Applying Swedish Automatic Balance Mechanism to Japanese Population

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Main Issue of the paper

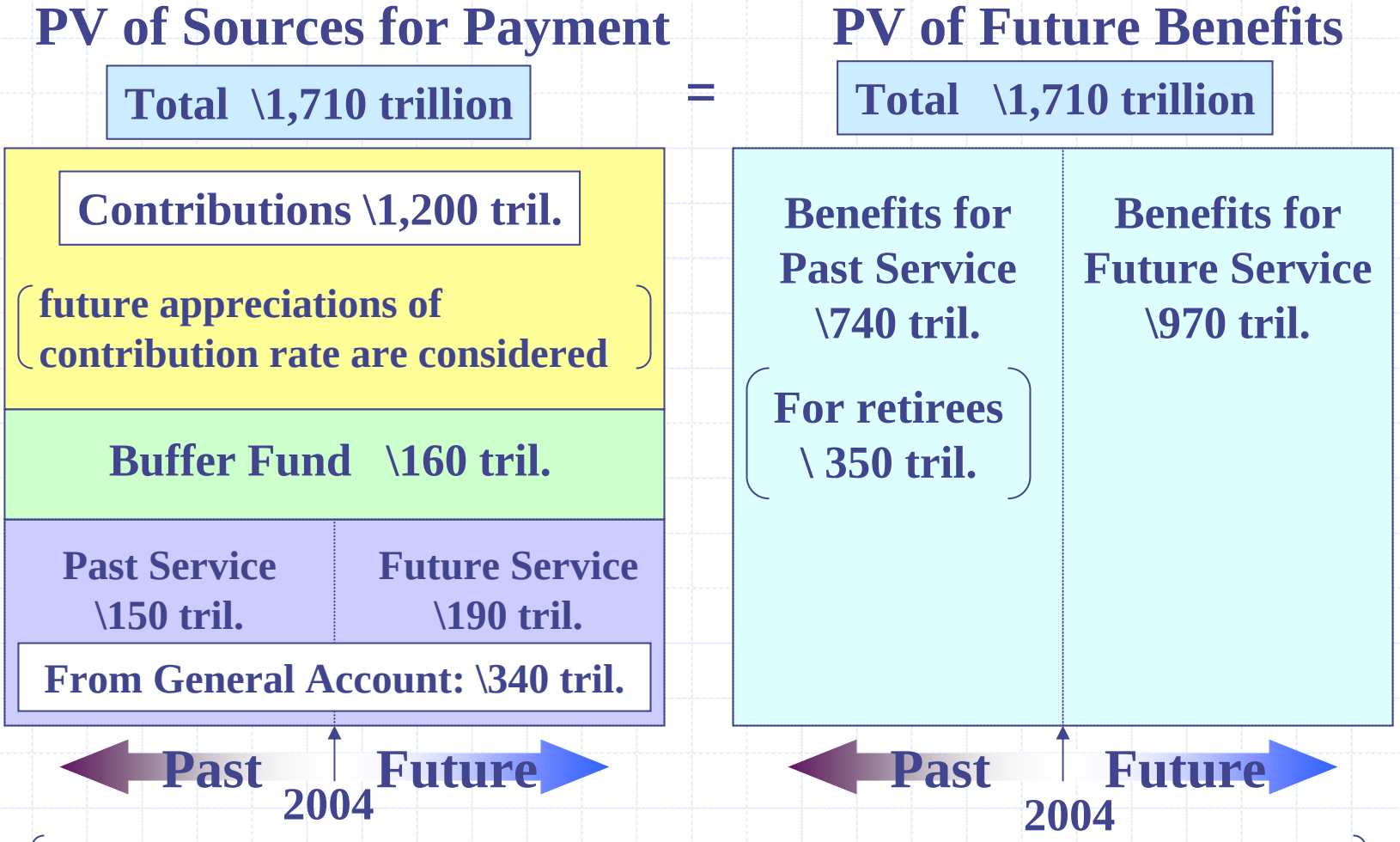
- **Does the Swedish Automatic Balance Mechanism work well under the severely decreasing population like Japan?**
- **If it doesn't, which conditions would be required?**

I have not yet find the appropriate answer to the second issue.

Contents

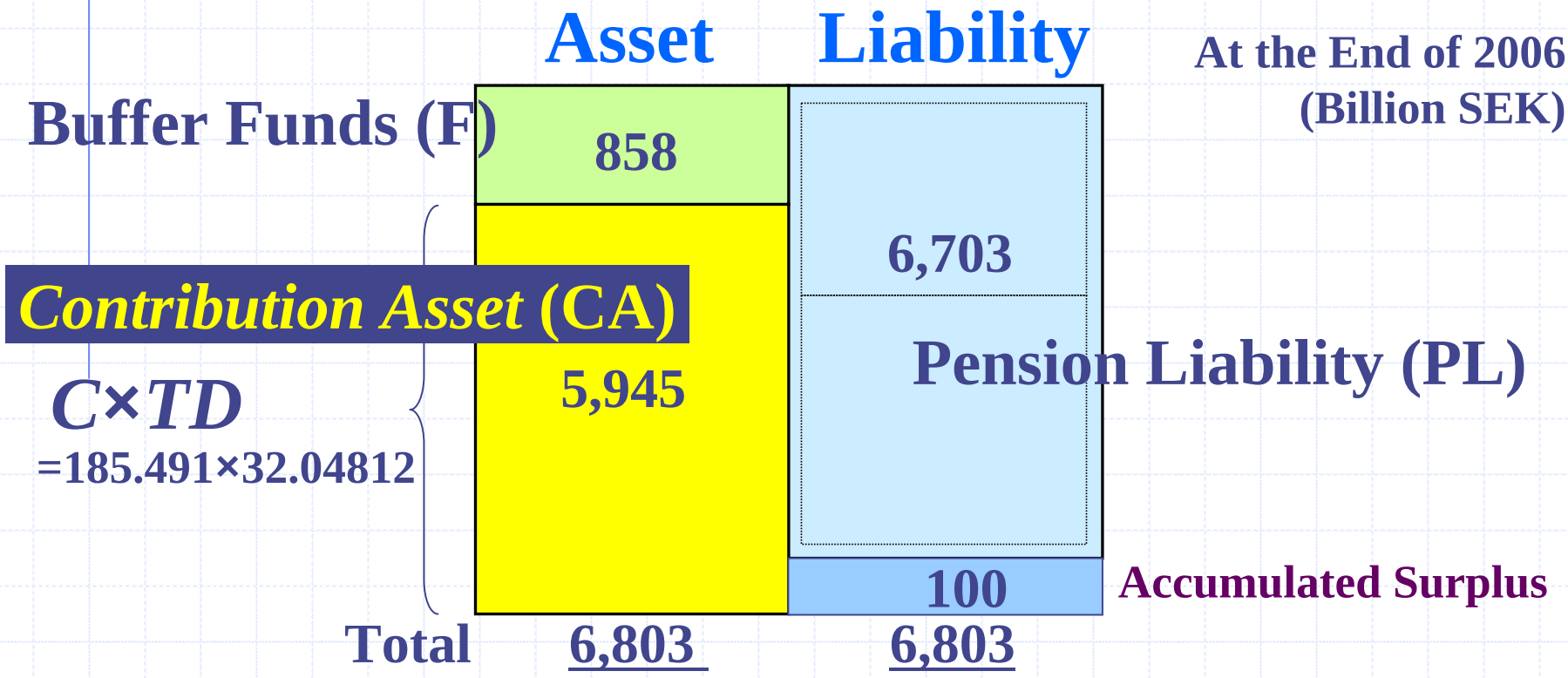
- **Discussions in 2004 Pension Reform in Japan**
- **Review of “Automatic Balance Mechanism” in Swedish PAY-GO Pension Scheme**
- **Pension Scheme Projection Model for Japanese Population**
- **Projection Results and its Analysis**

Balance Sheet of Japanese PAY-GO State Pension Scheme (EPI)



Assumed interest rate(3.2%) is the expected rate of return on Buffer Fund.

Balance Sheet of Swedish PAY-GO Pension Scheme (Inkomstpension)



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

Source : ORANGE RAPPORT Pensionssystemets årsredovisning 2006

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.

Theoretical Background for the Balance Sheet

Assuming "Steady State"

δ Fertility driven population growth rate

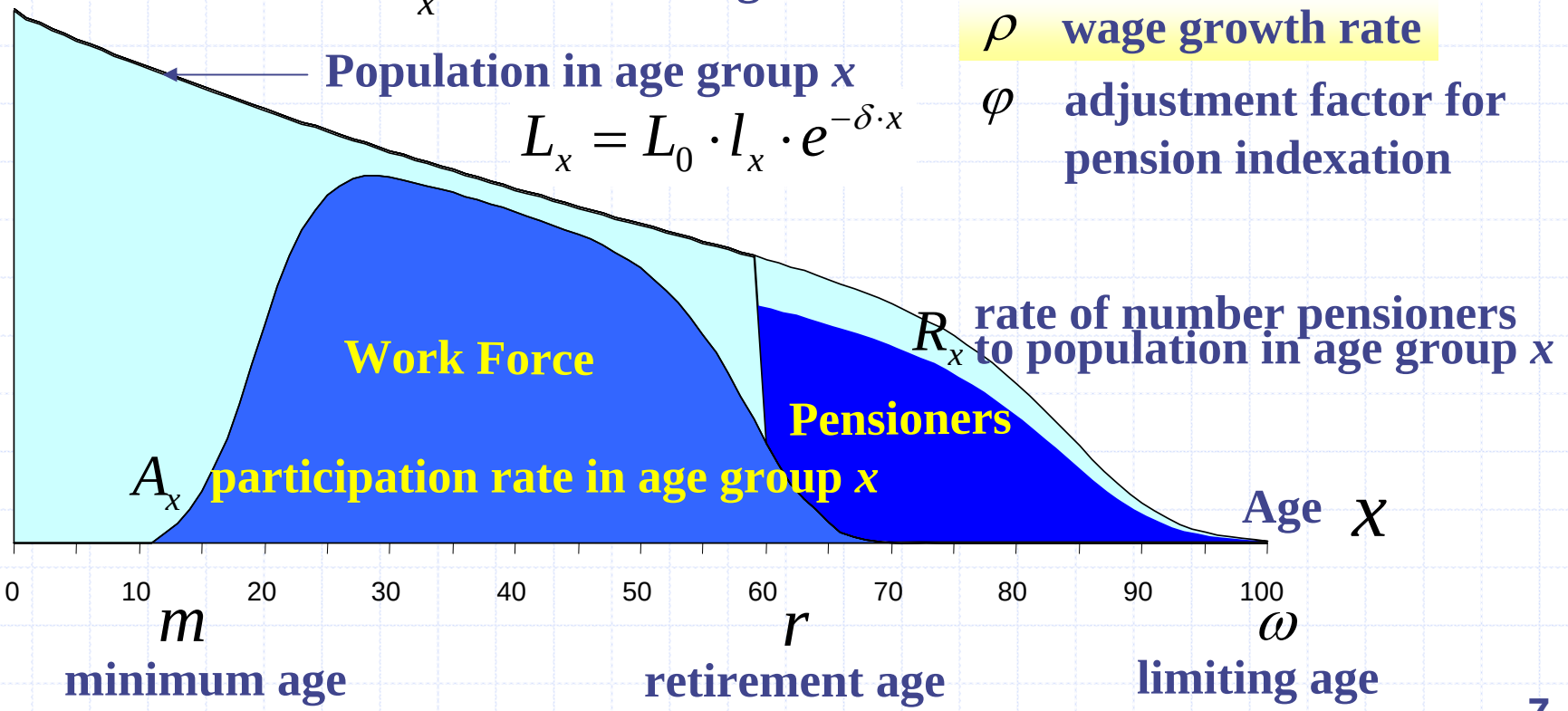
l_x life table at age x

$\overline{W}$ average wage

W_x average wage of age group x / $\overline{W}$

ρ wage growth rate

φ adjustment factor for pension indexation

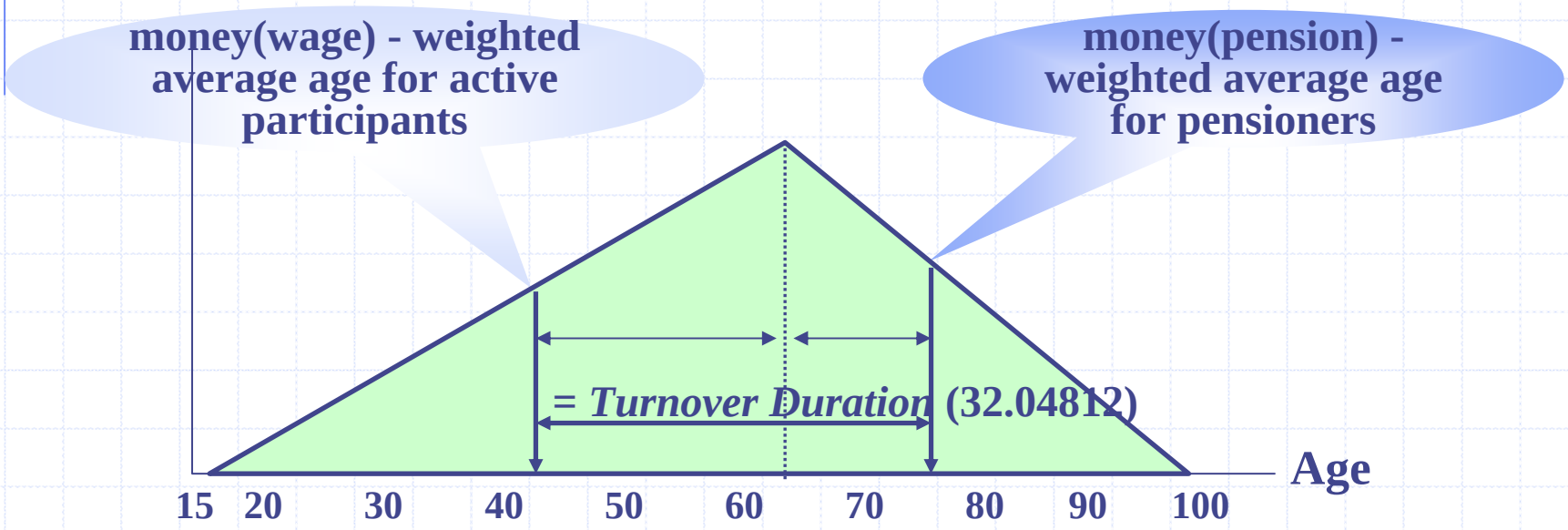


Theoretical Background for the Balance Sheet

Definition of "Turnover Duration"

$$\bar{x}_a = \frac{\int_0^{\omega} x \cdot l_x \cdot e^{-\delta \cdot x} \cdot A_x \cdot W_x dx}{\int_0^{\omega} l_x \cdot e^{-\delta \cdot x} \cdot A_x \cdot W_x dx}$$

$$\bar{x}_p = \frac{\int_0^{\omega} x \cdot e^{-(\delta+\varphi) \cdot x} \cdot l_x \cdot R_x dx}{\int_0^{\omega} e^{-(\delta+\varphi) \cdot x} \cdot l_x \cdot R_x dx}$$



$$TD = \bar{x}_p - \bar{x}_a$$

Theoretical Background for the Balance Sheet

Actuarial Liability V=PVFB - PVFC

$$V=\int_0^{\omega} L_0 \cdot l_x \cdot e^{-\delta \cdot x} \int_x^{\omega} {}_{u-x|}p_x \cdot e^{-(\delta+\rho)(u-x)} \cdot \left[R_u \cdot k \cdot \overline{W} \cdot e^{\rho(u-x)-\varphi(u-r)} - A_u \cdot c \cdot \overline{W} \cdot W_u \cdot e^{\rho(u-x)}\right] du dx$$

$\delta + \rho$: assumed interest rate

k : constant representing benefit level

Annual Contributions(C)

$$C=\int_0^{\omega} L_0 \cdot l_x \cdot e^{-\delta \cdot x} \cdot A_x \cdot c \cdot \overline{W} \cdot W_x dx$$

Rate of Contributions(c)

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

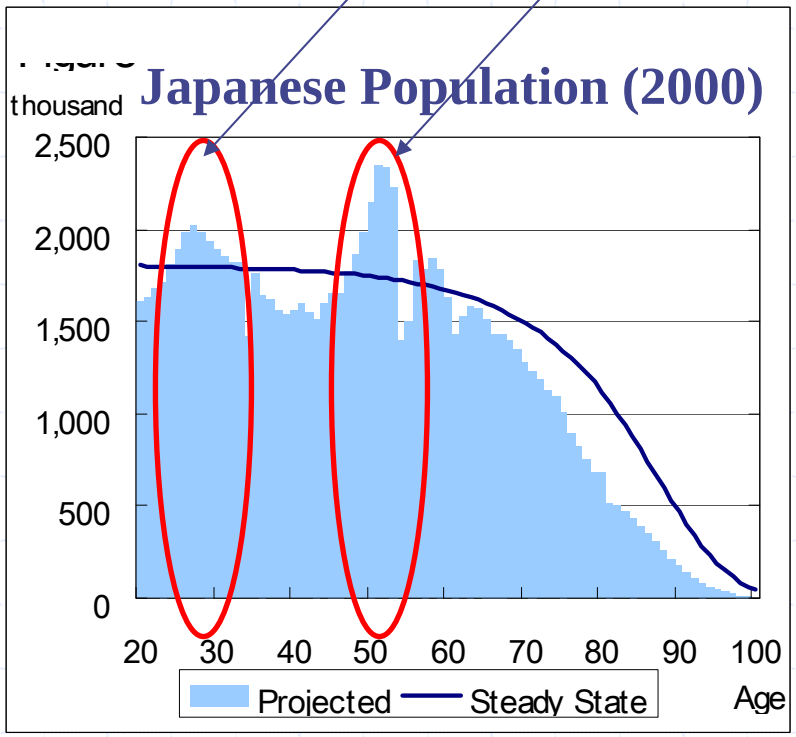
$$\frac{V}{C}=\bar{x}_p-\bar{x}_a=TD \quad \Rightarrow \quad V=C \cdot TD$$

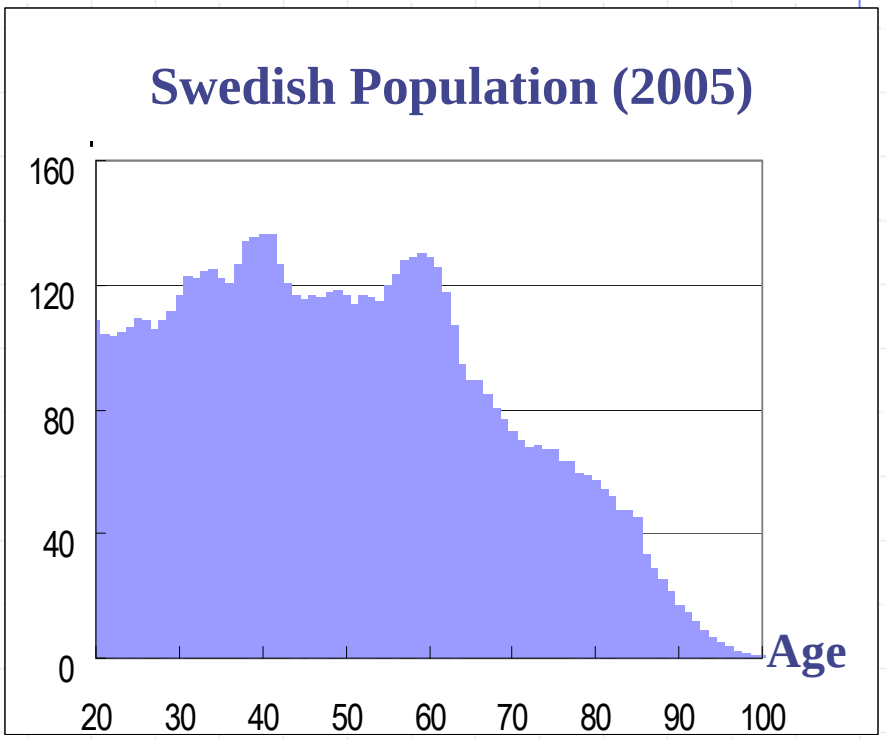
It may be assumed that the scheme can expect future contributions as an inter-generational wealth transfer insofar to "Steady State Pension Liability". Steady State Pension Liability can be easily calculated by using the above equation.

Present Population Structures

Generation Y

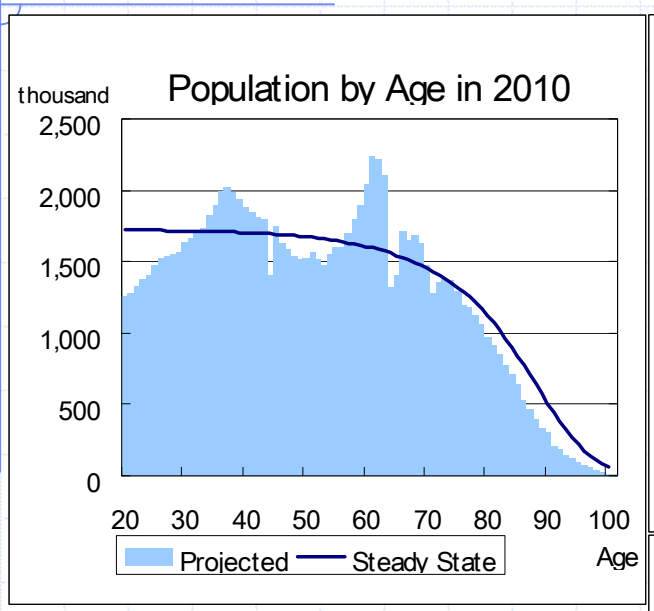
Baby Boomer

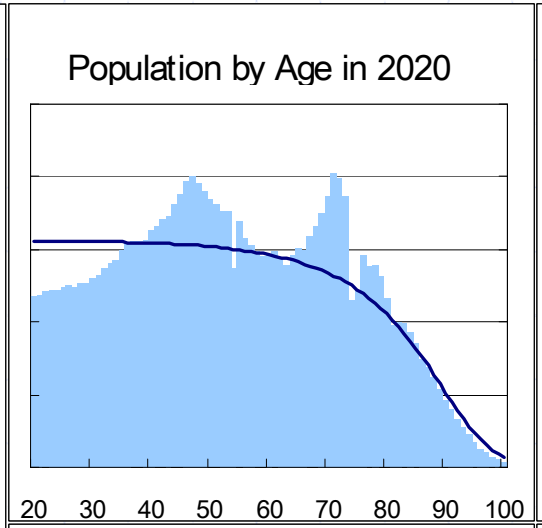


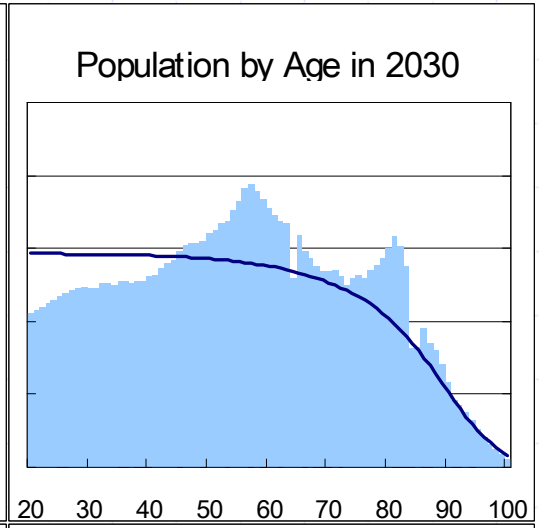


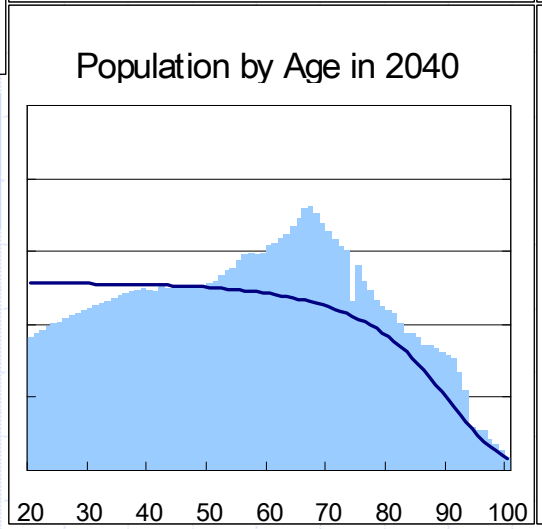
There seems to be no big difference.

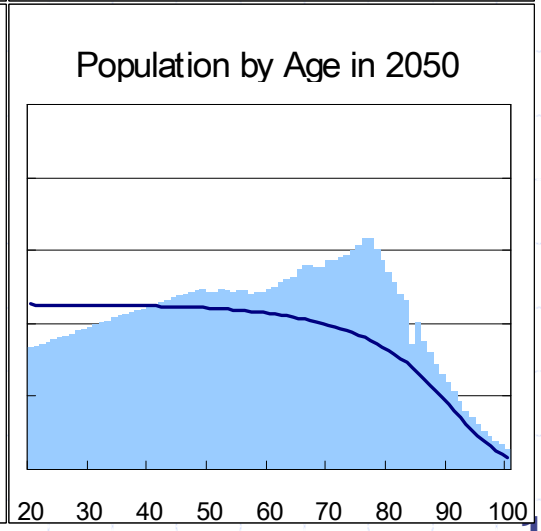
Population Projection in Japan







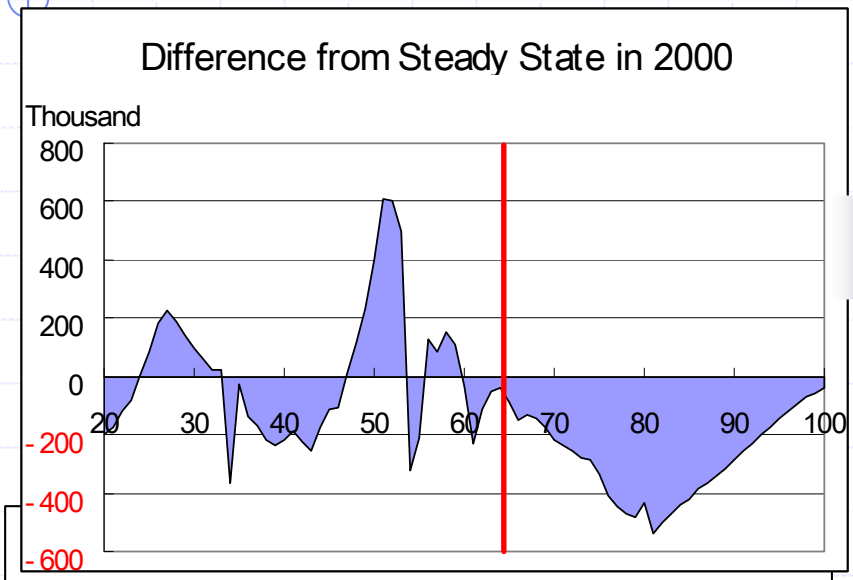


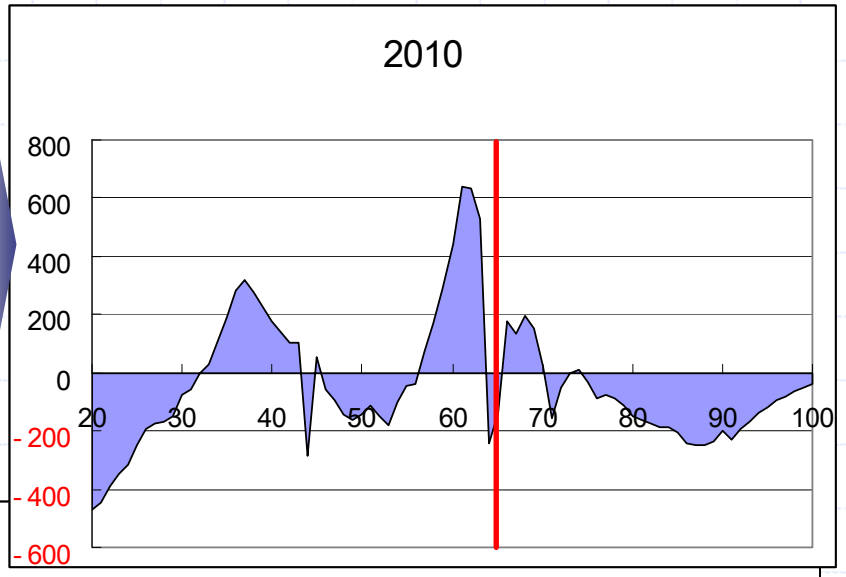


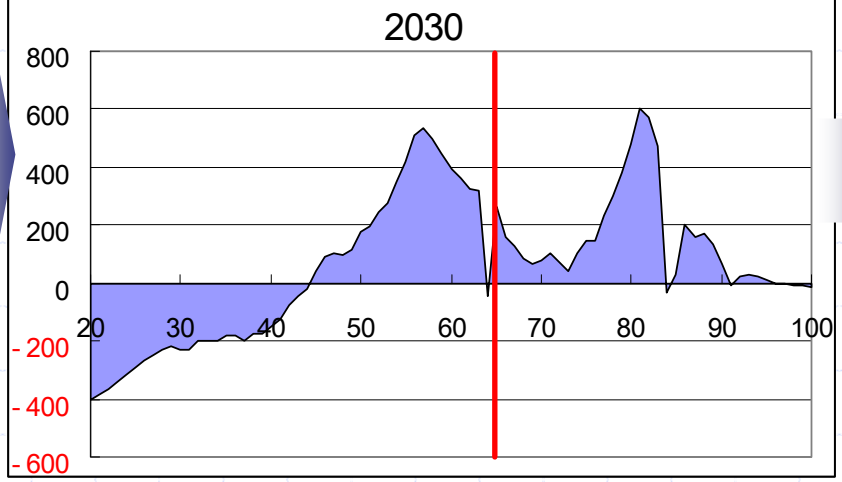
Generation Y will not create any baby boom.

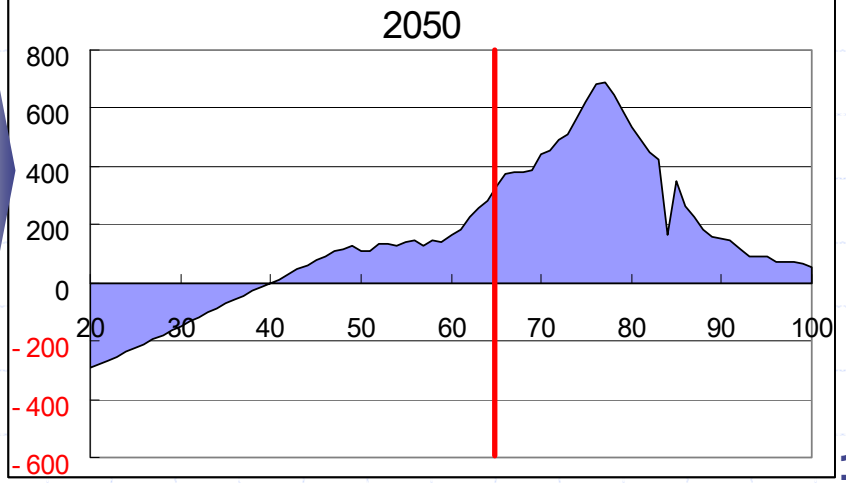
Population Projection in Japan

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

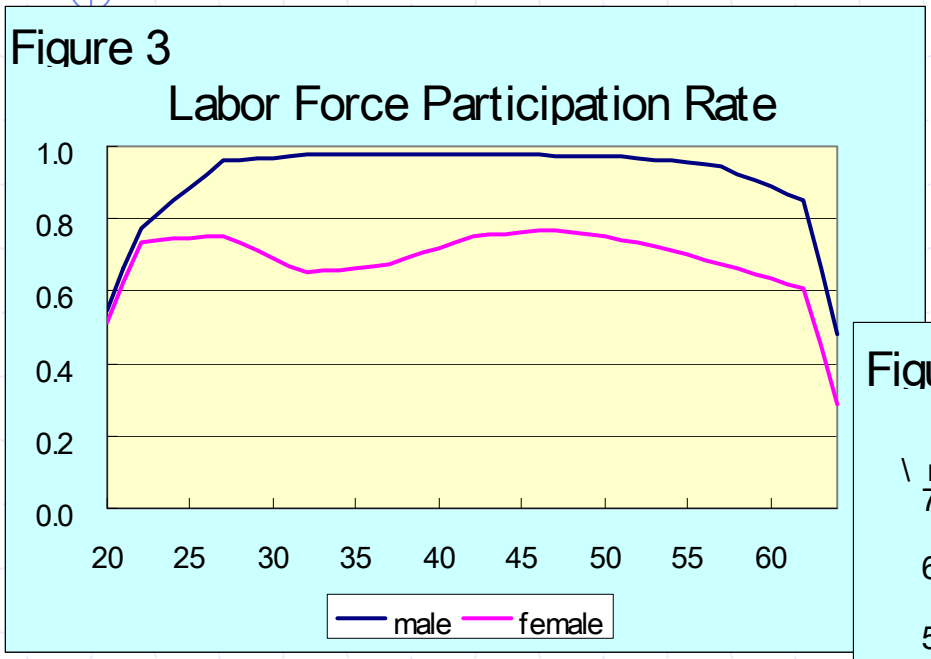
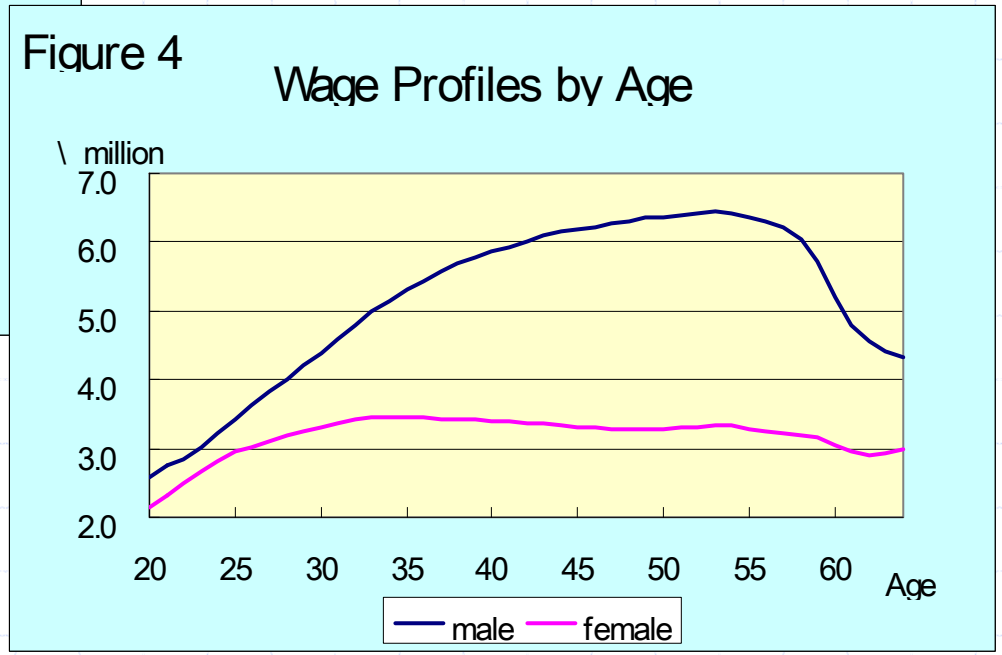


Figure 4

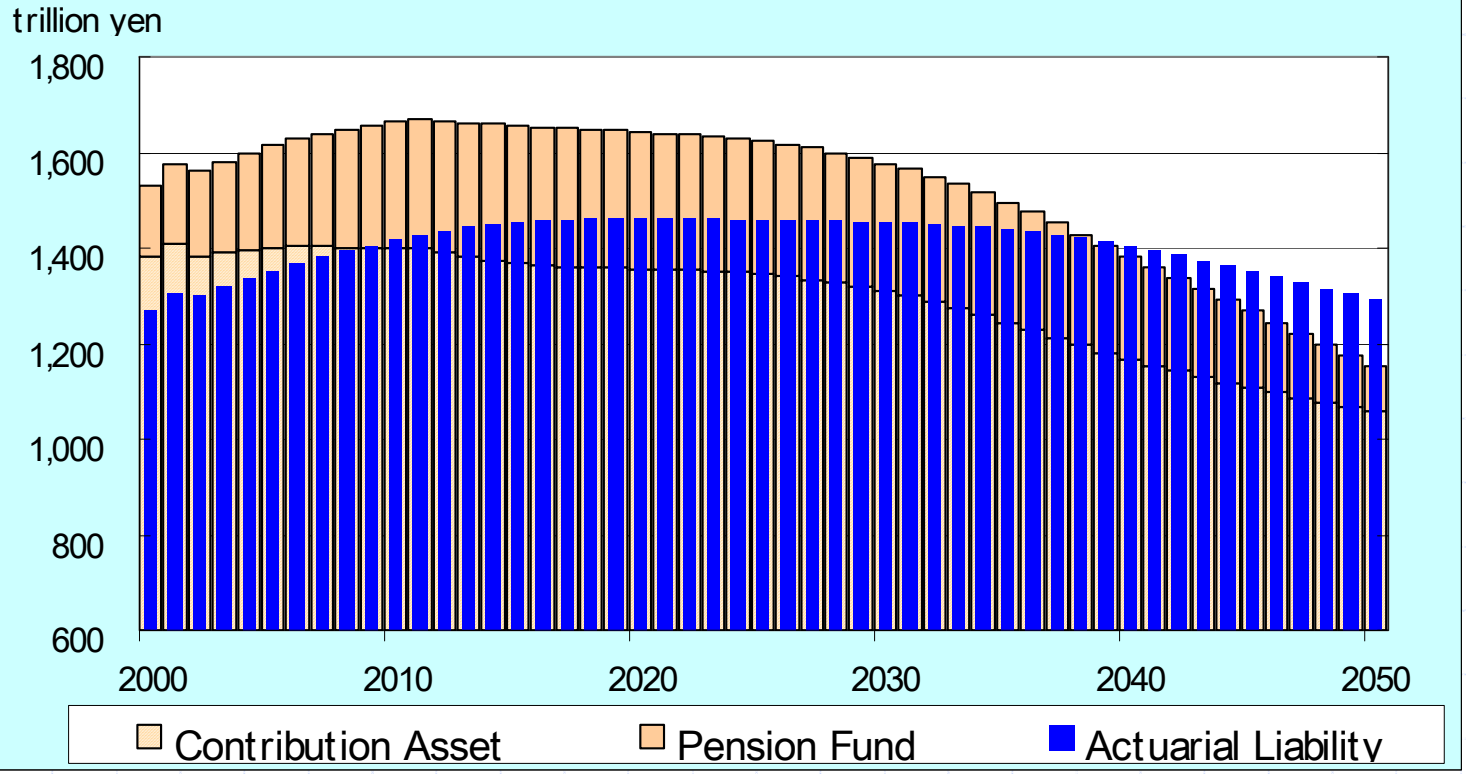


Projection Results

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

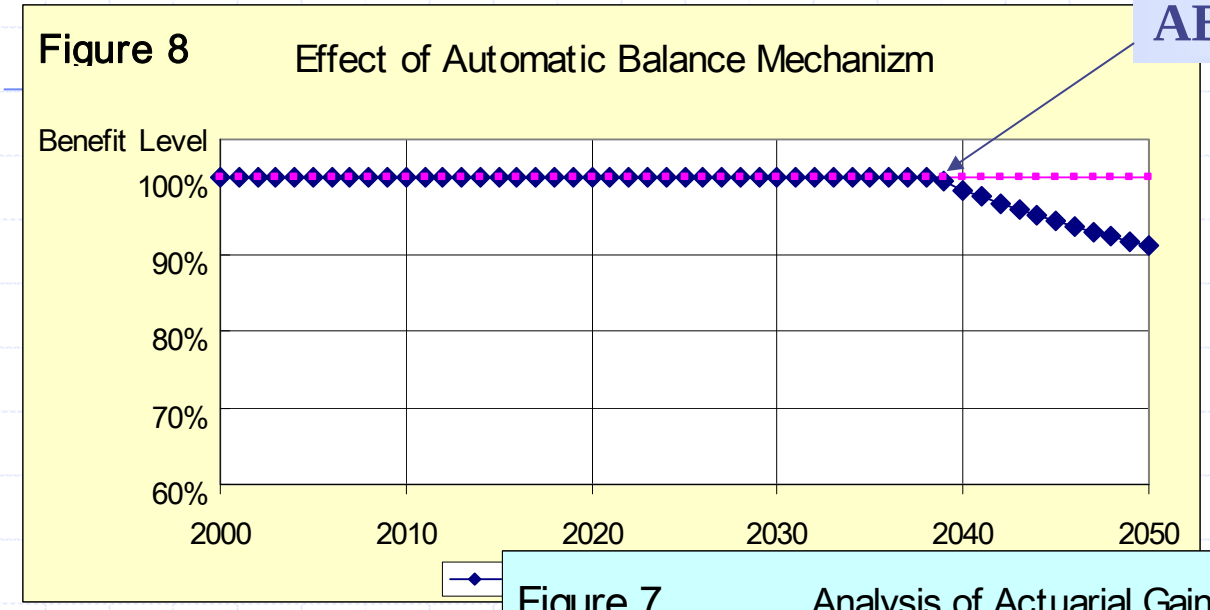
Net of Wage Increase

Figure 5

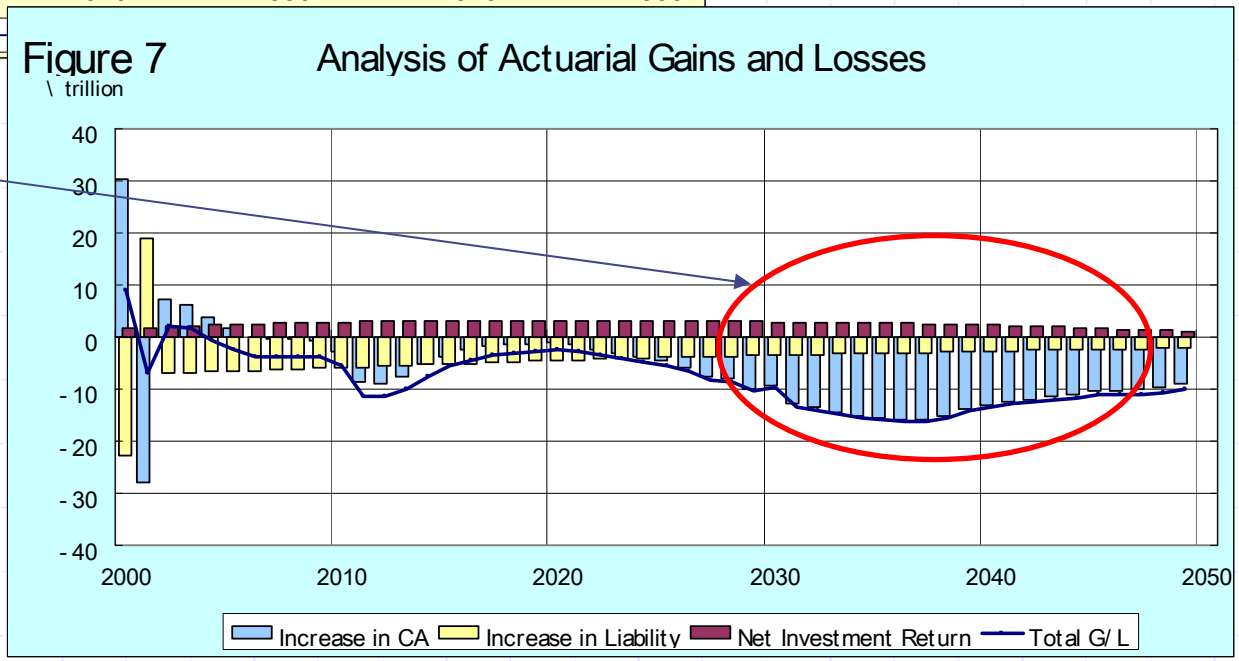


Projection Results

ABM will activate in2039



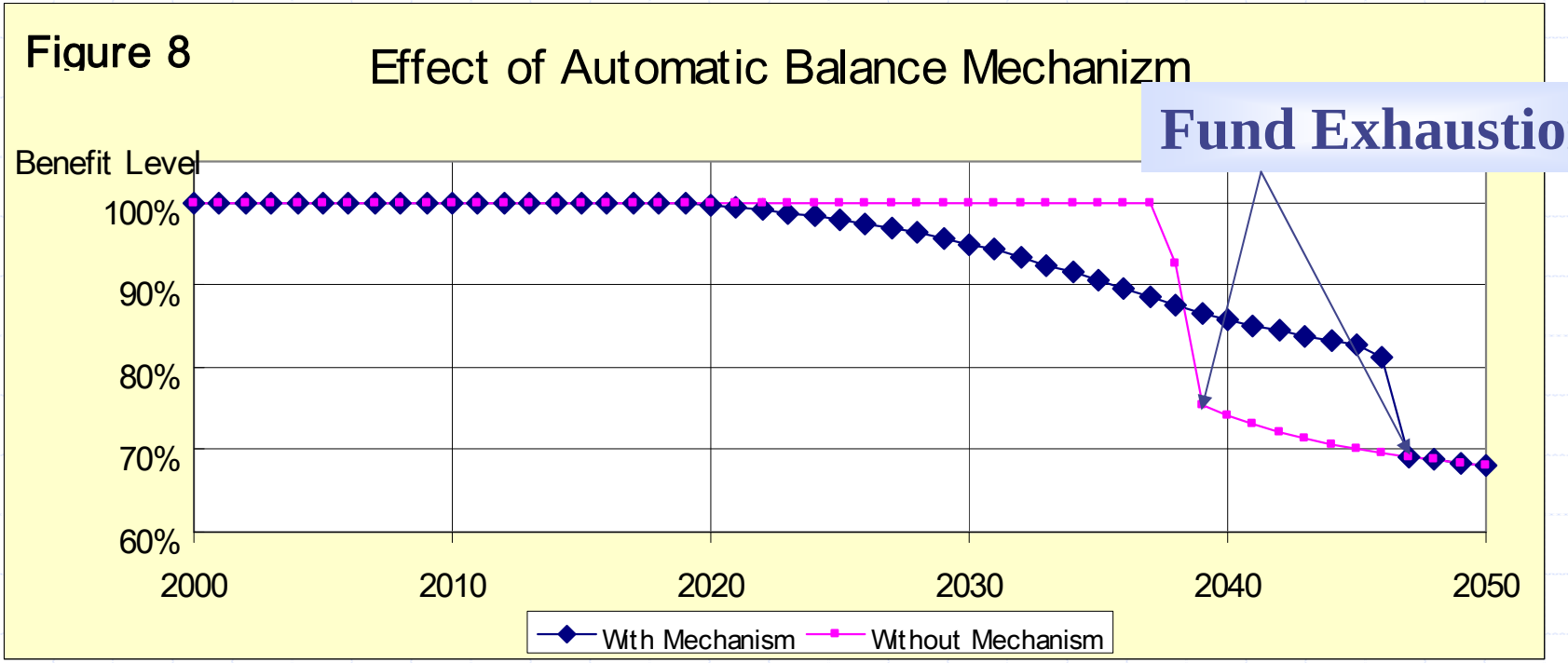
Net CA will decrease severely from 2030s



Projection Results

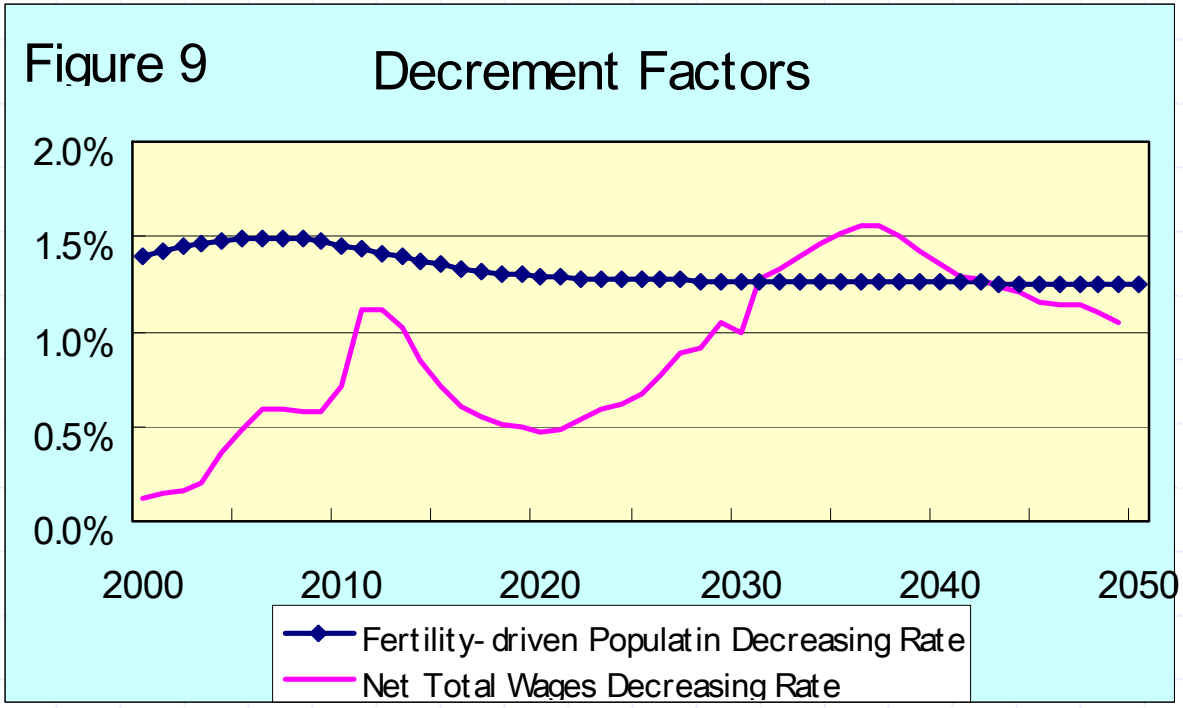
If there is no initial fund, the automatic balance mechanism will not be able to avoid the fund exhaustion for 50year.

Figure 8



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.