertility rate will converge to 1.39
- Labor Force Participation Rates: MHLW** Projection for 2004 Reform (moderate)
  - Labor Force = Participants of the Scheme
- Benefits Formula: Career Average (reevaluated)
- Rate of Benefit Accrual: 1% per annum
- Pensionable Age: 65
- Indexation in retirement: CPI
- Wage Profile: MHLW**
- Inflation, Wage Increase, Return on Assets: 1.0%, 2.1%, 3.2%

*National Institute of Population and Social Security Research
**Ministry of Health, Labor, and Welfare
Selected Assumptions

Figure 3
Labor Force Participation Rate

Figure 4
Wage Profiles by Age
Projection Results and its Analysis

Projection Results

Initial Fund: 5 times annual outlays
Real Rate of Return on the fund: 1.1%
Without Automatic Balance Mechanism

Net of Wage Increase

Figure 5
Projection of Financial Position without the activation of the Balance Mechanism
(Initial Fund: 5 times annual outlays, Real Rate of Return on the fund: 1.1%)

- Contribution Asset
- Pension Fund
- Actuarial Liability
Projection Results and its Analysis

**Figure 8**
Effect of Automatic Balance Mechanism

- **Benefit Level**
  - 100%
  - 90%
  - 80%
  - 70%
  - 60%

- **Year**
  - 2000
  - 2010
  - 2020
  - 2030
  - 2040
  - 2050

**ABM will activate in 2039**

**Figure 7**
Analysis of Actuarial Gains and Losses

- **Net CA**
  - will decrease severely from 2030s
If there is no initial fund, the automatic balance mechanism will not be able to avoid the fund exhaustion for 50 years.

Figure 8
Effect of Automatic Balance Mechanism

Fund Exhaustion

Projection Results and its Analysis
Projection Results

Considering the fertility driven population decreasing rate or the net total wage decreasing rate might generate a better result.

Considering those factors has not given the pleasant result.