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Risk Sharing and Individual Lifecycle Investing in Funded Collective Pensions

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Risk sharing and individual lifecycle investing in funded collective pensions*

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Abstract

The paper deals with the question of whether it is possible to combine the insights and recommendations of optimal individual lifecycle investing with the proven gains of defined benefit pension funds. These gains primarily stem from cost efficiency and (intergenerational) risk sharing. We investigate this subject for a concrete case, the pension fund sector in the Netherlands. Dutch pension funds traditionally are strong in organizing intergenerational risk sharing. There is a nationwide strong support among participants, employers and labour unions to continue with these collaborative funds; however stakeholders agree that renewal continuously is needed to adapt the system to an ever changing environment.

The paper explores two variants to the current setup. Both variants aim to combine collective risk sharing with the recommendations of individual lifecycle investing. One route is by adding return-related indexation policy to the current widespread practice of wage-related indexation policy. The second route is that participants have age-dependent stakes in an individual plan without risk sharing and a defined benefit plan with risk sharing.

Key words: pension funds, the Netherlands, intergenerational risk sharing, lifecycle savings and investments.

*) The views expressed in this paper are those of the authors and do not necessarily reflect those of our employers or colleagues.

1 Introduction

The interest of economists and financial planners in optimal lifecycle investing has grown substantially. The literature on lifecycle investing embraces a wide range of topics related to the key issue of achieving the optimal consumption path over the lifecycle by choosing savings and asset allocation in the most appropriate way (Bodie, McLeavey and Siegel 2007, Viceira 2007). The evidence suggests the use of defaults to stimulate individuals to follow the optimal savings and asset allocation strategies. Even larger welfare improvements may come from adding collective elements in the retirement income provisions. Collective savings plans can lead to substantial cost efficiency due to economies of scale. Moreover collective plans also enable risk sharing between younger and older participants. It is well known from the literature that risk sharing between young and older generations can lead to substantial welfare effects (Shiller 1999, Gollier 2008, Cui, de Jong and Ponds 2011). Intergenerational risk sharing effectively leads to an extension of the investment horizon and therefore more risk taking is possible compared to the optimal individual lifecycle investing.

The paper deals with the question of whether it is possible to combine insights and recommendations of optimal individual lifecycle investing with the proven gains of defined benefit pension funds, notably cost efficiency and (intergenerational) risk sharing. We investigate this subject for a concrete case, the pension fund sector in the Netherlands. Dutch pension funds traditionally are strong in organizing intergenerational risk sharing. There is a nation-wide strong support among participants, employers and labour unions to continue with collective pension funds, however stakeholders agree that renewal continuously is needed to adapt the system to an ever changing environment (Gortzak 2008, Verheij 2008). The paper explores two variants to the current set up. Both variants aim to combine collective risk sharing with the recommendations of individual lifecycle investing. One variant is to add return-related indexation to the current pension fund practice of wage-related indexation. The second variant is that participants have age-dependent investments in an individual DC plan without risk sharing and a defined benefit plan with risk sharing.

This paper first describes the main characteristics of the pension fund sector in the Netherlands. The plan structure can be characterized as a hybrid DB-DC plan. We discuss the main strengths and weaknesses of the current structure. We explain why the collective nature of the plan may come under pressure due to increasing maturity. Age differentiation in funding and benefit structure may provide a way out without giving up the advantages of collective risk sharing. We discuss the lifecycle investing literature and thereafter we study in depth two variants both aiming at implementing age-differentiation in collective pension plans.

2 Pension funds in the Netherlands

2.1 Three pillar structure

The Dutch pension system consists of three pillars. The first is the public pension scheme, which offers a basic flat-rate pension to all retirees at a level that is related to the minimum wage. It is financed on a pay-as-you-go (payg) basis. The second pillar is the employer-based supplementary scheme, which provides retirees with earnings-related income and covers 90 percent of the labor force. The third pillar is personal savings.

The second pillar mainly consists of funded DB plans that are executed by pension funds. Benefits are determined by years of service and a reference wage, predominantly the average wage over the years of service. The benefit formula takes into account the retirement benefits from the public scheme.

The Dutch pension fund system is very large. More than 90% of the labour force participates. The value of assets under management at year-end 2009 was 744 billion Euros – 117% of national income. There are 80 industry pension funds accounting for two-thirds of assets and plan participants. An additional 500 company pension funds encompass the remainder of assets and plan participants. Employee participation is mandatory and this is governed via collective labour agreements. Most pension funds (more than 95%) run an indexed defined-benefit plan with indexation contingent on the financial position of the fund. The aim of most plans is to deliver a supplementary pension income above the flat-rate public pension (payg-based) such that the sum of the public pension and the pension-fund pension is equal to 80% of average wage income. As the public benefit is quite modest (minimum wage), the significance of the second pillar in total retirement income is relatively large. Table 1 reports for different countries the weights of the three pillars in total retirement income.

Table 1 Pension systems in various countries

	The Netherlands	Germany	France	Italy	Spain	Switzerland	UK	US
	% of total retirement benefits							
PAYG public pensions	50	85	79	74	92	42	65	45
Occupational pensions	40	5	6	1	4	32	25	13
Personal pensions	10	10	15	25	4	26	10	42

Source: Börsch-Supan (2004)

2.2 Key characteristics of Dutch pension fund plans

The 580 pension plans (end of 2009) are structured largely in a similar way. The key characteristics of a typical Dutch pension fund plan are (compare also section 6):

- [1] Uniform accrual rate: employees build up for each year of service around 2% of their (pensionable) wage as new pension rights. A career of 40 years gives a pension income of 80% of the average wage over the career.
- [2] Uniform contribution rate: all employees pay the same contribution rate over their pensionable wage. The contribution rate is set yearly such that the yearly contributions match the present value of new accrued liabilities by employees due to an additional year of service.
- [3] Uniform indexation rate: the accrued liabilities of all plan participants are indexed yearly in a uniform way. Usually the aim is to index with the wage growth rate of industry or company of the corresponding pension fund¹. However the actual indexation rate is conditional on the financial position of the pension fund. When the funding ratio is below some threshold, than only partial indexation is given or even no

¹ A number of pension funds adjust the pensions of retirees with price indexation.

indexation at all. Full indexation is given when the financial position is sound. Usually the indexation policy is ruled via a so-called indexation ladder by which the indexation explicitly is linked to the funding ratio of the pension fund, mostly on a one-to-one basis.

[4] Uniform asset mix: the pension fund wealth is held in one asset mix.

2.3 Evaluation

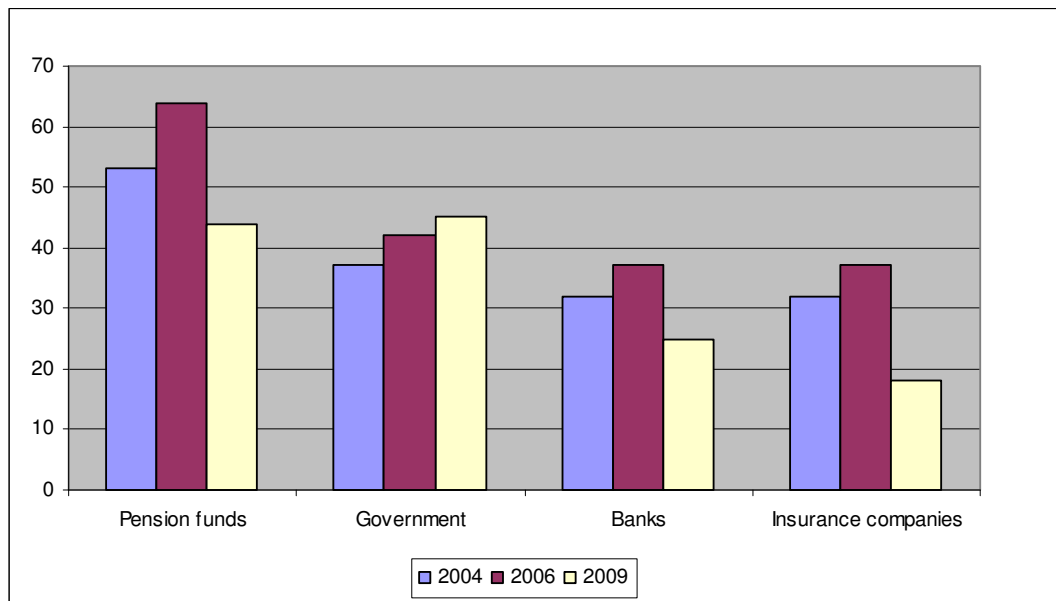
Academic studies point at the welfare-enlarging potential of Dutch pension funds. Individual members benefit from low costs due to economies of scale (Bikker and de Dreu 2009) and welfare benefits due to intergenerational risk sharing (Cui *et al.* 2011, Bovenberg, Koijen, Nijman and Teulings 2007). Mandatory participation allows pension funds to share funding surpluses and deficits with future generations. Welfare improvements occur because risk sharing enable pension funds to take more risk in asset allocation and to smooth consumption by stable contribution rates and pension benefits.

The benefits of sharing costs and risks come with several costs. [1] The plans impose a uniform funding policy on a heterogeneous group of participants, however optimal lifecycle investing approach suggests an age-dependent asset allocation policy as optimal. [2] Pension plans provide uniform pension products without any consideration of the heterogeneity in the pool of participants. Traditional DB plans thus leave little scope for tailoring the pension product to personal characteristics or preferences. [3] The worker also often lacks the expertise and the access to capital markets to undo investment policies that are not tailored to his individual-specific risk appetite. [4] Another problem is that the risk sharing contracts are not explicit. Situations can arise with substantial underfunding or overfunding. It is often ambiguous who is the ultimate bearer of downside risk and who is the ultimate owner of the surplus. This ambiguity may lead to governance problems. Whose interest has to be served? Furthermore, the lack of clarity about the funding of residual ownership means difficulties in defining what the optimal policy is. It is not clear which stakeholders' interests are to be optimized.

The welfare benefits due to economies of scale and intergenerational risk sharing can generally be shown to dominate these costs. Furthermore pension funds are perceived as very trustful organizations by plan participants (van Dalen and Henkens 2009). Figure 1 displays results of a survey among Dutch households regarding the confidence in institutions in the field of retirement income provisions. The confidence of the general public in Dutch pension funds² is very high compared with the outcome for banks and insurers. This confidence in funds is seriously decreased recently as a direct consequence of the fall in the funding ratio in the credit crisis and the applied recovery measures (indexation cuts and contribution rises). The confidence in the government has improved considerably and matches the confidence level in pension funds.

² As confidence is highly 'man-made', this puts a high responsibility to pension fund managers to establish good governance in order to safeguard time-consistency by controlling the risk of severe underfunding and generational equity, in particular as to the position of the younger members. Compare Ambachtsheer (2007) for a thoroughly analysis of necessary conditions to arrive at good pension fund governance.

Figure 1: Percentage pension fund participants "with some to much confidence" in pension-providing institutions, 2004-2009



Source: van Dalen and Henkens (2009).

3 Increasing maturity of pension funds

It can be foreseen that in the coming decades many Dutch pension funds will evolve to a much older age profile that matches their plan members. Most pension funds in the Netherlands have been operative since the 1950s. Gradually the relative proportion of retirees has increased over the years. This process of increasing maturity will put pressure on shifting the policy focus to meet the interests of the elderly. The older members have by nature an interest in a conservative asset mix to safeguard the payout of their pension benefits in the short run. This may conflict with the interests of the younger members. The young will aim at relatively high risk taking as the payout of their pension benefits is deferred till their retirement. A more conservative asset mix is not beneficial for young members as the low rate of return will lead to higher contribution rates to meet the ambitions regarding the level of income during the retirement period. The academic literature on the optimal asset allocation over the lifetime highlights the importance of lifecycle investment policy.

One may expect that a mature pension fund will hold a conservative asset mix. Pension funding policy in a pension fund with an ageing median participant may therefore not be attractive for younger and future participants. A conservative mix suggests a low return and thus either a higher contribution rate or a lower pension accrual per euro contribution.

The literature on the relationship between the age profile of a pension fund and the composition of the asset mix is scarce. The small number of papers in this field indicates that a more mature pension fund displays higher risk aversion and therefore holds a lower share of assets in equities compared to a younger pension fund. A recent study by Bikker, Broeders, Hollanders and Ponds (2009) on Dutch pension funds' strategic asset allocation in 2007 finds that a rise in participants' average age reduces equity holdings significantly, as theory predicts. This negative equity-age relationship has been found in other studies as well. For pension funds in Finland, Alestalo and Puttonen (2006) report that a one-year average age increase reduced equity exposure in 2000 by as much as 1.7 percentage points. Likewise, for Switzerland in 2000 and 2002, Gerber and Weber (2007) report a negative relation between equity exposure and both short-term liabilities and age. The effect they find is smaller yet

significant, as equity decreases by 0.18 percentage point if the average active participant's age increases by one year. For the US, Lucas and Zeldes (2009) did not observe a significant relationship between the equity share in pension assets and the relative share of active participants.

4 Lifecycle investment policy

The original literature on optimal lifecycle investments (Bodie, Merton and Samuelson 1992, Campbell and Viceira 2002) has pointed out that the optimal investments in risky assets over the lifecycle should be structured as follows:

$$[1] \quad a_x = \frac{\mu - r}{\gamma \sigma^2} \frac{HC_x + FC_x}{FC_x}$$

where:

a_x = fraction financial capital in stocks at age x

μ = expected rate of return stocks

r = risk free rate

γ = risk aversion

σ^2 = riskiness stocks (variance)

HC_x = human capital at age x

FC_x = financial capital at age x

The first part in the right-hand side of the expression is the standard result from the literature on dynamic asset allocation over time. Under some conditions (quite restrictive of nature but broadly accepted in theoretical analysis) this term says that the individual should maintain a constant part of financial wealth in risky assets over his lifecycle, regardless of the size of wealth and age³. The share in risky assets is increasing in the risk premium $\mu - r$, defined as the difference between the expected return on risky assets and the risk free rate, and decreasing in the degree of riskiness of the risky assets σ^2 and the coefficient of relative risk aversion γ .

Personal wealth of an individual not only consists of financial capital but also of human capital. Bodie *et al.* (1992) have shown that the asset allocation rule has to be augmented with the second part in the expression. The term HC_x reflects the present value of remaining human

³ The standard result of the first term is derived under the following conditions: [1] The risk attitude of the individual is characterized by constant relative risk aversion, which means that the individual maintains the same percentage exposure to risky assets regardless of the changes in wealth. [2] Investment returns follow a random walk (returns are independent and identically distributed); there is no mean reversion. [3] Individual has no other income than investment income, so personal wealth only consists of financial wealth. These three conditions are not in line with real life features. Young typically are more risk tolerant than older individuals as the remaining investment horizon of the young is longer. There is more and more evidence that the various financial assets display horizon effects in their risk characteristics (Campbell and Viceira 2002, Hoevenaars, Molenaar, Schotman and Steenkamp 2008). Stock returns appear to be less volatile when they are measured over long holding periods. Annualized risk may fall from 16% to 20% on a yearly base to less than 10% for terms of 10 to 20 year periods. This is known as mean reversion. In particular long-term investors like pension savers may benefit from this empirical finding. For short-term investors, T-bills (short term notes) and bank accounts are safe assets as investments in these assets will preserve wealth. The return consists of the real interest rate and inflation compensation. However, the real interest rate becomes volatile for longer investment horizons. A strategy of constantly reinvesting wealth in short-term notes indeed will preserve investor's initial capital wealth, but this strategy will not be the optimal strategy for a long-term investor. The safe strategy for such a long-term investor would be the holding of long-term indexed bonds, preferably wage-indexed bonds as these bonds provide also a hedge for standard-of-living risk.

capital which approximately equals the stream of wages to be received over the rest of the working period. The term FC_x is the value of financial assets at the moment of evaluation. Total personal wealth at the age x is the sum of HC_x and FC_x and this wealth is available for consumption over the remaining lifetime. As Figure 2 displays, personal wealth is at a maximum when an individual enters the labour market. Personal wealth gradually will decline over the lifetime as wealth is transmitted in yearly consumption. At retirement age (say 65) all human capital is depleted, so consumption during retirement has to come from financial capital only.

Figure 3 displays the relative share of real assets (equities) in the asset mix which declines gradually with the increase of age. This pattern is based on the recommendation of expression (1). A necessary condition for the decline of the relative share of real assets before the age 65 is that the correlation between growth rate of wage and the return on real assets is not too high. Note that from the age 65 onwards the relative share in real assets is constant as personal wealth then only consists of financial capital.

The negative relationship between age and equity exposure in the portfolio is usually derived under the assumption that human capital is close to risk-free, or at least is not correlated with capital return. Benzoni, Collin-Dufresne and Goldstein (2007) put forward that in the short run, this correlation is indeed low while in the longer run, labour income and capital income are highly cointegrated, since the shares of wages and profits in national income are almost constant. This finding implies that the risk profile of young workers' labour income is equity-like and that they should therefore hold their financial wealth in the form of safe bonds to offset the high risk exposure in their human capital. Therefore, Benzoni *et al.* (2007) (see also Cocco, Gomes and Maenhout 2005)) suggest that the optimal equity share in financial assets is hump-shaped over the lifecycle: cointegration between human capital and stock returns dominates in the first part of working life, whereas the decline in human capital accounts for the negative age-dependency of optimal equity holdings later in life.

As the contribution of Benzoni *et al.* (2007) is still in discussion among academics, we only follow the recommendations of the original contribution in this field, so a negative age-equity relationship.

Figure 2: Personal wealth over the lifecycle and its components

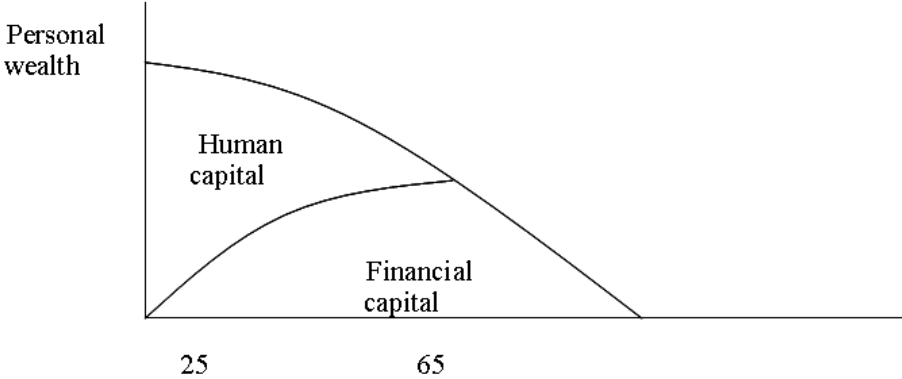
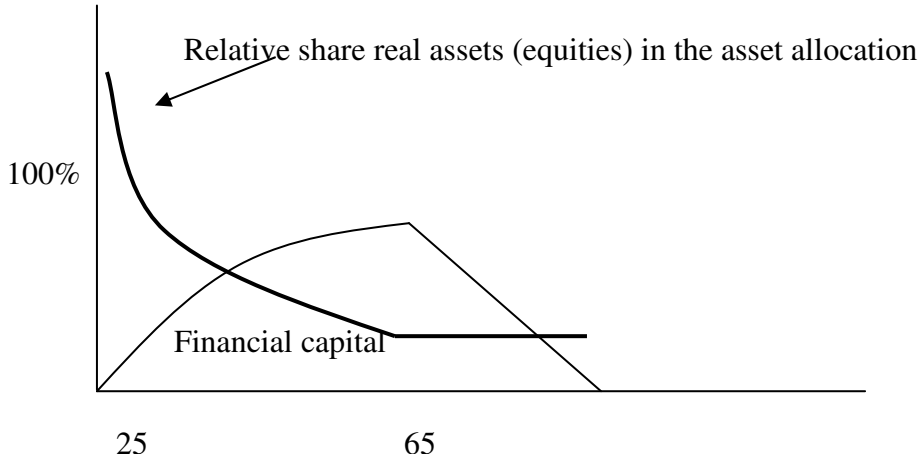


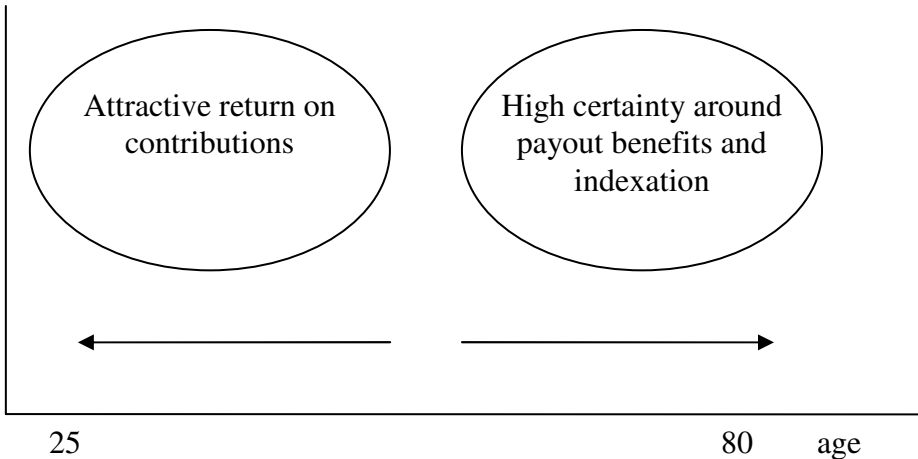
Figure 3: Relative share real assets (equities) in the asset allocation



5 Towards age-differentiation in collective pension plans

Pension funds are challenged by the ongoing ageing of the median participant and by the recommendations of life cycle investment theory to follow age-based, individual policies. This setting puts forward the key question of this paper. The aim of the paper is to explore for a mature pension fund pension, plan variants wherein simultaneously the proven benefits of collective risk sharing are safeguarded and pension and investment policies are structured according to age-differentiation.

Figure 4: Age-differentiation and policy aims



We evaluate the following alternatives:

Base variant 0

Current average wage plan with indexation ladder and fixed contribution rate

Variant A

Current average wage plan but age-based indexation related partly to performance and partly to wage growth

Variant B

Members hold individual accounts with age-dependent participation into two funds: a so called ‘indexation fund’ aimed to mimic the growth rate of wage-indexed pension liabilities⁴ and a so called ‘return fund’ with a risk-tolerant investment policy aimed to realize a high return.

The evaluation is with help of an asset-liability model (ALM) model⁵. The table below reports some characteristics for a number of key variables. An asset mix with 60% real assets and 40% nominal assets delivers an expected return of 6,3%. The initial funding ratio is assumed to be 100% real; this corresponds with a nominal funding ratio of (almost) 150%.

The contribution sum in a specific year has to match the costs (present value) of new accrued pension rights in that year. The contribution rate is 20%, being the ratio of the present value of new accrued liabilities and pensionable wages. The present value calculations are based on a real discount rate of 3%, being a prudent calculated real return on assets (nominal rate of return minus wage growth). We assume that in the initial state all indexation has been paid out.

Table 2: ALM assumptions

Initial funding ratio	100% real (=150% nominal)
Inflation	2.0%
Wage growth	3.0%
Nominal rate of interest	4.5%
Real rate of interest	2.5%
Equities	7.5%
Return mix 60/40	6.3%

6 Base case

We first look at the performance of the base case variant. As said before, the contribution rate is fixed whereas the indexation is contingent on the financial position of the pension fund. The indexation policy is ruled by the so called indexation ladder. We start with explaining the functioning of the ladder.

6.1 Explanation of indexation ladder

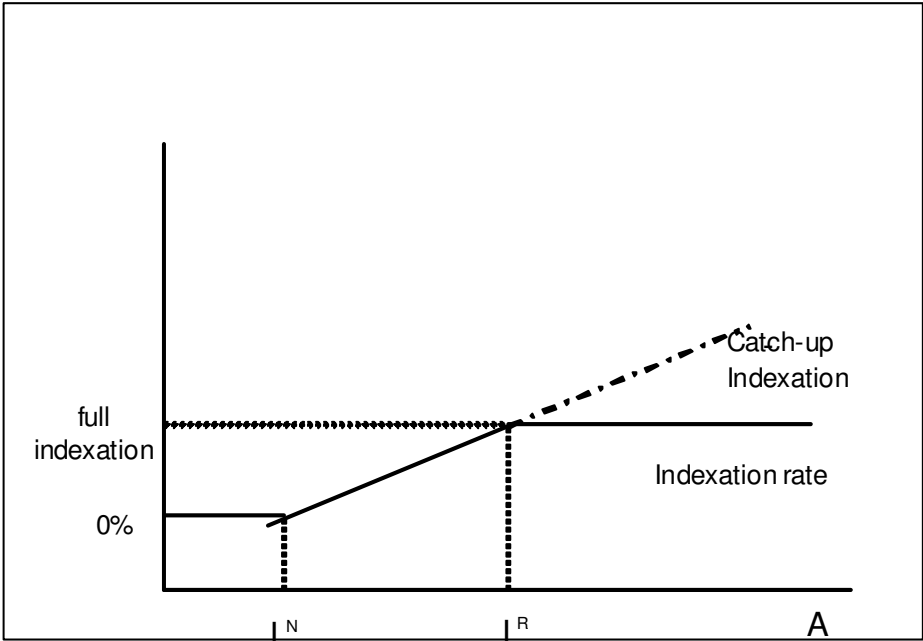
Figure 5 displays the functioning of an indexation ladder for a typical pension plan currently in the Netherlands (compare also Ponds and van Riel 2009). The x-axis denotes the value of the assets A of the pension fund under study. A pension fund is said to be fully funded when assets A equal the value of the real liabilities L_R , the latter being the value of accrued rights when full indexation always would be given. The value of the nominal liabilities, L_N , is the value of accrued rights when no indexation would be given. The difference between real and nominal liabilities, $L_R - L_N$, is the required indexation reserve that is needed to cover the indexation promise to the participants. The actual indexation reserve position is $A - L_N$, which may be either positive or negative. Along the vertical axis, the indexation rate is set.

⁴ More precisely, the aim of the indexation fund is to realize a return equal to the long-term real rate of interest plus the wage growth rate.

⁵ We make use of the ALM model of APG (All Pensions Group), a Dutch pension service provider with around 25 pension fund clients and more than 250 bln euros assets under management.

There is room for full indexation equal to the wage growth when the value of assets is equal to or larger than the value of the real liabilities: $A \geq L_R$. Then, the actual indexation reserve $A - L_N$ is at least equal to the required indexation reserve $L_R - L_N$. The indexation rate will be zero when the assets are equal to or even below the nominal liabilities: $A \leq L_N$. The actual indexation reserve then is zero— or is even negative. Between these two points (i.e. when $L_N < A < L_R$), indexation follows the wage growth partly where the indexation given is determined by the proportion of the actual indexation reserve in relation to the required indexation reserve. When $A > L_R$, catch-up indexation may be given up to a maximum equal to the previously missed indexation due to indexation cuts. The possibility of catch-up indexation is indicated by the dotted line.

Figure 5: Indexation ladder



6.2 Results

Figures 6 and 7 present key results of the base variant by giving the probability distributions for the funding ratio and pension result over a 20-years period. As Figure 6 shows, the median funding ratio is increasing. This can be explained by the level of contribution rate vis-à-vis the new liabilities. The contribution rate is calculated with a prudent assessed real rate of return on assets. As the average real rate of return on assets is higher than the prudent real return (3.3% resp. 3%), the growth rate of assets is on expectation in excess of the growth rate of liabilities. Figure 7 displays the distribution of the pension result⁶. A pension result of 100 means that there has been full indexation. Indexation cuts in the past which are not caught up lead to pension result of less than 100. The distribution of the pension result clarifies that the base variant shows up a relatively high frequency of full indexation, however the probability of indexation cuts is substantial.

The results of the base variant indicate that the relatively good performance regarding the pension result can be explained from the gradual increase in the funding ratio, leading to a

⁶ The variable pension result is calculated as follows: $\frac{[1+i]/[1+w]}{[1+i]-1}$, with i as cumulative given indexation and w as the cumulative growth rate wages. Alternatively we might have presented the outcomes for the variable indexation result, defined as: $\frac{[1+i]-1}{[1+w]-1}$

high average real surplus in the longer run. This surplus is used effectively to absorb an increasing part of the volatility in the funding ratio, such that the probability of a real funding ratio below 100 (or in other words a nominal funding ratio below 150) is quite small.

Figure 6: Probability distribution of funding ratio, base variant

initial funding ratio = 150% nominal (100% re el)

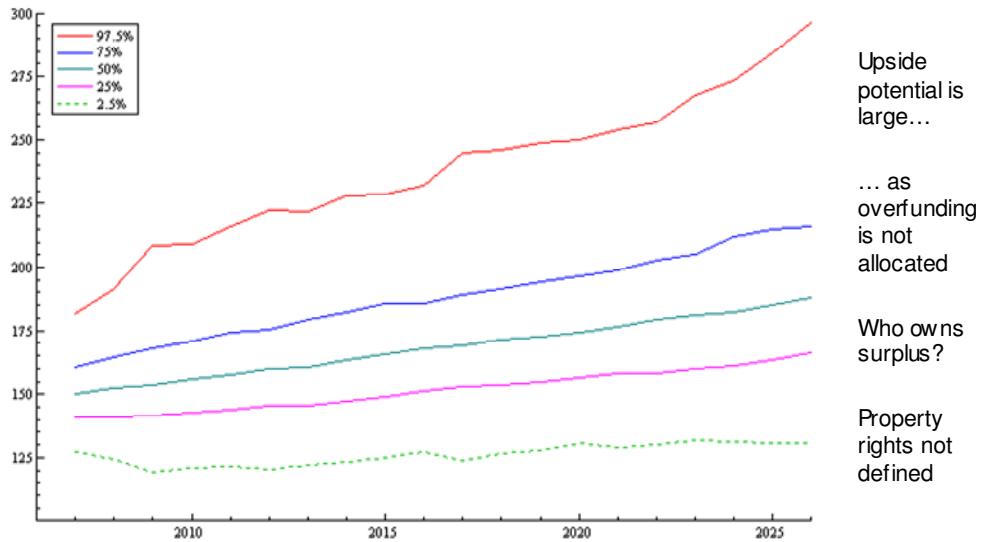
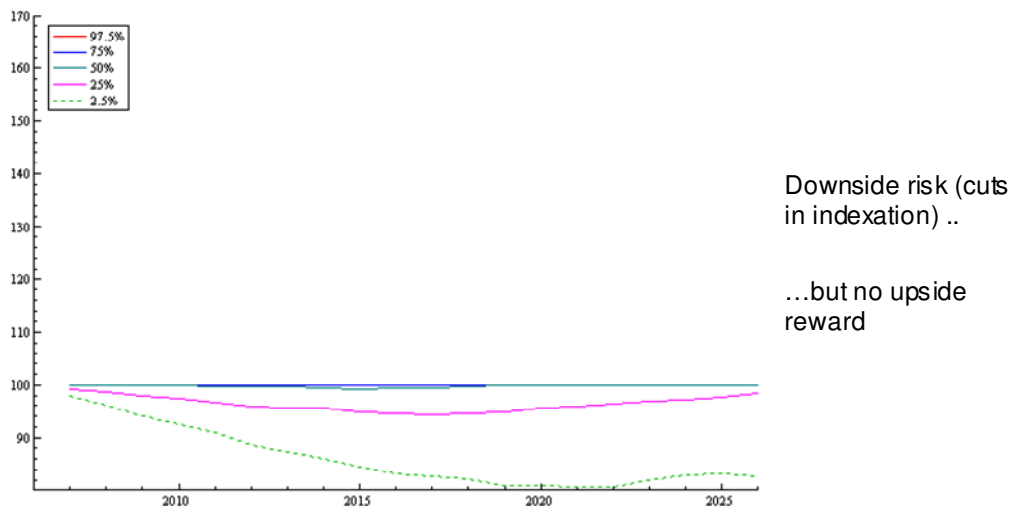


Figure 7: Probability distribution of pension result, base variant



7 Variant A: age-dependent return indexation

Variant A is identical to the base variant with one important difference: the indexation rule. The indexation for participants younger than 65 now consists of two components. The first component is related to the wage growth rate as in the base case. The second component is related to the realized return on the asset mix. The relative size of these two components is age-based to capture the basic ideas of the lifecycle investing. The weight of the return component of the indexation for the younger participants has to be large. This weight will become smaller as the worker ages whereas complementary to this the wage component increases with age. The expression below models a linear relationship between age and the relative size of the two components of the indexation formula. The real return is defined as the return on assets minus the change in the real value of liabilities over one year. It is further assumed that the part of the indexation related to the wage is unconditional (i.e. the indexation ladder is not operative).

Indexation 25 to 64 year :

$$\text{Indexation} = \frac{65-x}{40} \text{ Real Return} + \frac{x-25}{40} \text{ WageGrowthRate}$$

x = age

Example variant A

Assume that for a specific year the relevant variables have the results below:

Return	= 7%
Wage growth	= 3%
Change real value liabilities	= 2.5%

The indexation for a person with age 35 and respectively age 45 are equal to 4.1% resp. 3.4%. The indexation for 65 and older equals wage indexation of 3%.

$$\begin{aligned} \text{indexation } 35y &= \left(\frac{65-35}{40}\right) \cdot \text{realreturn} + \left(\frac{35-25}{40}\right) \cdot \text{wage} \\ &= 3/4 * [7\% - 2.5\%] + 1/4 * 3\% = 4.1\% \end{aligned}$$

$$\begin{aligned} \text{indexation } 55y &= \left(\frac{65-55}{40}\right) \cdot \text{realreturn} + \left(\frac{55-25}{40}\right) \cdot \text{wage} \\ &= 1/4 * [7\% - 2.5\%] + 3/4 * 3\% = 3.4\% \end{aligned}$$

$$\text{indexation } 65y = \text{wage} = 3\%$$

Figure 8 presents the probability distribution of the aggregate pension result for all plan members taken together. There is a large spread of possible results but the average pension result exceeds 100, the latter being the maximum of the base variant. The downside risk also is less severe. Both the 2.5th and the 25th percentiles are higher than in the base case.

Figure 9 shows the probability distribution of the funding ratio. First note that the spread in the funding ratio is lower than in the base case. The probability of high overfunding is

reduced considerably whereas the underfunding probability in variant A is slightly smaller compared to the base variant. This reduction in funding ratio volatility can be explained by the new indexation rule. Plan members, in particular the younger participants, bear part of the (real) return volatility.

The new indexation rule suggests more risk in the evolution of pension liabilities over time, however on expectation the new indexation rule leads to a higher pension income. Figure 10 displays the pension result for four different ages over an almost 40 year horizon. The 27-age participant has the highest risk due to the high exposure to the market risk in the early years of employment. The return risk declines when the participant get older. Figure 11 shows the median of the indexation result for different age cohorts at retirement. The bottom line is the median of the participants that were 65 at the moment the plan switches to the new indexation rule. The median for this group is 100⁷. Subsequently the median is shown for the age group that was 60 at introduction. They benefit 5 years due to the new rule which explains that the median slightly exceeds 100. Also, the medians of the pension result are shown for the age groups retiring 10 and 15 years after introduction of the new rule.

The important conclusion from this exercise is that return-related indexation is possible without a negative impact on the funding position of the pension fund.

Figure 8: Pension result on fund level in variant A

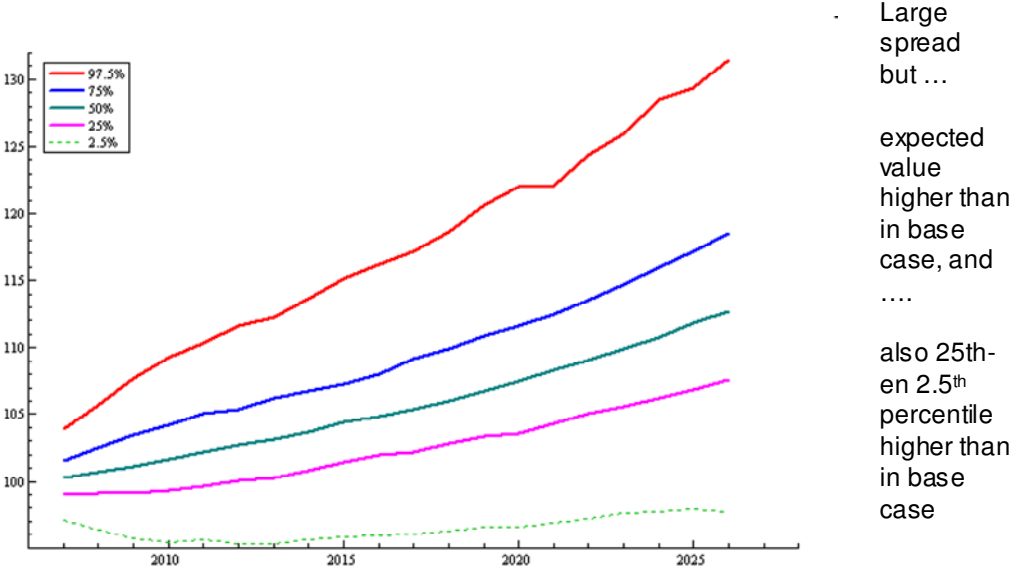
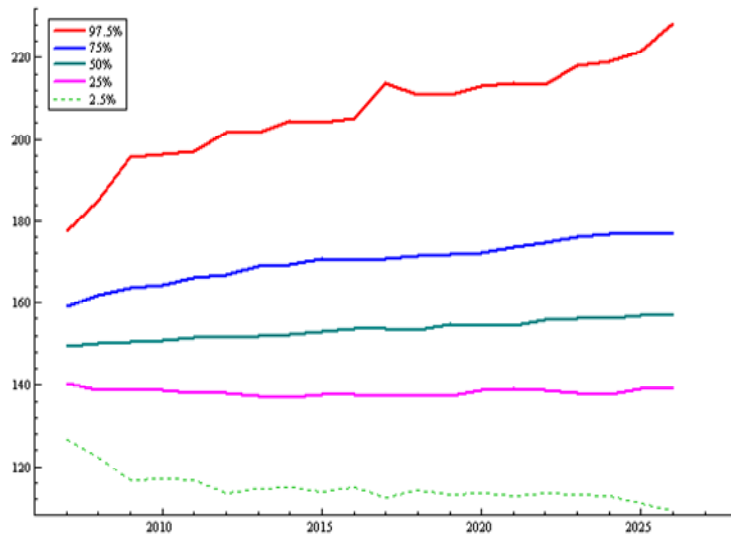


Figure 9: Nominal funding ratio, variant A

⁷ Note that the pension result for this group is by construction always equal to 100%.

Initial funding ratio = 150% nominal (100% réel)



Higher pension result mitigates overfunding ...

... but funding ratio higher than 100%, even 2.5th-percentile

Figure 10: Indexation result as percentage of wage indexation for three age cohorts

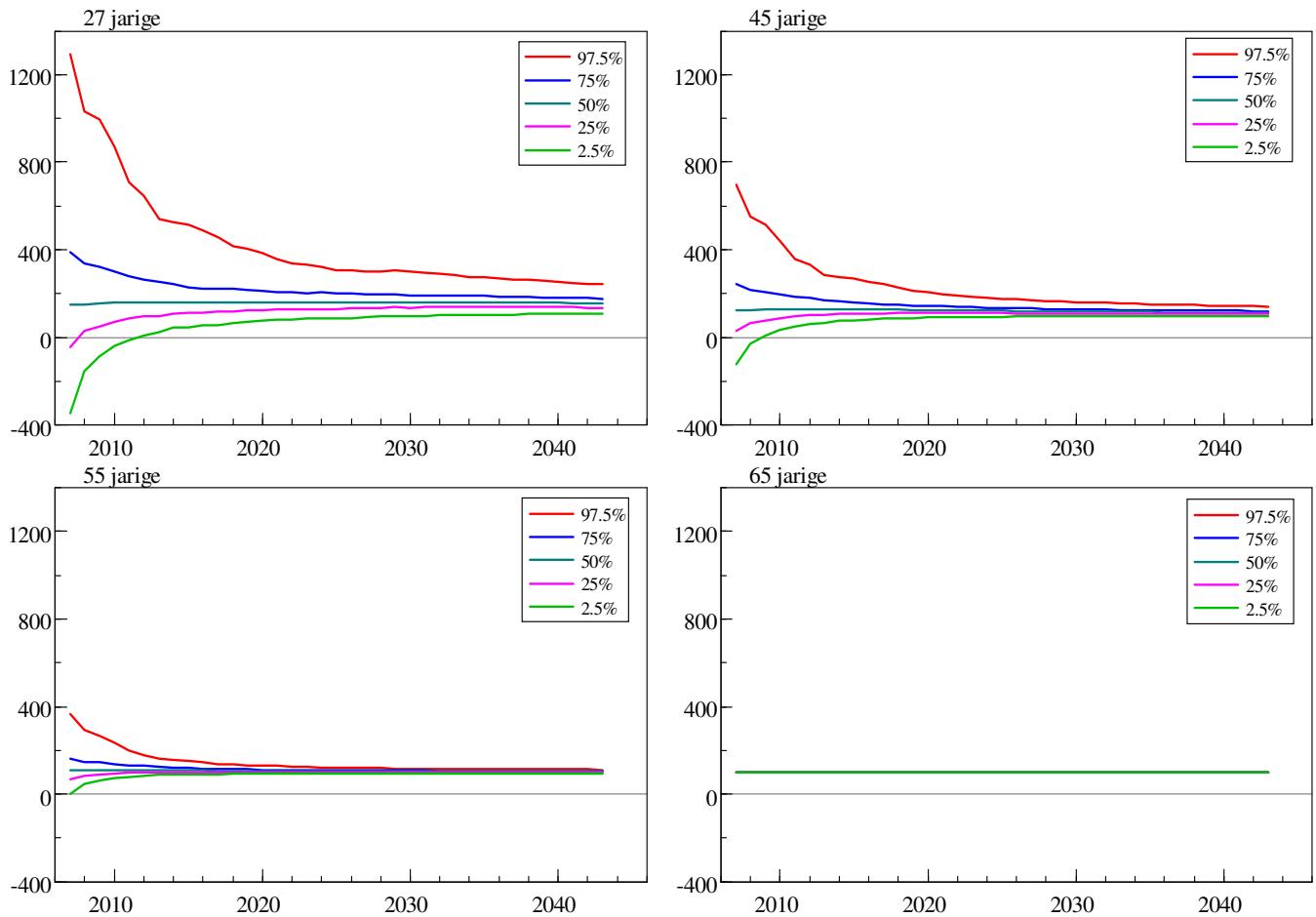
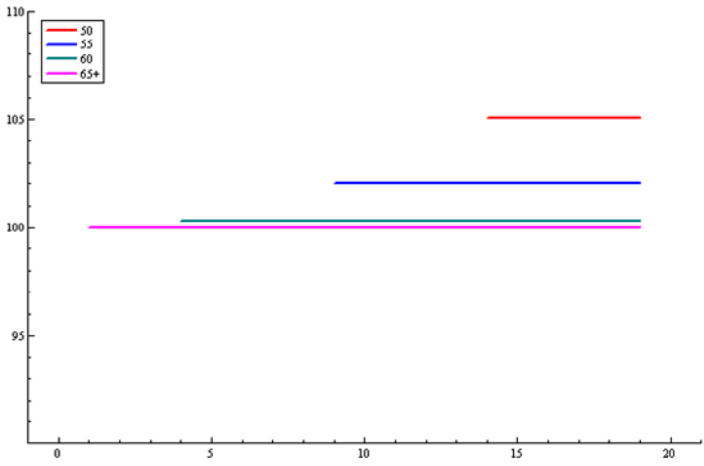


Figure 11: Pension result at retirement and thereafter for different age cohorts



Median of pension result

The younger the participant at transition, the better the median

Young more reward for each euro contribution

8 Variant B: “First DC, then DB”

The current institutional structure of the pension fund is removed in variant B. The assets under management are allocated to the various individuals proportional to the value of their accrued liabilities. An individual’s wealth is age-based distributed over two accounts as shown in Figure 12. The returns on these two accounts are determined by the performance of the underlying asset portfolios of the accounts.

The return on the DC-account is determined by the DC mix. This is a risk-tolerant mix aimed at realizing an attractive return. Wealth held in the Annuity account delivers an annuity-like payout linked to the performance of the Indexation mix. This mix is aimed at delivering a return that mimics the return of a wage-indexed defined benefit with as much certainty as possible.

The contributions are allocated to the two accounts according to the distribution in Figure 12. At year-end the accounts are rebalanced such that total assets including realized return plus new contributions is allocated over the two portfolios as depicted in Figure 12.

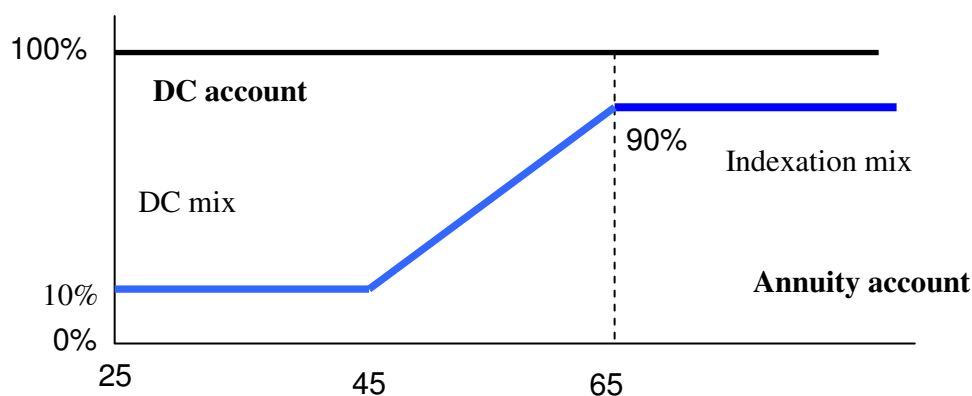
DC account:

Assets end of year = initial assets (1 + return DC mix) + contributions – transfer to Annuity account -/- payouts during retirement

Annuity account :

Assets end of year = initial assets (1 + return Indexation mix) + contributions + transfer from Annuity account -/- payouts during retirement

Figure 12: Relative shares of DC mix and Indexation mix over the lifecycle



Risk sharing

Variant B maintains an important risk sharing component as the conversion rate at which assets are shifted from the DC account to the Annuity account is fixed at 2.5%. The risk of deviations between the actual real rate of interest (with an expected value 2.5%) and the fixed conversion rate is borne by the total assets held in the Annuity accounts.

Furthermore, it is assumed that there is unconditional wage-indexation of annuities. Also, the risk of deviations between the actual rate of return on the Indexation mix and the required

return to pay full indexation is borne by the total wealth held in the Annuity accounts. So one may speak of continuation of intergenerational risk sharing regarding the covering of the value of the annuities by the assets kept in the Annuity accounts.

Example variant B

Assume that for a specific year the relevant variables have the results below:

Return DC mix	= 8%
Return Indexation mix	= 5.5%
Wage growth	= 3%
Change real value liabilities	= 2.5%

As calculated below, for a person age 35, the sum of the growth rates for the two accounts equals 7.5%. 90% of the assets are held in the DC mix, giving a return of 8%. The remaining 10% is kept in the Indexation mix with a return of 5.5%. This 5.5% is partly used to keep pace with the higher present value of the deferred annuities (2.5%), the remaining 3% is available to index the annuities for the wage growth. The higher present value is the change in the present value of annuities due to getting one year closer to pay out and due to real interest changes.

$$\begin{aligned} \text{Change wealth 35y} &= 0.9 \cdot \text{ReturnDCmix} + 0.1 \cdot (\text{Return Indexationmix} - \text{PV Increase}) \\ &= 0.9 \cdot 8\% + 0.1 \cdot (5.5\% - 2.5\%) = 7.5\% \end{aligned}$$

$$\begin{aligned} \text{Change wealth 55y} &= 0.5 \cdot \text{ReturnDCmix} + 0.5 \cdot (\text{Return Indexationmix} - \text{PV Increase}) \\ &= 0.5 \cdot 8\% + 0.5 \cdot (5.5\% - 2.5\%) = 5.5\% \end{aligned}$$

$$\begin{aligned} \text{Change wealth 65y} &= 0.1 \cdot \text{ReturnDCmix} + 0.9 \cdot (\text{Return Indexationmix} - \text{PV Increase}) \\ &= 0.1 \cdot 8\% + 0.9 \cdot (5.5\% - 2.5\%) = 3.5\% \end{aligned}$$

Performance

Figure 13 shows the yearly spread in the pension result to be received by the retiring age-cohort in that specific year. The median is always larger than 100% and steadily increasing. After 20 years the median approaches its steady state level. The figure demonstrates the large spread around the median. The upside risk is relatively large. The downside risk is also substantial, however both the 2.5th and 25th percentiles are higher compared to the base variant. Figure 14 reflects for a number of age cohorts the course of the median pension result during the retirement period of the specific age cohort. For all three age cohorts, there is an upside as during retirement 10% of the assets are held in the DC mix.

Figure 13: Pension result at age 65 in variant B

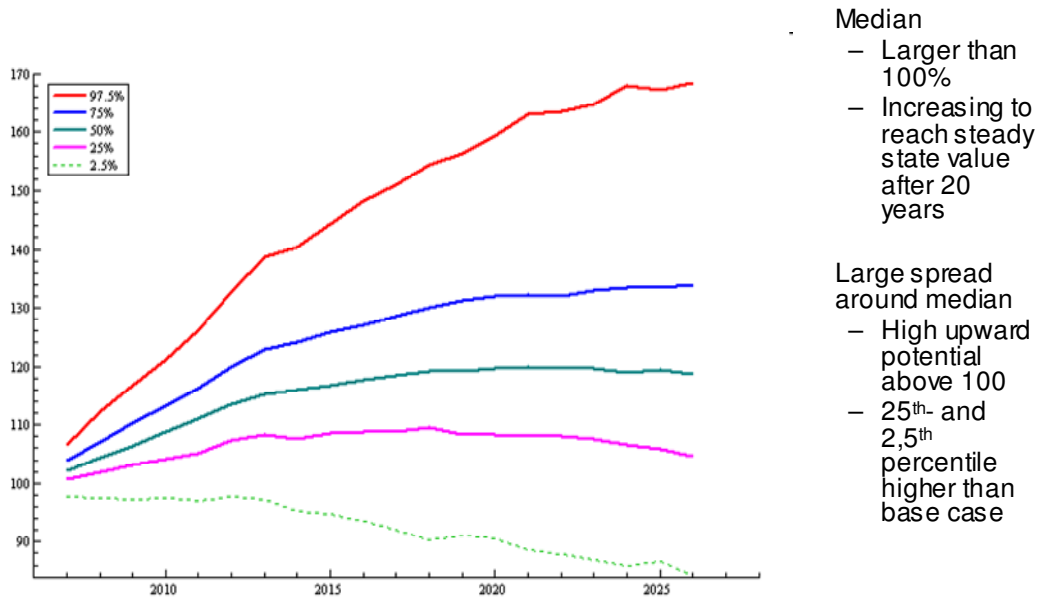
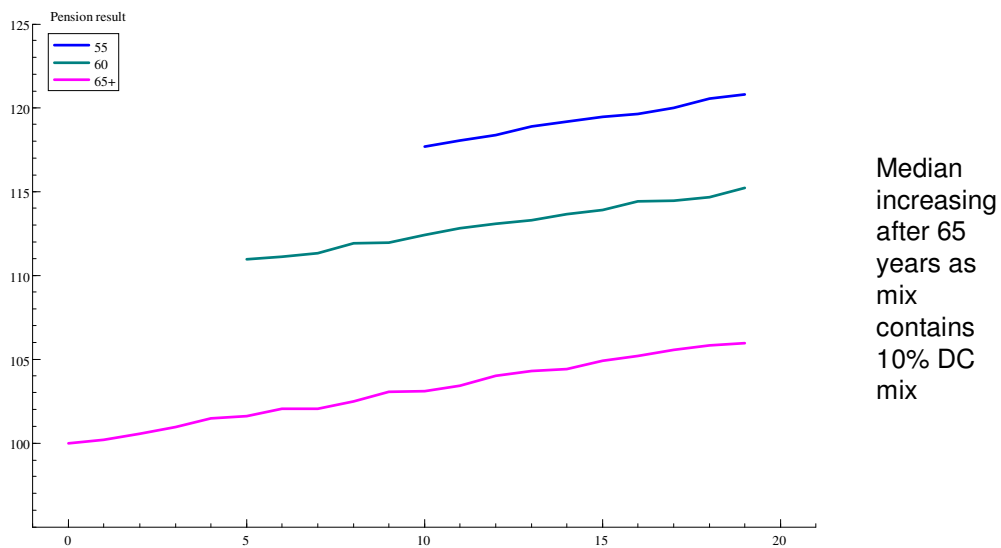


Figure 14: Median pension result after retirement for different ages in variant B



9 Evaluation

Pension funds in the Netherlands will mature in the coming years. This may lead to a shift in policy focus towards the interests of the elderly. The asset mix may become more conservative to safeguard the payout of benefits to retirees as promised. A conservative mix is not in the interest of the young participants. The lifecycle investing approach recommends that individuals accept high risk exposure early in life and that risk exposure has to decline gradually over the lifecycle.

This puts forward the key question of this paper. The aim of the paper is to explore for a mature pension fund, pension plan variants wherein simultaneously the proven benefits of collective risk sharing are safeguarded and pension and investment policies are structured according to age-differentiation.

Variant A that may also be called ‘age-based return indexation’ is orientated towards age-differentiation in pension policies, but maintains the current institutional structure of a pension fund with its benefits of collectivity and risk sharing. The pension plan design can be shaped according to the insights of lifecycle investing. This plan redesign might be a promising way for maturing pension funds to meet the diverging interests of the elderly and the young.

We find that return-related indexation is possible without having a negative impact on the funding position of the pension fund. A serious drawback of variant A is the continuance of the lack of clear ownership as to the pension fund assets. Property rights are not explicitly defined and this may give rise to conflicts in periods with a serious underfunding or overfunding.

Variant B that we have characterized as ‘First DC then DB’ has no problem regarding the property rights, however this comes at the price of giving up a large part of the collective nature of the plan design. Essentially variant B contains an individual component in the pension plan setup. The collective element is present in two ways. First, there is a fixed conversion rate. Secondly, annuities are indexed for wage growth. Both assumptions imply that the total wealth kept in the Indexation mix is larger (“overfunding”) or smaller (“underfunding”) than the value of the annuities. The investment strategy followed in the Indexation mix may aim to replicate the rate of return on wage-indexed benefits, however it cannot guarantee this return.

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