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Notional Funding: How an Imaginary Pension Fund Can Help Steer a PAYG System

Ismo Risku

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ABOUT ME

Ismo Risku

Finnish Centre for Pensions

- **Ismo Risku** is a head of planning in Finnish Centre for Pensions, a central organisation of the Finnish earnings-related pension system. He has been working in the Finnish Centre for Pensions since 1999. His responsibilities include long term assessments of the Finnish pension system. He is a Fellow of the Actuarial Society of Finland.

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- Background
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The basic idea of notional funding

- Assume a pension system with well-defined benefit rules, including:
  (a) Information on pensions already accrued
  (b) Accrual rules for present-day workers
  (c) Financing based mostly on PAYG (Pay-As-You-Go) principle
- Given points (a) and (b), it becomes possible to determine the pension liability and calculate the actuarial cost of annual accruals
- A contribution level in notional funding (NF) system consists of two components:
  (a) Full funding contribution, corresponding to the value of the annual accrual
  (b) An additional contribution to compensate for any missing returns on assets
- The NF system aims to avoid unsustainable growth of net liability (liability minus assets)
- The NF system aims to avoid too high or too low pension contributions
- In essence, pension financing is approached as a debt management challenge

General background

- Consider a defined benefit pension system primarily financed by a pay-as-you-go (PAYG) system supplemented with some assets
- Population ageing challenges PAYG financing
- Low real interest rates challenge funding
- These two elements may cause problems, if corrective measures are not implemented consistently and in a timely manner

- Population ageing is the result of:
  - (a) Declining fertility rates
  - (b) Declining mortality rates

- I will focus on the effects declining fertility rates:
  - (a) This serves as a simplifying assumption
  - (b) Furthermore, a sensible response to declining mortality rates might involve an increase in the retirement age and a reduction in annual pension accruals

Specific background in Finland (1/2)

- Over 90% of Finland's pension provision is based on earnings-related mandatory pensions:
  a) The system is defined benefit
  b) Financing is primarily through a PAYG (Pay-As-You-Go) system
  c) Assets approximately equal 8 years of pension expenditure

- Due to the DB principle, contributors bear the risks

- Declining work force is a significant problem
  a) In 2010 total fertility rate was 1,9 and now it is approximately 1,3
  b) Immigration alleviates the problem, but hardly solves it

- There is a desire to increase investment risks to boost expected returns
- While this policy seems sensible, it will also increase the risks transferred to younger generations

Specific background in Finland (2/2)

- In Sweden, contribution rates are fixed while benefits are flexible
- Finnish life expectancy coefficient is adopted from Sweden
  - It adjusts the initial pension levels in accordance with life expectancy
  - In the future, both retirement age and benefit levels will be adjusted in line with life expectancy
- Because of the baby bust, the sustainability of the pension system is facing challenges
- The Finnish government aims to strengthen pension financing through a rule-based adjustment system
  - Specific details are under consideration
- Notional Funding is one rule based system
- So far NF is just a concept
- It is possible that it remains just a concept
- I hope this presentation will clarify the ideas
- All comments, including critical ones, are welcomed!

Notional Funding model

Benefit rules

- To illustrate the NF model, we need specific benefit rules:
  (1) There is only an old-age pension available, starting at the age of 65 years
  (2) The accrual rate is set at 1.5 % per year
  (3) Both accrued pensions and pension in payment are indexed to consumer prices

- Real world benefit rules tend to be much more complex

- However, simple benefit rules are useful when seeking to understand how financing rules operate

The basic idea formally (1/3)

The liability of the system L_i evolves according to the equation:

$$(1) \qquad L_1 = L_0(1+i) - e_1 + \Delta_1$$

Where

i is the interest rate,

e_1 is the pension expenditure on year 1 and

Δ_1 is the capital value of the accrued pensions during the year 1.

The assets of the system A_i evolve as follows:

$$(2) \qquad A_1 = A_0(1+i) - e_1 + c_1^f + c_1^a$$

Where

c_1^f is the full funding contribution, i.e. $c_1^f = \Delta_1$

c_1^a is the additional contribution

Now, the problem lies in determining the income from the additional contribution c_1^a

The basic idea formally (2/3)

The net debt $L_i - A_i$ evolves according to the equation:

$$L_1 - A_1 = (L_0 - A_0)(1 + i) - c_1^a$$

Let g_1^D be a targeted growth rate of the net debt from period zero to period one, i.e.,

$$L_1 - A_1 = (L_0 - A_0)(1 + g_1^D)$$

Now we can solve the additional contribution c_1^a:

(3) $$c_1^a = (L_0 - A_0)(i - g_1^D)$$

A sensible target growth rate g_1^D should be related to the expected long-run wage bill growth. I will consider the case where g_1^D equals the expected growth of the present value of the wage bill over a 20-year forward-looking window:

$$g_1^D = \frac{\sum_1^{20} \beta^i wage_i}{\sum_0^{19} \beta^i wage_i}$$

Note that the wage bill forecast is based on the observed population

The basic idea formally (3/3)

To sum up, the evolution of the system is defined by

(1) $L_1 = L_0(1+i) - e_1 + c_1^f$

(2) $A_1 = A_0(1+i) - e_1 + c_1^f + c_1^a$

(3) $c_1^a = (L_0 - A_0)(i - g_1^D)$

Where

L_j is the liability (year *j)*

A_j are the assets

e_j is the pension expenditure on year *j* and

c_j^f is the full funding contribution

c_j^a is the additional contribution

g_j^D is the desired growth rate of net liability

i is the interest rate

The legacy cost and the additional contribution

- PAYG systems lacks assets or have assets that are in sufficient to cover liabilities
- The absence of assets implies a lack of asset income
- This missing asset income is the legacy cost of the PAYG system
- The additional contribution is equal to this legacy cost

Partial funding as a reference model

- As a reference model, a partial funding (PF) is studied:
  (1) A specific fraction (30% in our case) of pension benefits are prefunded
  (2) The rest is financed through a strict PAYG-method
  (3) If realised return deviates from the assumed return, a retrospective approach is applied

- Everything else, including benefits, population and the economy, remains identical under NF and PF

Population and economy

- In order to generate numerical results a population and an economy are required

- Population
  (1) The mortality rate is zero until the age of 85, after which everyone dies
  (2) Initially, the population size is equal for each cohort
  (3) There is no migration
  (4) We study outcomes under various fertility assumptions

- Economy
  (1) Working begins at the age of 20 and continues until retirement
  (2) The wage profile in the next slide
  (3) The growth rate of real wages is 1.2% per year
  (4) The contribution rate does not affect wages (in a more realistic setting this should be considered)
  (5) A risk-free real interest rate of 3% is assumed, but the actual returns on pension assets may deviate from this

The wage profile

7 scenarios

Scenario 1: Constant population, no return deviations

- This is the simplest illustration
  (1) The fertility rate is 2 (implying no population growth nor decline)
  (2) The asset return equals the riskless rate (3 %)

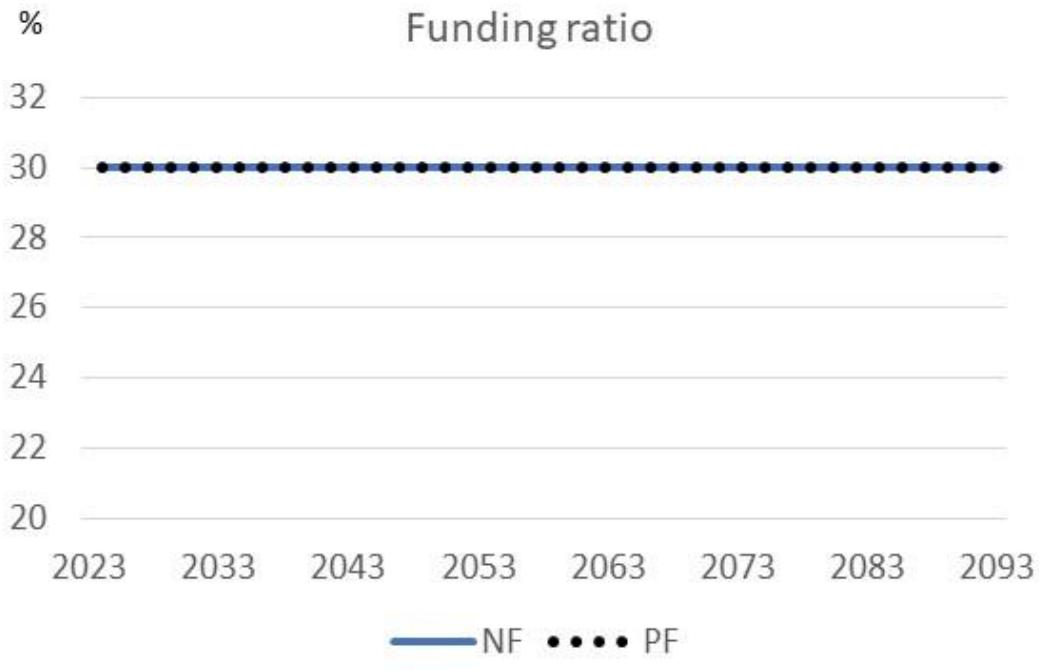
- Essentially, nothing changes as time passes

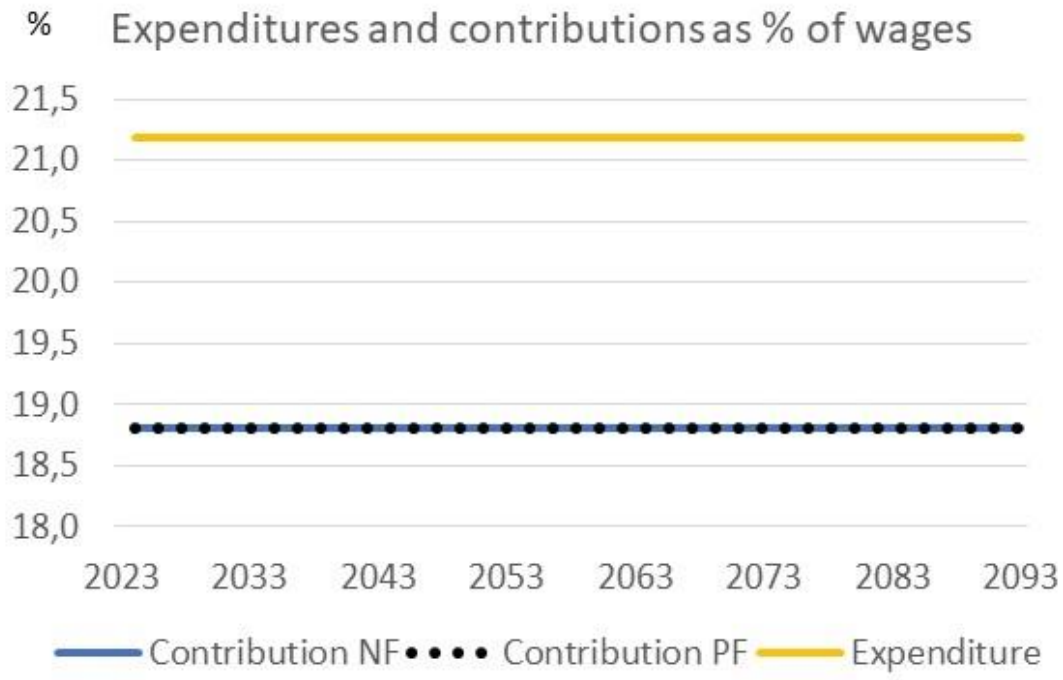
- NF and PF deliver <u>almost</u> identical outcomes:
  (1) Expenditures 21.2% relative to wages
  (2) Contributions 18.8% relative to wages
  (3) Funding ratio 30 %

- However, there are some differences:
  (1) The age profile of the contribution rate will be different
  (2) Intergenerational transfers will be different

Scenario 1: Constant population, no return deviations

Note: the first simulation year is 2024 in all illustrations



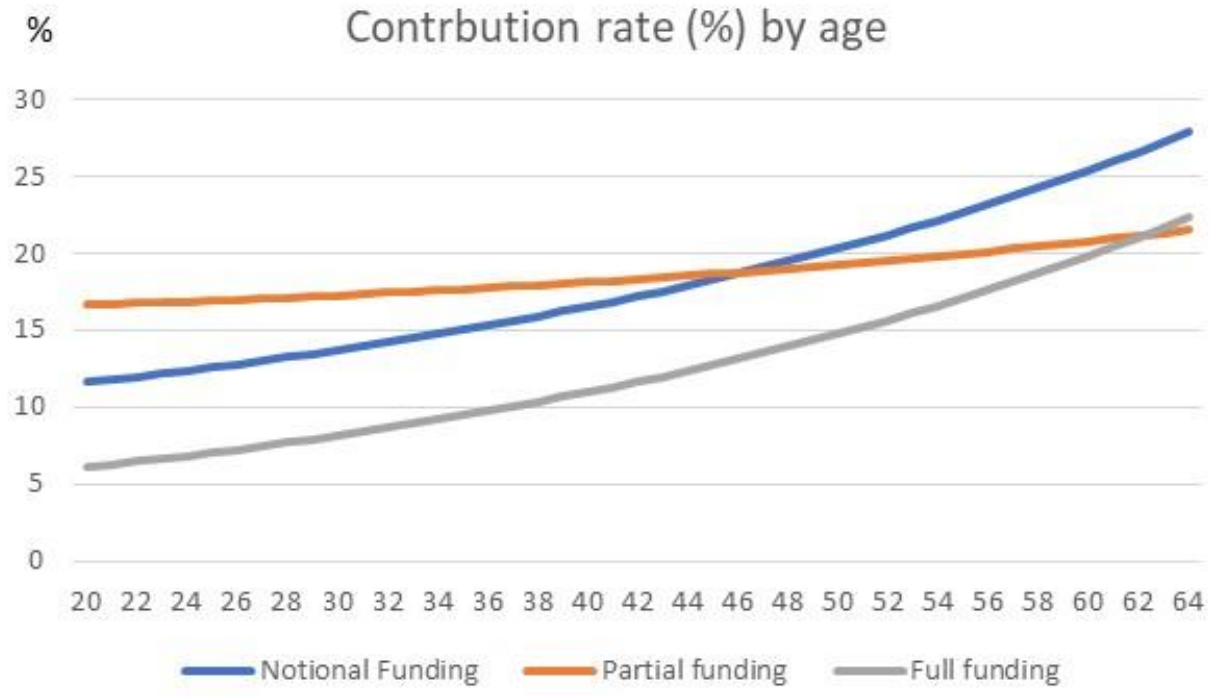


Scenario 1: Constant population, no return deviations

Contribution rate by age

- The contribution rate by age is steeper under NF than under PF
  - In NF, contribution equals full funding contribution plus constant additional contribution
  - In PF, contribution equals 30 % of full funding contribution plus constant PAYG-contribution

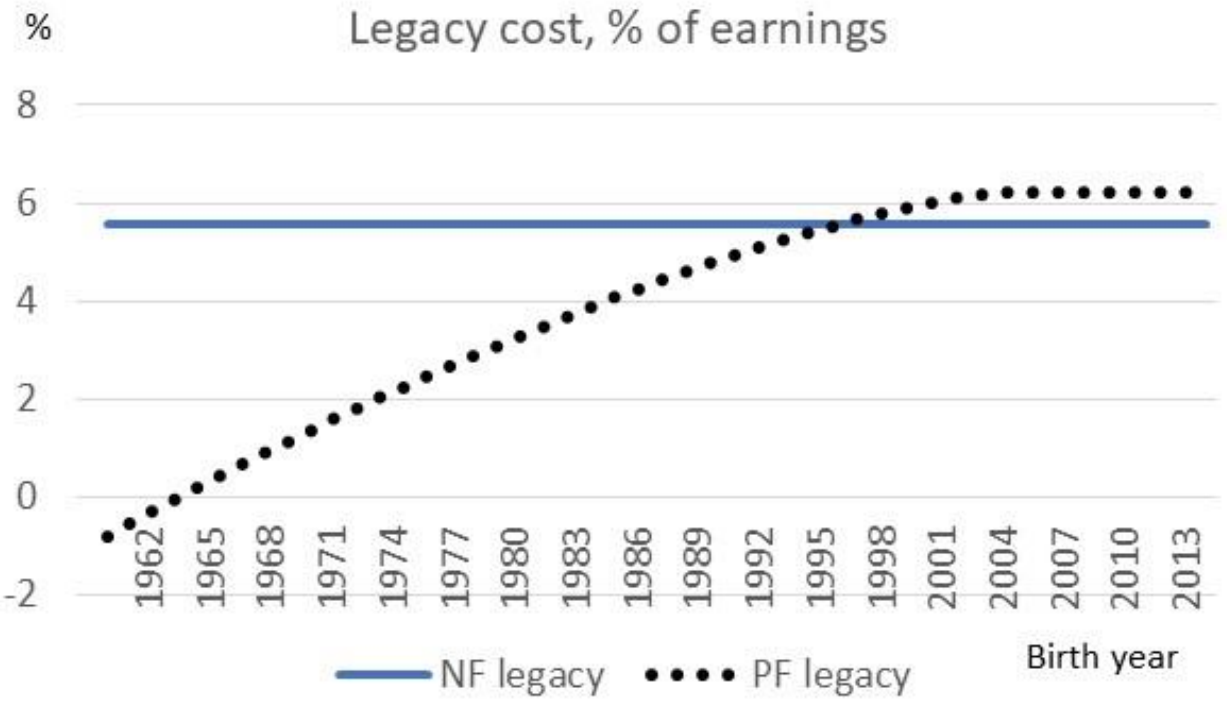
- The difference between the full funding contribution and actual contribution is the legacy cost
  - Under NF, it isn't age related
  - Under PF, it is highest for the youngest



Scenario 1: Constant population, no return deviations

Intergenerational effects

- Benefits are identical under NF and PF
- Therefore we may focus on contributions
- More precisely: the figure displays the present value of the lifetime additional contribution relative to the present value of the lifetime earnings
- This calculation is forward-looking, considering only the future lifetime from 2024 onwards while ignoring the past
- In this scenario, the generational effect arises due to different age profiles of contributions
- In the following scenarios, the average contribution rate in any given year may also differ between NF and PF



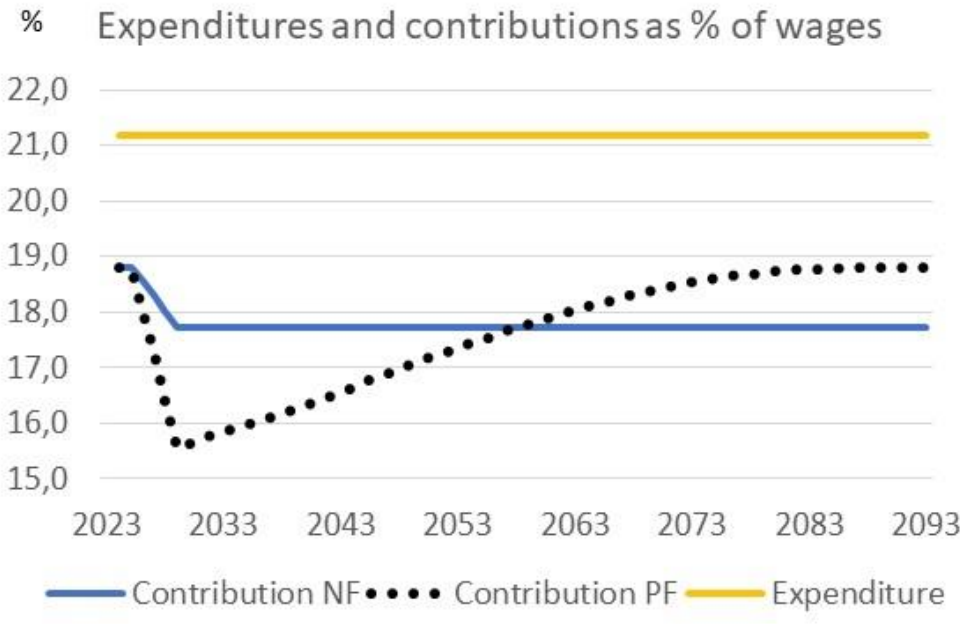
Scenarios 2 and 3: transitory return deviations

Assumptions:

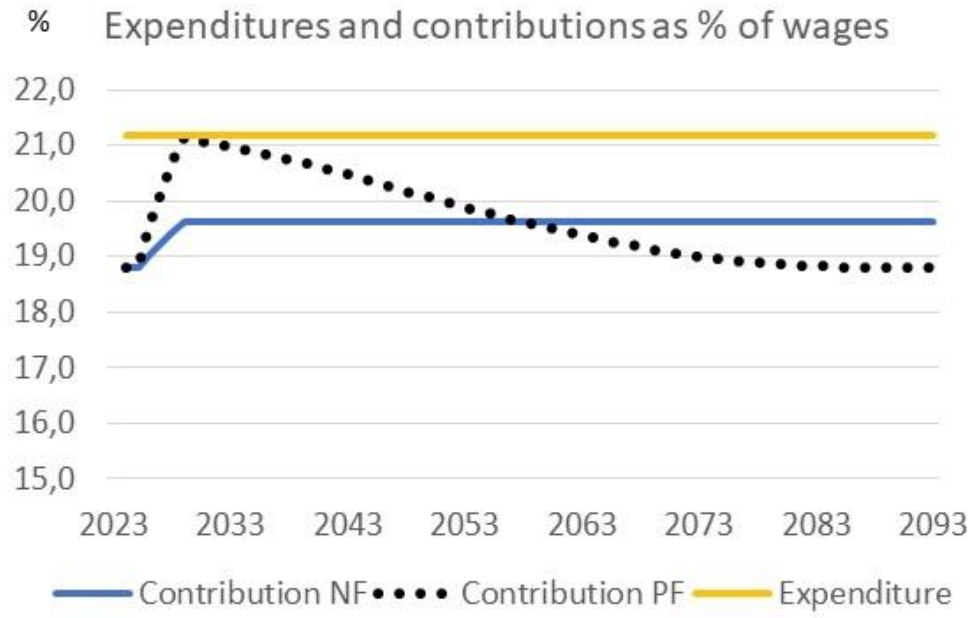
(1) the fertility rate is 2
(2) the asset return is + 13 % or - 7 % during 2025-2028
(i.e. +/- 10 pp. deviation for 4 years)

Scenarios 2 and 3: transitory return deviations

High return (13 %) yrs. 2025-2028

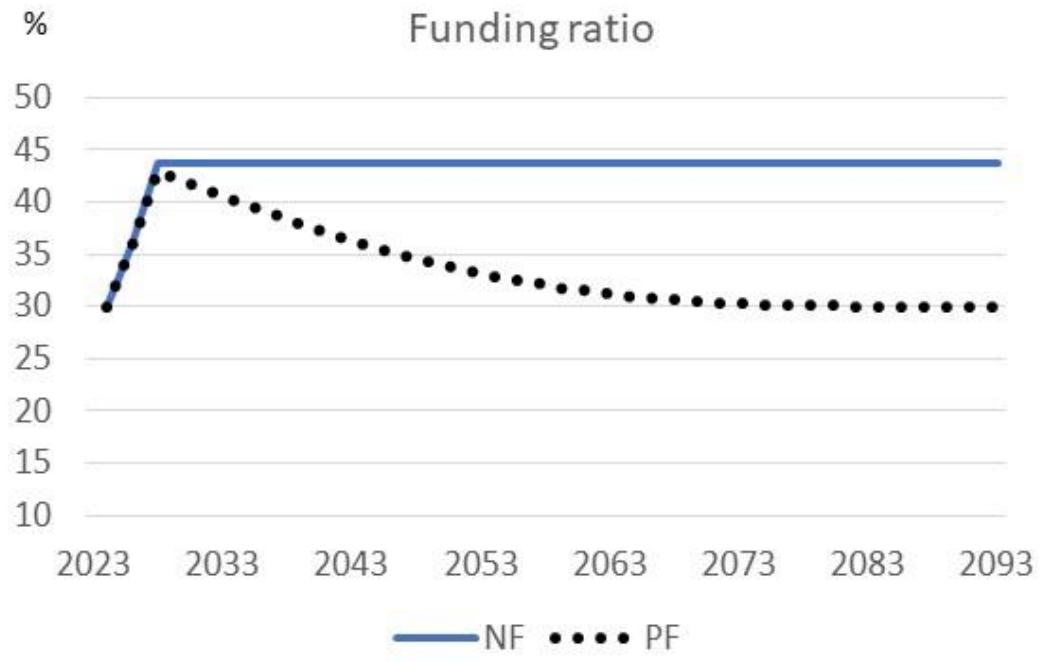


Low return (-7 %) yrs. 2025-2028

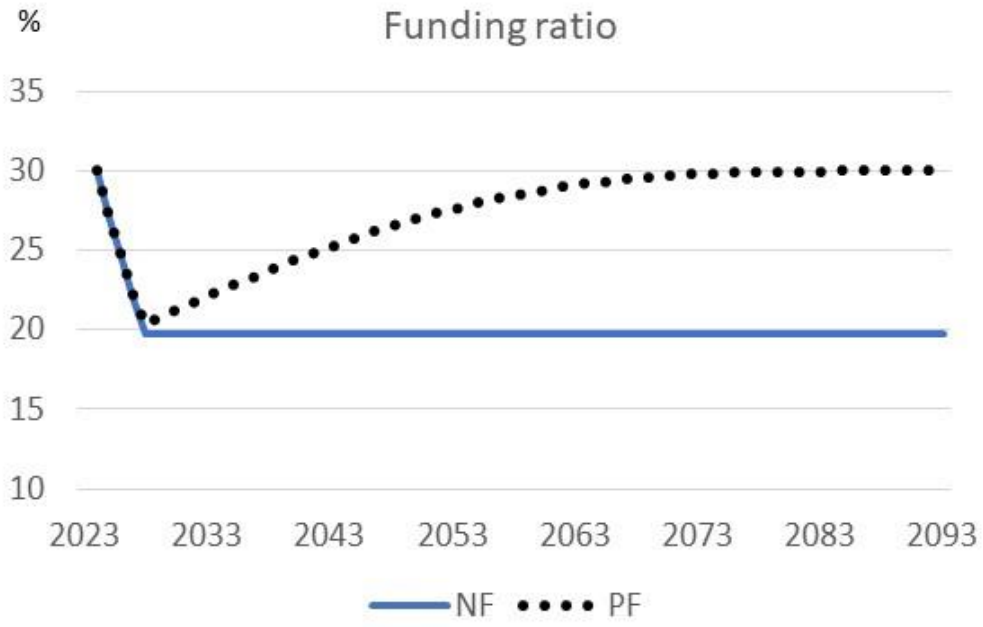


Scenarios 2 and 3: transitory return deviations

High return (13 %) yrs. 2025-2028

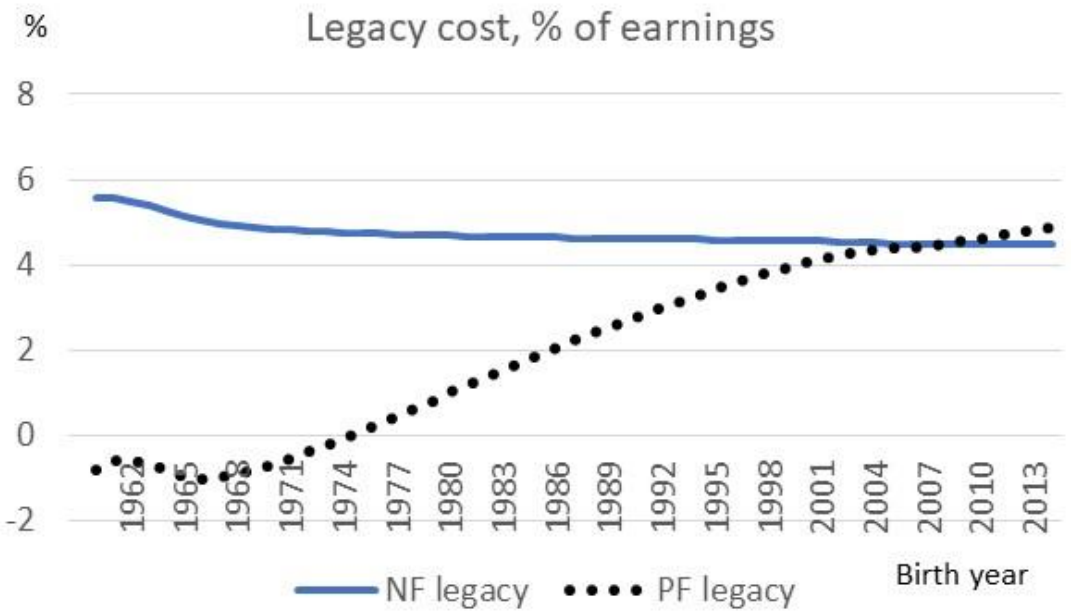


Low return (-7 %) yrs. 2025-2028

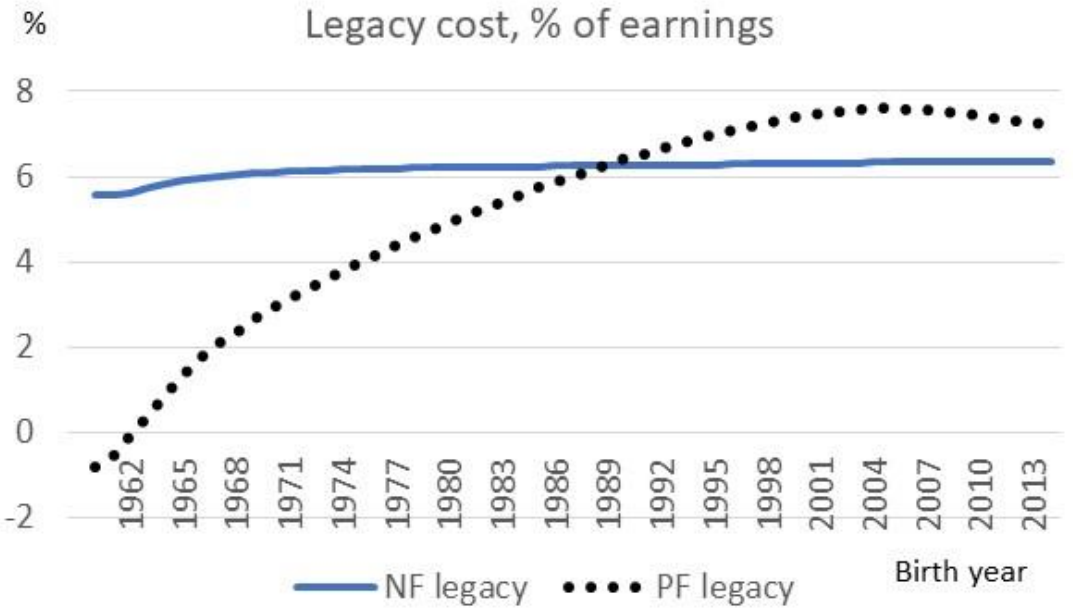


Scenarios 2 and 3: transitory return deviations

High return (+ 13 % for 4 years)



Low return (-7 % for 4 years)



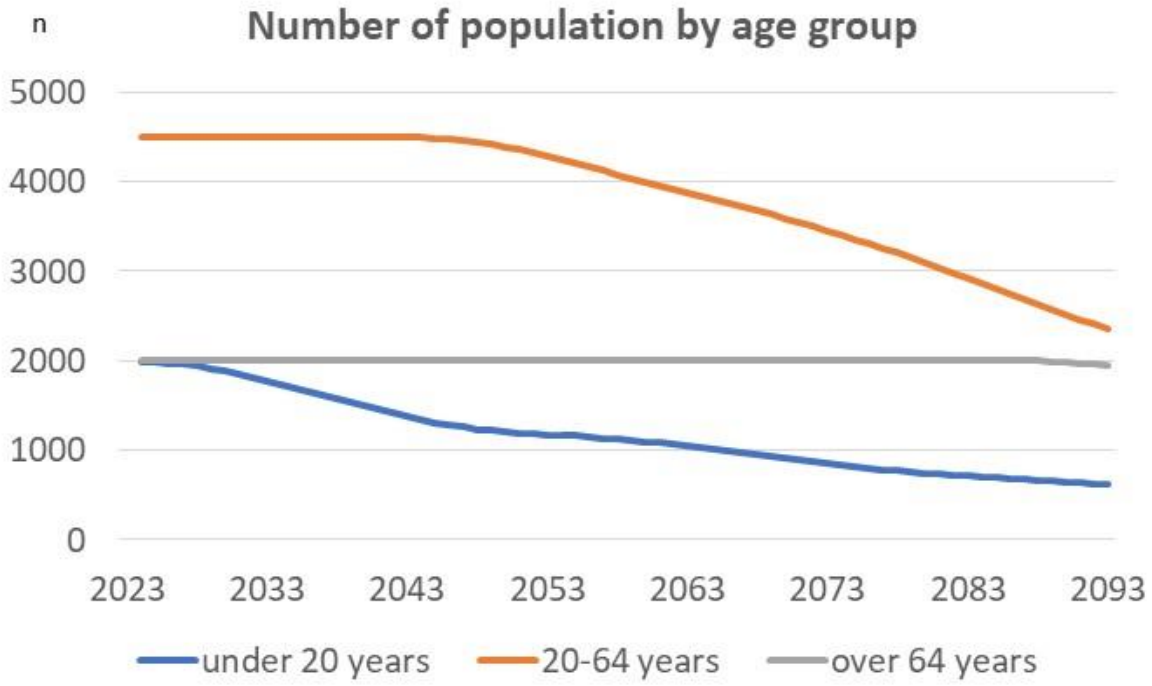
Scenarios 4 and 5: low fertility

Assumptions:

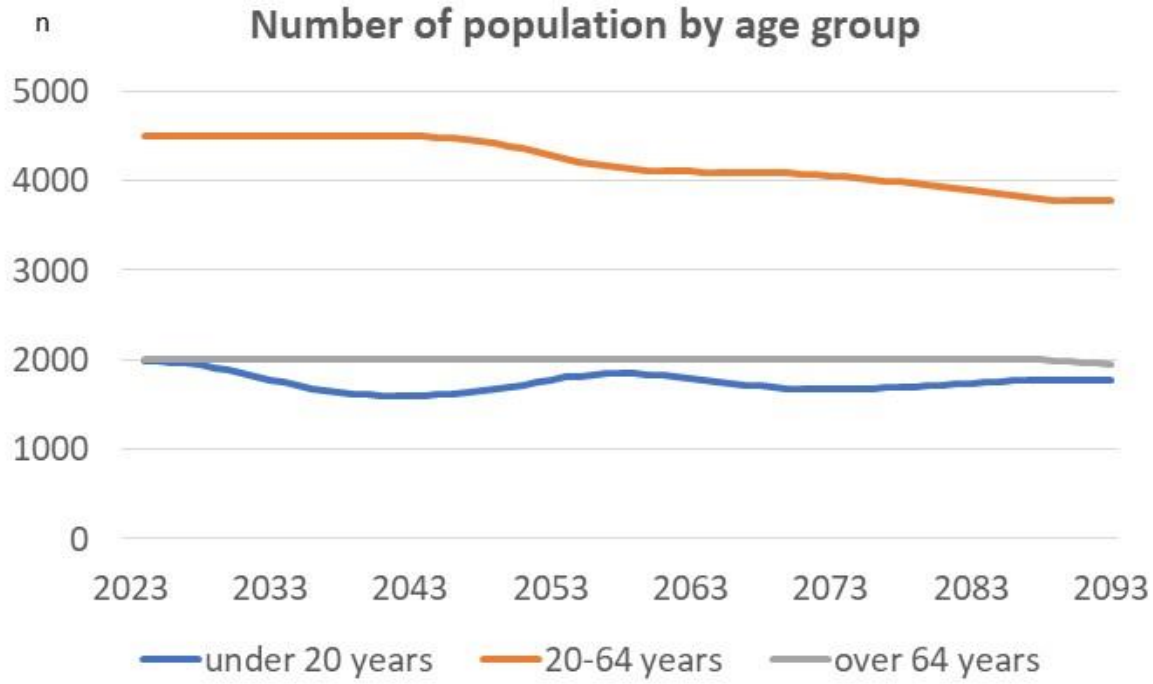
(1) the fertility rate drops from 2 in 2023 to 1,2 by 2033 an
   a) is 1,2 thereafter
   b) returns to 2 by 2043
(2) the asset return is 3 %

Scenarios 4 and 5: fertility

Constant low fertility (TFR 1,2)

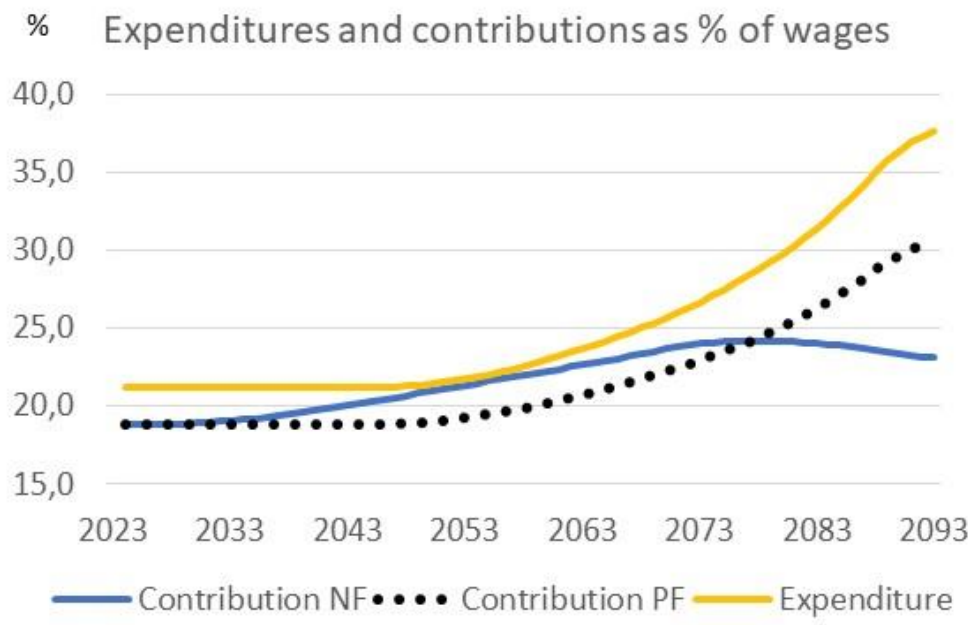


Transitory fertility shock

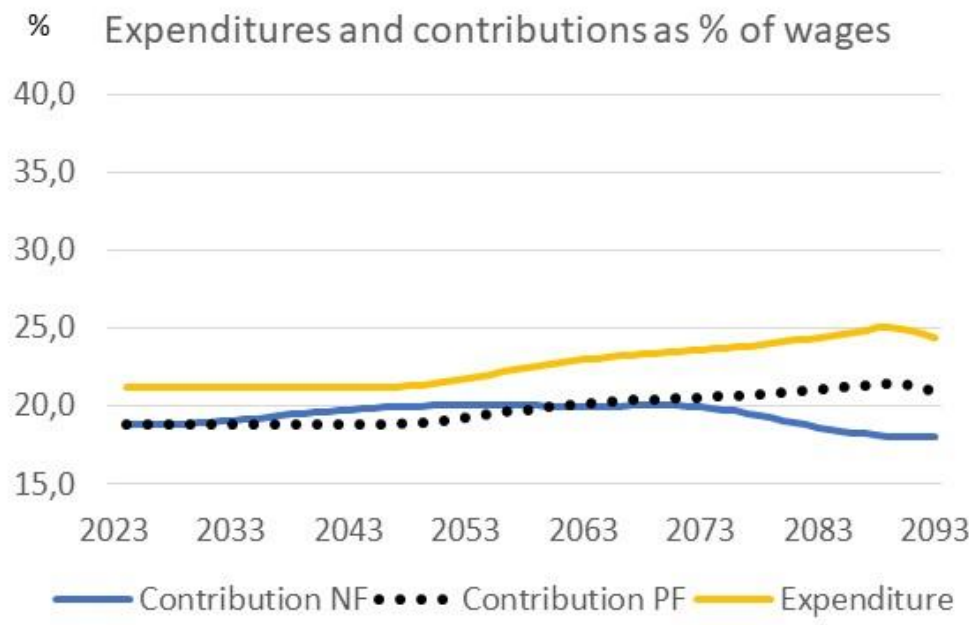


Scenarios 4 and 5: fertility

Constant low fertility (TFR 1,2)

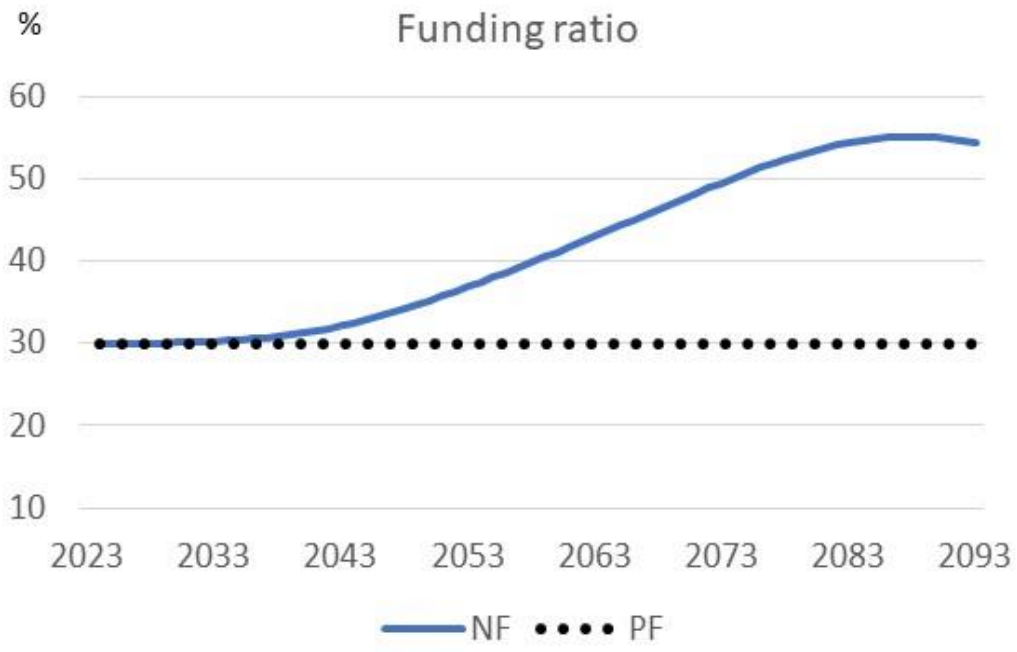


Transitory fertility shock

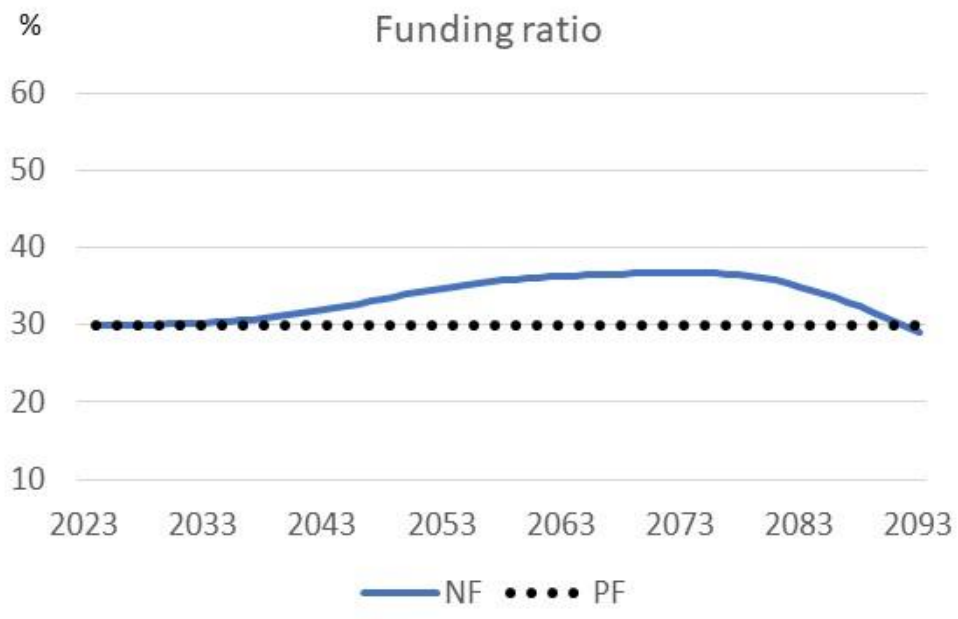


Scenarios 4 and 5: Funding ratio & fertility

Constant low fertility (TFR 1,2)

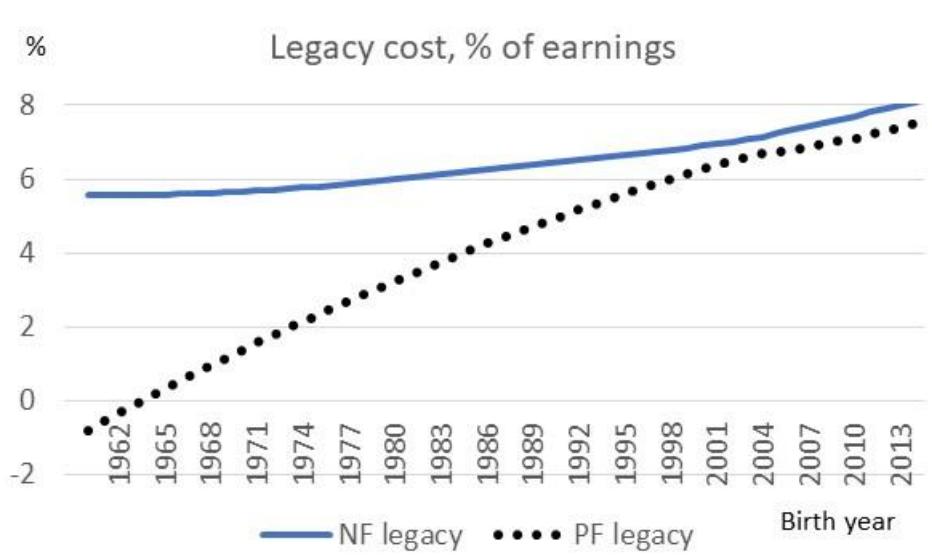


Transitory fertility shock

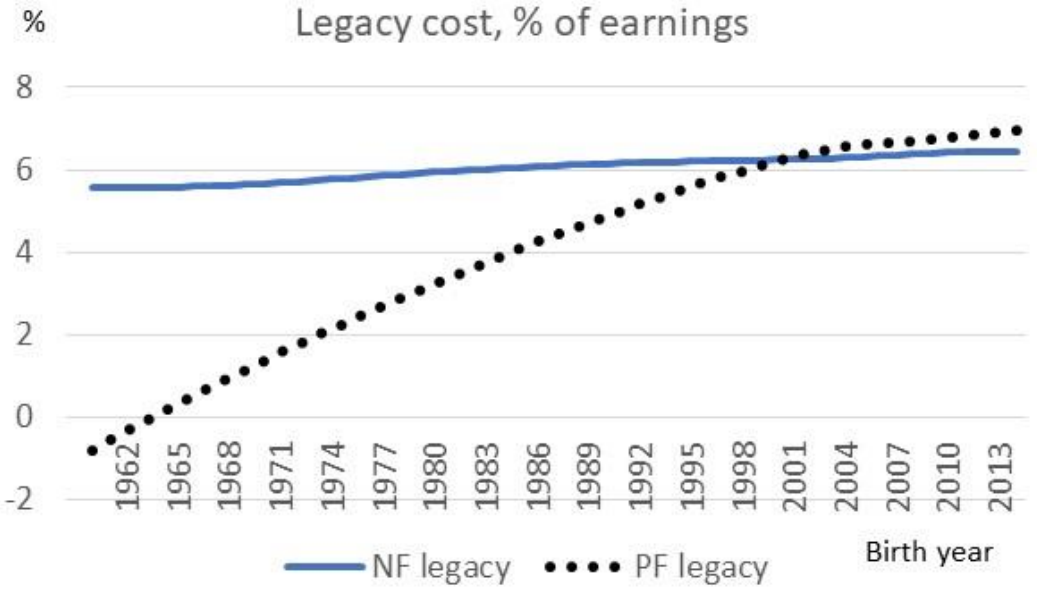


Scenarios 4 and 5: fertility

Constant low fertility (TFR 1,2)



Transitory fertility shock



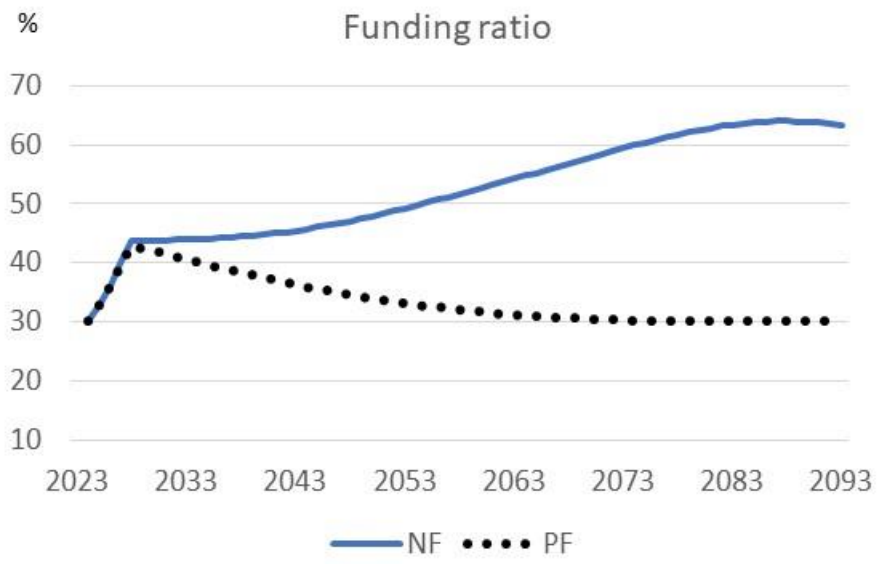
Scenarios 6 and 7: low fertility with return deviations

Assumptions:

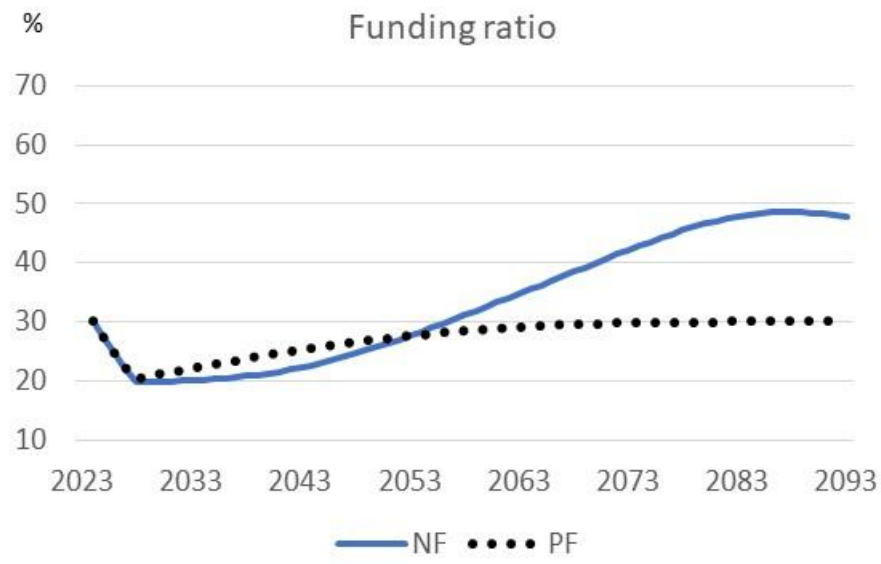
(1)the fertility rate drops to 1,2 by 2033 and stays constant
(2)the asset return is + 13 % / - 7 % during 2025-2028

Scenarios 6 and 7: Funding ratio

Low fertility and high return

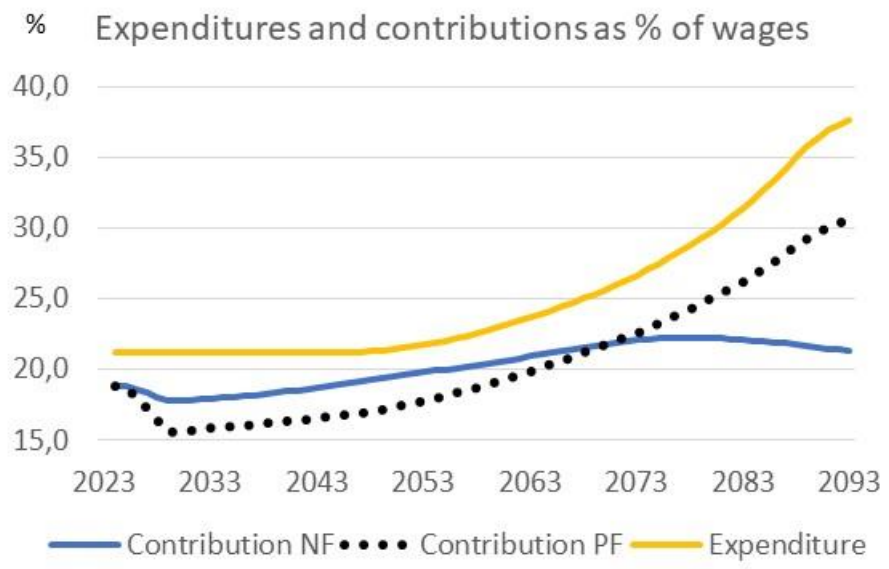


Low fertility and low return

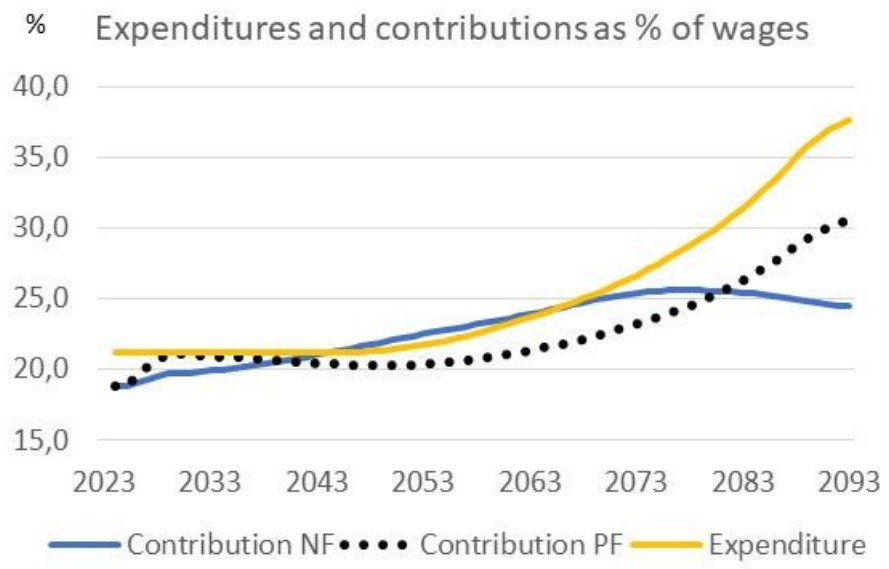


Scenarios 6 and 7: expenditure and contribution

Low fertility and high return

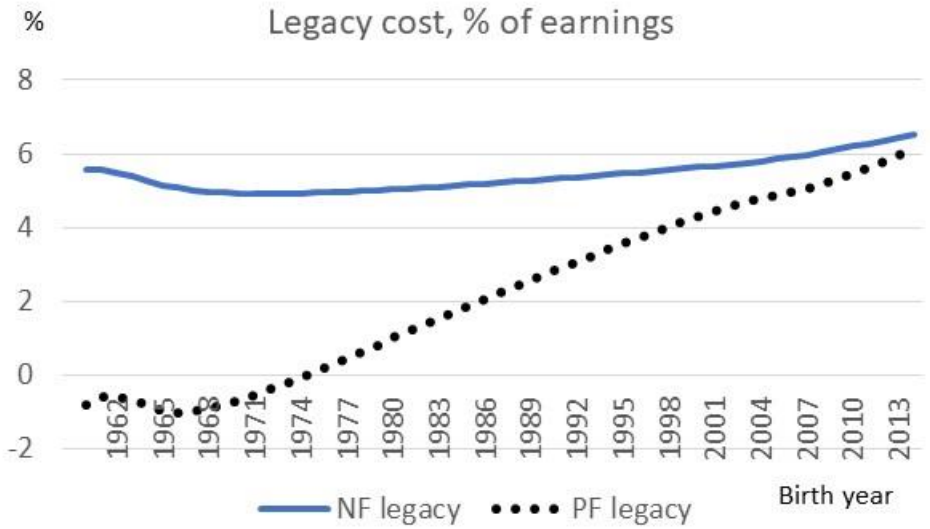


Low fertility and low return

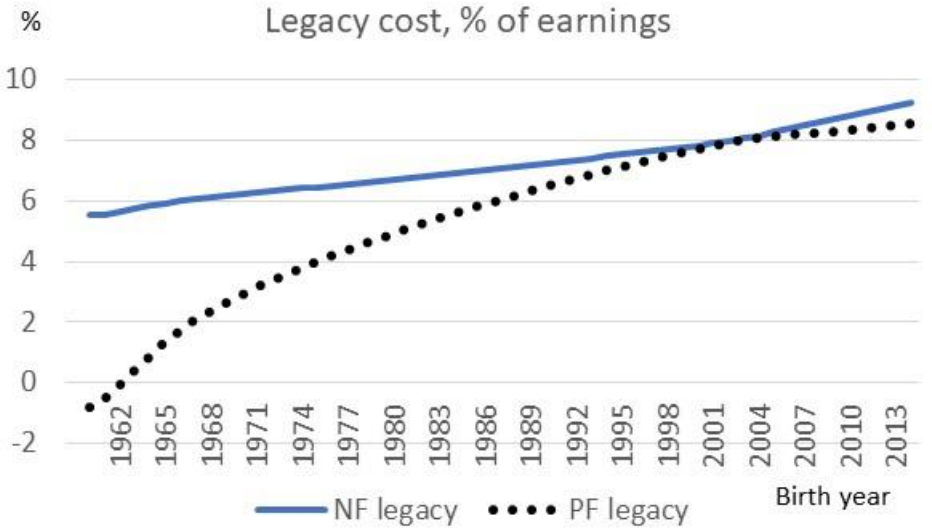


Scenarios 6 and 7: legacy cost

Low fertility and high return



Low fertility and low return



Benefit adjustment

Notional funding with benefit adjustment (1/2)

To reiterate, the evolution of assets and liabilities is defined as follows:

$$(1) \qquad L_1 = L_0(1+i) - e_1 + c_1^f$$

$$(2) \qquad A_1 = A_0(1+i) - e_1 + c_1^f + c_1^a$$

Where c_j^a is the additional contribution needed to finance the legacy cost

This additional contribution could come from various sources

One particular source is pension benefits

Next, I will study one specific rule for distributing the legacy cost among contributors and beneficiaries

Notional funding with benefit adjustment (2/2)

I will split the needed additional financing (c_1^a) to three components

$$c_1^a = c_1^{ac} + c_1^{af} + s_1^f \quad (3)$$

c_1^{ac} equals 5.55% of wages or less. It will be less than 5.55% if less is enough. In this case other components are zero. This 5.55 % is somewhat arbitrary, but not entirely. In the scenario 1 this is the required additional contribution.

c_1^{af} is a flexible contribution adjuster

s_1^f is a flexible benefit adjuster

These flexible adjusters are interconnected so that pensioners and contributors face similar adjustments in relative terms, i.e.:

$$\frac{s_1^f}{c_1^{af}} = \frac{e_0}{wage\ bill_0}$$

This is just one illustration. Other possibly more intuitive solutions might exist.

Scenarios 4, 6 and 7

with benefit adjustment

Scenarios 4, 6 and 7 with benefit adjustment

Scenario 4: low fertility

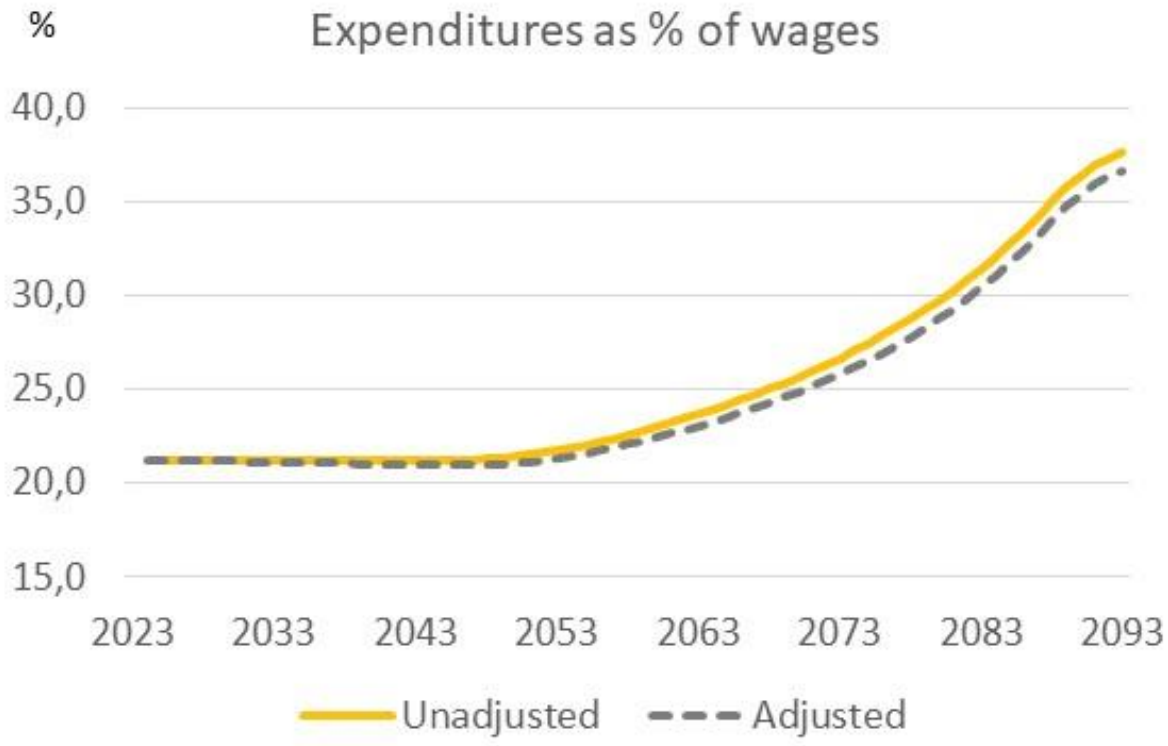
Assumptions:

(1) the fertility rate drops from 2 in 2023 to 1,2 by 2033 and is 1,2 thereafter
(2) the asset return is 3 %

Scenarios 4, 6 and 7 with benefit adjustment

Scenario 4: low fertility

- Benefit adjustment results in modest pension reductions:
- In 2040, the reduction is 1% of benefits
- In 2070s and 2080s, the reduction increases to 3%
- This 3% benefit reduction implies 1%-point reduction in the expenditure ratio

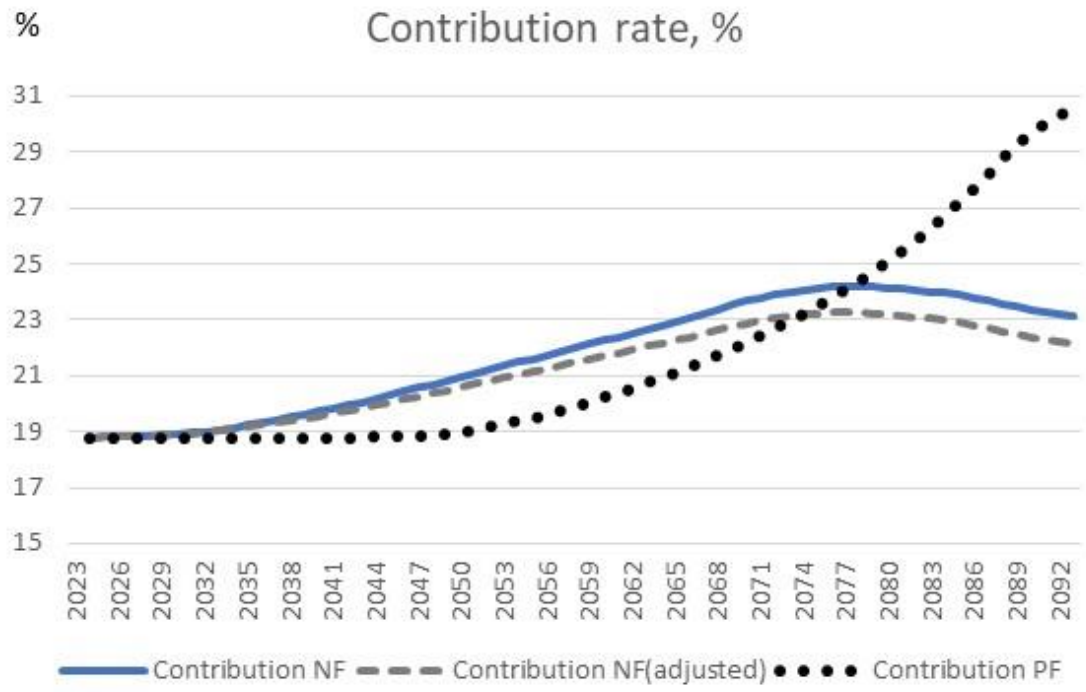


Scenarios 4, 6 and 7 with benefit adjustment

Scenario 4: low fertility

- Benefit adjustment smooths the contribution rate somewhat (there is an equal reduction in contributions as in expenditures)

- However, the difference between the NF and PF contribution is huge

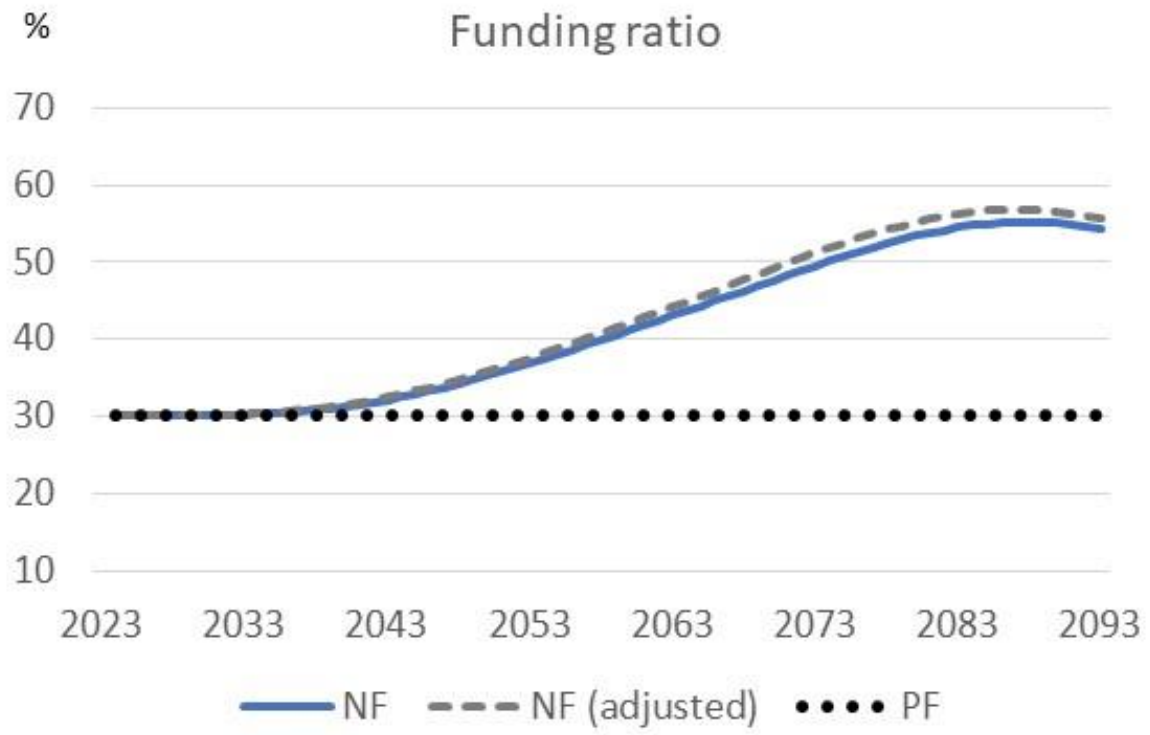


Scenarios 4, 6 and 7 with benefit adjustment

Scenario 4: low fertility

- The benefit adjustment results in a slight increase in the funding ratio
- Liability is calculated here, assuming that the existing benefit reduction applies to all accrued pensions as well

- Intergenerational transfers have become more complicated now, as both contributions and benefits are changing
- I will omit the formal intergenerational results
- However, it is evident that that the benefit adjustment transfers risks to older generations as well



Scenarios 4, 6 and 7 with benefit adjustment

Scenarios 6 and 7: low fertility with return deviations

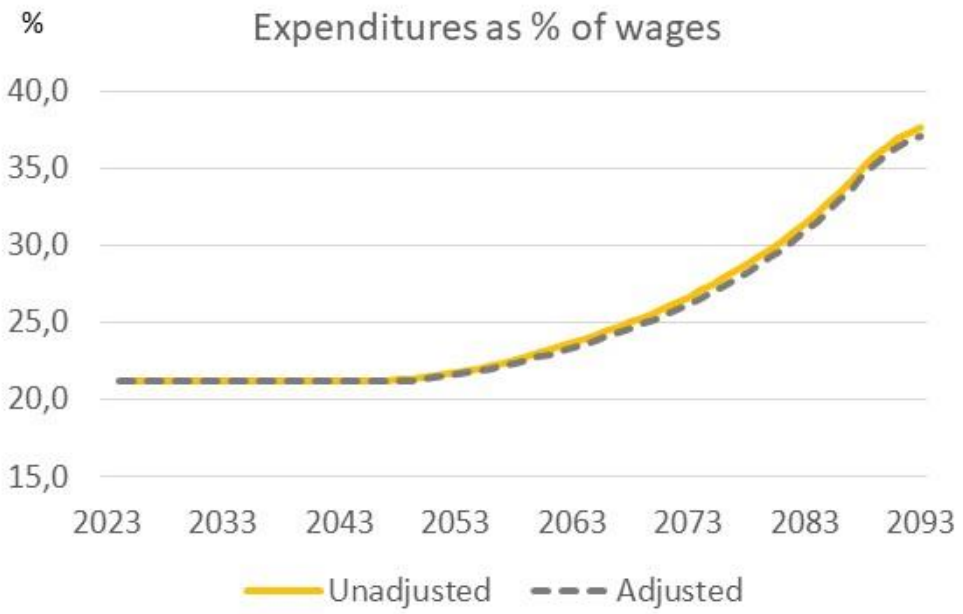
Assumptions:

(1) the fertility rate drops to 1,2 by 2033 and stays constant
(2) the asset return is + 13 % or - 7 % during 2025-2028

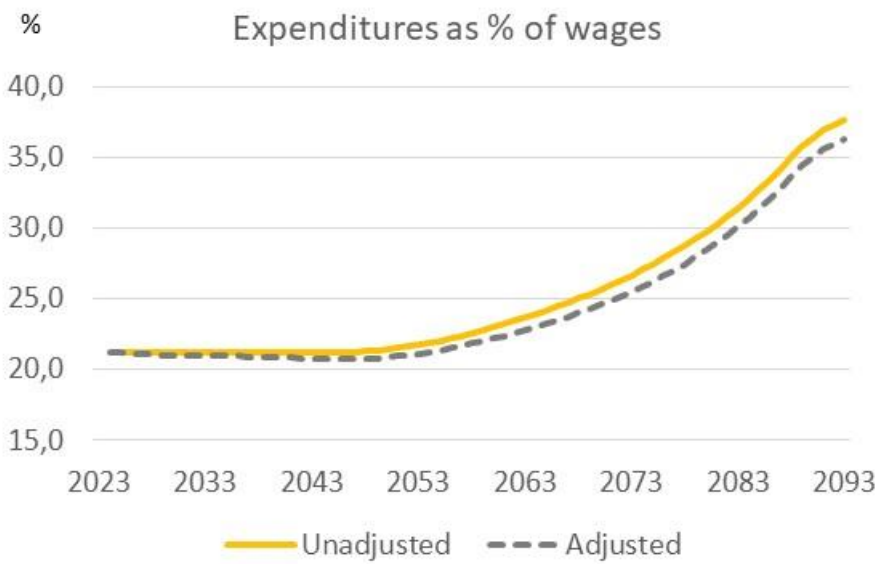
Scenarios 4, 6 and 7 with benefit adjustment

Scenarios 6 and 7: Expenditures relative to the wage bill

Low fertility and high return



Low fertility and low return

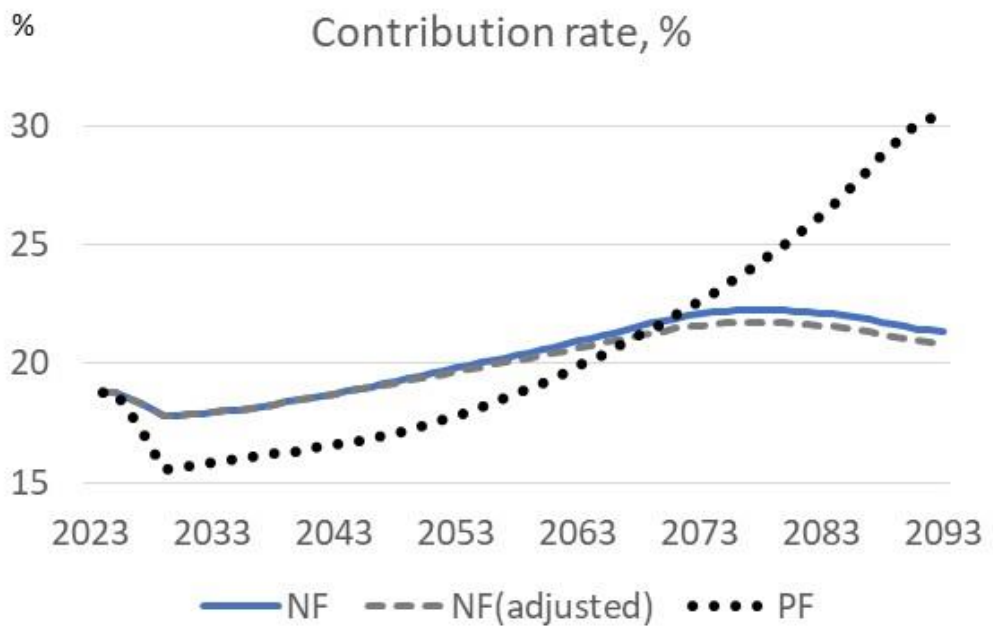


Benefit adjustment depends on returns. In 2080s with low returns1,3 %-points and with high returns 0,5 %-points

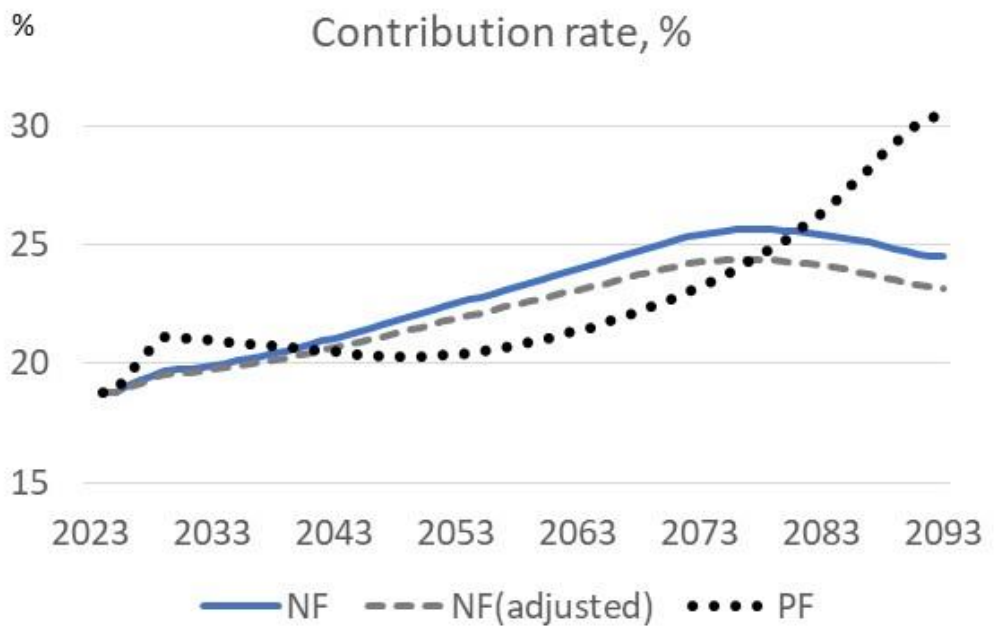
Scenarios 4, 6 and 7 with benefit adjustment

Scenarios 6 and 7: Contribution rate

Low fertility and high return



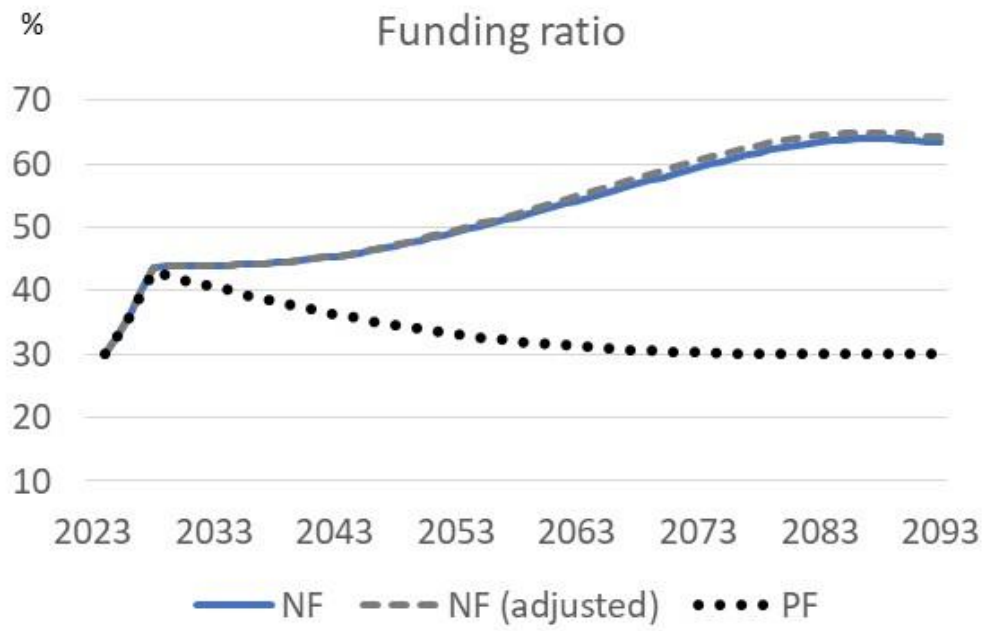
Low fertility and low return



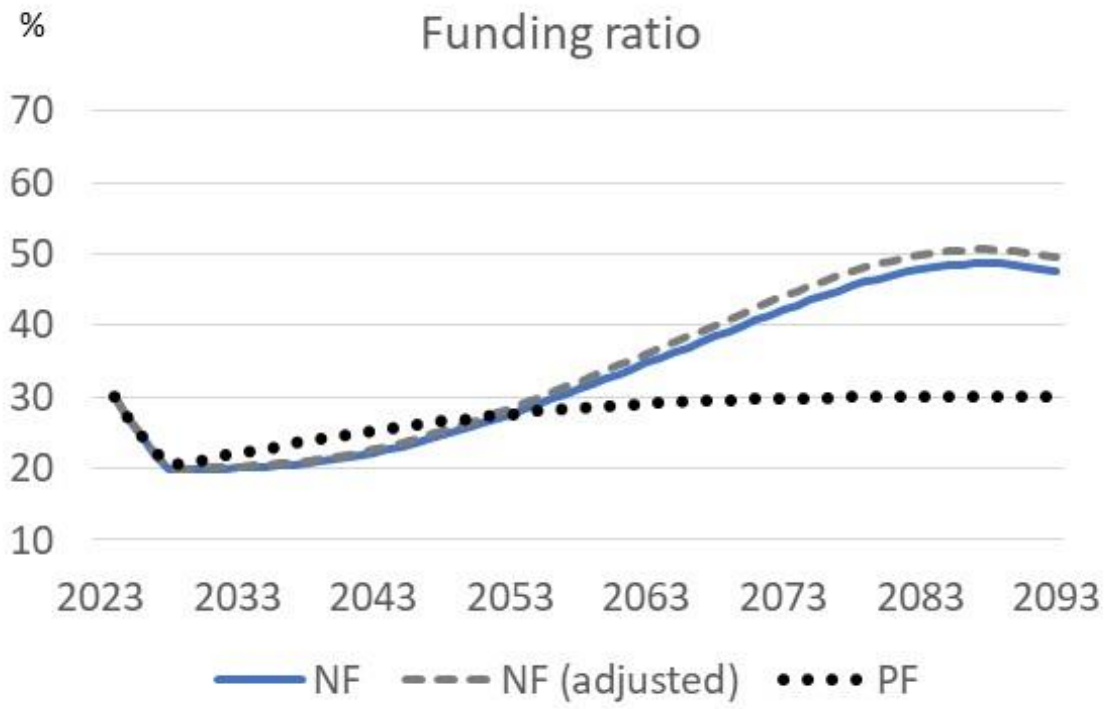
Scenarios 4, 6 and 7 with benefit adjustment

Scenarios 6 and 7: Funding ratio

Low fertility and high return



Low fertility and low return



Discussion

Discussion (1/3)

- Notional funding applies the logic of funding to a PAYG pension system
- Informational consequences are as follows:

  (i) The implicit PAYG pension debt becomes explicit

  (ii) The cost of the implicit debt becomes explicit

  (iii) All accruals, covered by NF system, must be priced and charged

  - In most social security pension systems, time spent on disability benefits, child care etc., may accrue pension benefits
  - Someone, whether insured collectively or the state, must bear these costs
- This set up implies a rather rigorous and transparent treatment of pension financing
- However, rigorous and transparent system may not be very popular
- Perhaps, in the first place, PAYG pensions are so common because they allow for avoiding such rigor

Discussion (2/3)

- Discount rate is likely the most important single parameter in NF system
- However, fully funded pensions are more sensitive to changes in the discount rate
- The NF system's foundation lies in PAYG financing, and pure PAYG is not sensitive to fluctuations in the discount rate

- If benefits are riskless, then a riskless rate serves as a neutral choice as for the discount rate
- Higher discount rates tend to shift the financial burden toward younger generations
- Often, relatively high discount rates are justified by higher than riskless expected returns
- This rationale, however, ignores the fact that proper valuation of future riskless income streams should be based on riskless rates, regardless of the asset allocation of the pension provider

Discussion (3/3)

- Intergenerational outcomes were more equitable in each of seven scenarios under NF than under PF (under NF, the legacy cost was relatively stable)
- However, this need not be a universal outcome

- The NF approach can be applied to benefit adjustments as well as to contribution adjustments
- In my setup, the role of benefit adjustment was relatively modest
- Nonetheless, benefit adjustment helped to smooth contribution rates

- If benefits are adjusted, they are no more riskless
- In this case, it might be logical to apply a somewhat higher discount rate than the riskless rate

- I presented NF as an actual tool to set the contribution rate and, potentially, adjust benefits
- One could also use NF as well as a theoretical benchmark for studying an existing pension system

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