

PENSION REFORM IN THE NETHERLANDS: ATTRACTIVE OPTIONS FOR OTHER COUNTRIES ?



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■ I. INTRODUCTION

The Dutch pension system is often referred to as one of the better pension systems in the world. The system is characterized by an accumulated pension capital of 1200 Billion Euro, substantially more than annual Dutch GDP. Moreover basic income for all elderly persons is provided on a pay-as-you-go basis (paid for by the current working generations). Like in all other countries, the rapid increase in life expectancy, the financial crisis and the lack of trust in financial institutions have raised concerns on the sustainability of the pension system as it is. The second pillar pension benefits that have always been perceived as guarantees by the participants have recently been reduced by many pension funds. Moreover the government has implemented a rapid increase in the eligibility age for the basic retirement income benefits implying that many workers are forced to work substantially longer than initially intended.

In 2010 two government appointed advisory committees, the Goudswaard¹ and Frijns committee, recommended structural changes to the Dutch pension system to keep it sustainable. Their thoughts have subsequently been supported and detailed by the employer organizations as well as the labor unions and by the government. Although discussions on the details of the adjustments are still going on, substantial changes are likely to be implemented as of 2015. These changes reflect at least five important dimensions:

1. The eligibility age for basic retirement income will increase from 65 now until 67 in 2024 and will subsequently be automatically linked to the development of the life expectancy.
2. Pension investments will be based on life cycle investing and thereby explicitly focus on the long run.

3. Pension income will as before take the form of monthly payments until death, but no minimum level of payments will typically be guaranteed. Pension income can decrease as well as increase, even in nominal (euro) terms.

4. While the benefits of mandatory collective schemes will be maintained, individual property rights within the collective fund will be better defined and protected.

5. Transparency will be increased by providing annual pension information to all participants that not only states their expected real pension income but also the (sizable) investments risks taken, by reporting pension income in pessimistic scenarios.

This paper summarizes the current plans to reform the Dutch pension system and highlights elements of the new Dutch pension system that might be valuable for the (re)design of pension systems in other countries. These include:

- a. Insurance against individual longevity risk using mandatory annuitization.
- b. Explicit linkage of retirement dates and the level of retirement income to estimates of life expectancy.
- c. The design of decumulation products (variable annuities or draw down plans) where the income that is generated is directly linked to investment returns, interest rates and possibly to inflation rates.
- d. Extension of financial markets by trading risks that are not traded on financial markets.
- e. Transparency on the implications of risk in financial markets for the pension income to be obtained.

The outline of this paper is as follows. Section II describes the main ingredients of the Dutch pension system to provide the required background for understanding the discussion on the reforms. Section III summarizes the main arguments to provide pension income until death (i. e. annuities) to insure against ones individual longevity risk. Section IV then turns to the risk management of reductions in over-all mortality rates, i. e. to macro longevity risk and increases in life expectancy. In Section V we consider optimal exposure to financial risks in retirement products. Section VI explores how to start explicitly with a risk profile in terms of pension

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income that is contracted and to take this as the starting point for a generalized Liability Driven Investment (LDI) strategy. In Section VII we explore potential differences between mandatory collective (“DB”) and individual pension schemes. The next section analyses consumer information and consumer protection in the Netherlands. Finally Section IX concludes.

■ II. THE CURRENT DUTCH PENSION SYSTEM

The Dutch pension system consists of three pillars. The first pillar provides a flat minimum retirement income for all. The second pillar provides pension income that is related to labor income. It is accessible only for employees and is mandatory for them. Finally the third pillar provides voluntary pension coverage for those with insufficient pension income. It is particularly important for the self-employed who are not covered by the second pillar.

The first pillar (AOW) provides full basic income for everyone who lived in the Netherlands for the full period between the age of 15 and the age of 65. Those that lived abroad for some period or arrived in the Netherlands at a later age get proportional benefits. Having lived abroad for 20 years for example would imply a $20/50 = 40\%$ reduction in benefits. AOW income is a Pay-As-You-Go (PAYG) element in the pension system that is paid for by the current working generations and partially through taxation. The eligibility age has been 65 ever since the system was introduced in 1957. In the ongoing reform, the eligibility age has already been announced to increase to 67 in 2024 and will subsequently be linked to the observed survival rates (see Section 4). AOW income cannot be claimed before the eligibility age.

Participation in second pillar pension arrangements is mandatory for all employees. The dominant model originates from a pure Defined Benefit (DB) system but developed over the years. In DB pension systems participants annually accrue pension rights in a collective pool and receive pension income after retirement. In traditional DB schemes the pension income would be a nominal guarantee and all risks are either avoided in the investment strategy or covered by an external party such as the sponsor of the plan. However, in the dominant Dutch “DB” model the pension income to be received is clearly dependent on returns in financial markets, interest rates and inflation rates. Participants annually accrue a fixed percentage (say 2%) of their income as annual retirement income after the statutory retirement date until death. Until 2003 the relevant income concept was typically the final wage income, implying a substantial subsidy to individuals with steep careers. In 2003, this has been adjusted to average income over the working years. At least as relevant though is whether or not the accrued pension income is compensated for inflation. This is where the dependence on financial markets comes in. In the so called conditional indexation mechanism, also introduced in 2003, accrued rights are fully compensated for inflation if the value of the assets largely exceeds that of guaranteed liabilities. If the value of the

assets does not exceed that of guaranteed liabilities by much, part of the inflation will typically be compensated while no compensation will be given if the value of the assets hardly exceeds that of guaranteed liabilities. The value of the liabilities primarily depends on the level of the term structure of interest rates, while the value of the assets obviously depends on returns in financial markets as well as on the level of the interest rates. Poor equity returns, but even more so low interest rates, imply that accrued pension rights will not be compensated for inflation. Likewise increases in survival rates raise the value of the liabilities of the fund and can imply that benefits are not indexed.

If the market value of the assets is less than the market value of guaranteed liabilities, the level of the pension benefit can even be reduced by the pension fund. This is a marked difference with the adjustment mechanisms that insurers can use in the third pillar. In case of such underfunding, a recovery plan is to be submitted to the supervisor to show that the value of the assets will within five years, again exceed that of guaranteed liabilities (including a 5% margin). If such a recovery plan cannot be constructed, pension benefits have to be cut. This happened with the pension benefits of a sizable number of pension funds in the Netherlands in April 2013. The level of the cuts for some of the smaller funds has been in the range of 5-10% and further cuts in April 2014 are not unlikely. Both the rapid increase in life expectancy and the low level of interest rates have contributed to rapid increases in the market value of guaranteed liabilities. More than the development in equity markets, these two factors caused the benefit cuts.

Pension entitlements in the second pillar come with a statutory age as of much the accrued level of pension income can be received. Participants have substantial choice though to claim benefits earlier or later than this statutory age. The level of annual income is then recomputed at an actuarially fair basis, implying roughly a 7-8% higher annual income for every year that one postpones claiming. The statutory age will be increased in the years to come, in line with the increase in the statutory age for AOW entitlement. Until recently, pension funds offered quite attractive financial opportunities for early retirement, funded by the wealth of the pension fund. These provisions have now all disappeared which has led to a rapid increase in the average actual retirement age which was below 60 years some time ago to almost 64 years in 2013.

The third pillar of the pension system offers a wide variety of voluntary financial products to obtain adequate retirement income. Like in many other countries individuals are reluctant to buy these products and are often much too optimistic on the amount of wealth that is to be saved to generate adequate retirement income. A distinguishing feature of the Dutch retirement products compared to other countries is that pension capital is to be converted² to pension income (i. e. to annuities) at or around retirement. This will almost always imply conversion to nominally fixed annuities as other annuity products are hardly offered in the Dutch market. The Authority Financial Markets (AFM), the Dutch supervisory

body for consumer protection in financial markets, strongly encourages management of the financial risks around conversion of pension capital to these nominal annuities. If equity markets or interest rates drop unexpectedly, the pension income that can actually be bought might be substantially less than expected. The AFM therefore encourages pension products that are based on life cycle features (less risk taking in equity markets close to retirement) and on matching the duration of the fixed income investments in the capital with the duration of the annuity to be bought.

More information on the current Dutch pension system and on its strengths and weaknesses is provided in Bovenberg and Nijman (2009, 2012).

■ III. INSURANCE AGAINST INDIVIDUAL LONGEVITY RISK

An extensive academic literature (Brown et al (2008), Mitchell, Piggott and Takayama (2011)) shows that the fact that individuals do not know the date at which they pass away is one of the main risks in their retirement planning. Components of pension systems that provide income until death provide an element of insurance against this individual longevity risk. All pension systems around the world seem to have an unfunded (PAYG) element that provides for some income, be it as an element of the pension systems or explicitly as (means tested) subsistence income for the poor. In some countries the level of income generated by this pillar is much more sizable than in others. Because of the fiscal deficits and population ageing, the generosity of this pillar has recently been reduced in many European countries and is likely to be reduced further. The European Committee and many national European governments therefore promote accumulation of pension wealth using adequate retirement products.

The academic literature (see e.g. Brown, Davydoff and Diamond (2005)) argues that under a number of simplifying assumptions one should even draw down all pension capital as an annuity, that is as an income stream until death which insures against individual longevity risk. Annuities provide cheap income for survivors because of the mortality credit in pricing the annuity, which reflects the fact that the survivor can spend the capital that in

non-annuitized products would have gone to (the heirs of) those that passed away. Two main counterarguments to substantial use of annuities are a preference to leave a bequest and background risks which require unexpected payments, e.g. to health care costs. Once bought, annuities cannot be reversed because the individual will always have superior information on his or her survival probabilities. A third counterargument can be that the annuities that are available in the market do not generate adequate exposure to other risk factors. Nominally fixed annuities e.g. do not have exposure to equity markets or to inflation. As we will discuss in more detail in Section 6 one of the elements in the Dutch pension reform will therefore be to enable provision of variable annuities in the third pillar with adequate exposure to equity markets.

Experience in many countries (the US and Australia are prime examples) also shows that, notwithstanding the implications of these normative models, it is very hard to persuade individuals to insure against their individual longevity risk using annuities. Individuals prefer flexibility and want to avoid to pay in more than they would “get out” if they would pass away at an early age. See Brown et al (2008) for extensive discussions on the behavioral aspects of annuity choice. In several countries (UK, Netherlands) it has been made mandatory to consume pension capital in annuitized form (in the UK: as of the age of 80) which is of course one (paternalistic) way to overcome the behavioral issues.

■ IV. INCREASES IN LIFE EXPECTANCY AND EXPOSURE TO MACRO LONGEVITY RISK

In the previous Section we considered individual (micro) longevity risk and pension products that provide life contingent income as a way to insure against this risk. Another aspect of the design of pension systems is how to deal with uncertain life expectancy of the insured population, i. e. of uncertainty in future survival probabilities. Changes in life styles and improvements in health care have generated rapid increases in life expectancy that are often estimated to be more than a year every ten years. The increase in (projected) life expectancy moreover fluctuates from year to year. Table 1 shows numerical results for the

Table 1. Estimated remaining life expectancy of Dutch men and women per age group in 2060

Year of estimate		2010	2012	2010	2012
Gender		men	men	women	women
Age	0	85,9	86,8	87,6	87,3
	25	61,0	61,9	62,7	62,5
	45	41,3	42,2	42,9	42,7
	65	22,2	23,1	23,9	24,3
	85	5,9	6,6	7,4	7,8

life expectancy in the Netherlands in 2060 as projected by the Dutch Actuarial Society. In two years time the projected life expectancy for new born males increased by almost a year while it decreased for females. The life expectancy as of the current statutory retirement date (65) increased strongly for men and increased as well, but much less for women.

Providers of pension income have to deal with the uncertainty in life expectancy as of retirement in particular. If people live longer they have to pay pension incomes for a longer period. While individual longevity risk diversifies away in the portfolio of a pension provider, this is not the case for this macro longevity risk.

Macro longevity risk hits all pillars of the pension system. Macro longevity risk can for now not or hardly be traded in financial markets (but see Blake *et al.* (2013)) for proposals to stimulate trades in longevity risk). Insurers that offer life time pension income in the third pillar have to maintain large solvency buffers for this risk unless they are able to add other exposures to their portfolio that hedge against the risk of having additional expenditures in pensions if life expectancy increases unexpectedly (see e.g. Wong, Sherris and Stevens (2013)). For these reasons, Dutch insurers have recently become quite reluctant to take additional macro longevity risk in their books and argue that it should be possible for them to offer financial products of which the cash flow generated to the individual depends on projected survival rates by an independent body such as the Society of Actuaries or Statistics Netherlands. The adaption of pension income to changes in survival rates to be implemented in the second pillar could serve as an example.

In the Dutch second pillar (the mandatory participation in pension funds), increases in survival rates have increased the estimated value of the liabilities of many pension funds by more than 5% in recent years. In the pension agreement between employers and labor unions in 2010 and 2011 the decision has been taken to change the legal structure such that the annual benefits of all participants can be reduced in case of increased survival probabilities in order to a balance between the value of the assets and the value of the liabilities. The common way to summarize this mechanism is "People live longer on average and the same pension capital is allocated to them but they receive less per year during more years". Typically bad (as well as good) shocks in life expectancy will be smoothed over a ten year period implying that elderly citizens are somewhat protected.

In AOW, the first PAYG pillar, it is not the level of the income but the eligibility age that adjust to keep the system sustainable in case of increases in life expectancy. As discussed in Section 2, the eligibility age will be increased to 67 in 2024. As of that date, the eligibility age will increase further if the estimated life expectancy has increased. This automatic linkage of the eligibility age to life expectancy prevents political debates whenever the eligibility age would have to be adjusted. An important difference between the second and third pillar and this first pillar is that all actuarial calculations in the second and third pillar will be rooted in model-based estimates (cohort tables) using e.g. the Lee-Carter (1992) approach

or the approach put forward by Blake *et al.* (2013). This provides the best estimate of the market value of the life contingent liabilities and the level of assets required to honor them. The main drawback of this approach is that it requires subjective elements such as the best approach to project survival rates. In the first, unfunded, pillar where market values are less important life expectancy will therefore be based on observed survival rates in recent years (period tables). This underestimates life expectancies of the current generations but is in line with an aim to balance the budgeted costs of this component of the pension system.

■ V. ADEQUATE FINANCIAL RETIREMENT PRODUCTS

In this section we will focus on the design of adequate financial products for accumulation and decumulation of retirement wealth. Section 3 presents strong reasons why ideally these products should be designed as true annuities, i. e. should generate income until death. As discussed there, there is wide spread evidence (Brown *et al.* (2011)) that for behavioral reasons many potential participants prefer non-annuitized products that generate income for their heirs once passed away. This distinction is not crucial for the analysis of optimal exposure to financial risks such as equity market risk, interest rate of inflation risk that we consider in the Section.

The issue whether or not a pension product should offer guaranteed income streams or other elements of guarantees (e.g. guaranteed minimum return) is at the heart of the Dutch pension reform. The third pillar products offered by insurers provide nominal guarantees, possibly with a fixed annual increase to compensate for expected inflation. In Defined Contribution products pension capital is to be converted to such nominally guaranteed annuities. Likewise in the current DB products offered by pension funds the information provided to the participants suggests that guarantees are offered. The small print of the regulation shows that this is not the case. The actual investment policy of many DB pension funds (in particular the largest ones) is risk taking, whether or not sufficient wealth is available to honor the guarantees that have been suggested. As a result many pension funds had to cut the payments to current retirees and the pension rights of future retirees in April 2013, mainly because of the low interest rates.

The Dutch pension reform is based on the starting point that guarantees based on riskless bond investing make an unattractive retirement product. Of course everyone prefers low risk in future pension income if it would be possible to achieve this without an impact on either the expected pension income or the required contribution (cost) level. However, expected pension income in future years ($Y^e(t)$), the degree of risk in this outcome and the level of contribution to be paid in ($P(t)$) are intimately linked. Let R denote the (flat; nominal or real) riskless interest rate, λ the equity risk premium and w the allocation to equity markets in the investment strategy. Standard discounting arguments in finance show that in case of a flat

expected (nominal or real) income stream and a constant investment strategy with expected return $\mu = R + w\lambda$ the contribution level $P(t)$ and the expected income level Y^e are connected through

$$P(t) = \sum_{i=0}^{\infty} p(i) / (1 + \mu)^i Y^e(t) = A Y^e(t)$$

where i is the number of years until retirement and $p(i)$ the probability to live at least for i more years. The variable A that is implicitly defined in this equation is known as the annuity factor. A simple back of the envelope computation based on duration analysis shows that the impact of risk taking is sizable. For simplicity we assume all agents work until retirement at 65, survive until the age of 85 and then pass away. Retirement capital is paid in during working life, i. e. on average at the age 45. Retirement income is obtained during retirement, that is on average say at age 75. Estimates of the equity premium (the difference between the expected return on stocks and bonds) typically fall in the range from 2%-6%. For simplicity we assume an equity premium of $\lambda = 3\%$. If the contribution level is unchanged, a 50/50 asset mix will then have a 1.5% higher annual expected return than riskless bond investing, implying a $(75-45)*1.5\% = 45\%$ higher expected income than in case of a riskless investment strategy. Risk taking is essential for adequate retirement products, unless one is extremely risk averse. The same reasoning likewise shows the benefits of risk taking in the decumulation phase. Lack of risk taking as of the age of 65 would reduce the expected average pension income by $(75-65)*1.5\% = 15\%$.

This simple numerical example shows that pure guarantees are unattractive in long run investing for pension income. Even in the retirement phase, risk taking is attractive unless the agent is quite risk averse. Annuities (as well as risk free drawn products that are not life contingent) that generate a flat nominal income profile are suboptimal for such agents, variable annuities and risk taking in draw plans is more attractive. Of course the welfare gain that can be achieved by risky rather than riskless annuities is more sizable for individuals for whom a substantial fraction of pension income is generated by this financial pension product. In the Netherlands, this is the case for middle and high income levels. For the lowest income groups the retirement income almost exclusively depends on AOW income from the PAYG first pillar (see Section 2) and the design of the funded pension product will be of less significance.

While full guarantees over a long investment period are unattractive, it can of course well be in line with individual preferences to have some level of guaranteed income while another part of wealth is invested in risky assets. Life cycle theory (see e.g. Merton (1969) and Cocco, Gomes and Maenhout (2005)) argues that the asset allocation of retirement capital should focus on risky assets for young participants and gradually reduce the risk exposure in the portfolio for older participants. The optimal level of the guaranteed income is therefore likely to increase with age (see Bodie, Merton and Samuelson (1992)). While pension products with an age dependent level of guarantees can be offered in the Dutch third pillar and in individual DC products in the second pillar they can currently not be offered by the collective pension funds. The underlying

reason is that all agents in the fund are to be treated identically to avoid illegal age discrimination in the collective pool. Whenever referring to guarantees it is important to note that guarantees in Dutch pension products will always be nominal guarantees, i. e. guarantees in Euro terms rather than in real terms (corrected for inflation). Real guarantees are not investable because no bonds linked to Dutch inflation are traded. Unless agents are affected by money illusion, their preferences will be to receive real guarantees on their pension income, which are not investable.

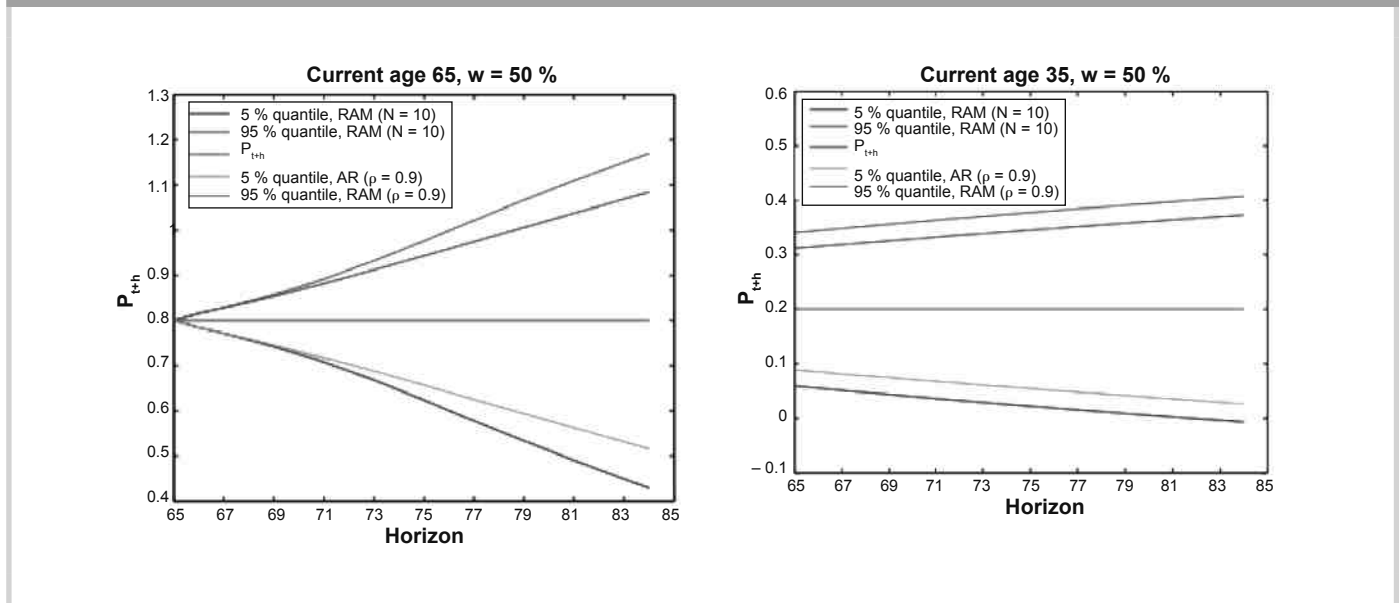
As stated before, life cycle theory argues that the asset allocation of retirement capital should focus on risky assets for young participants and gradually reduce the risk exposure in the portfolio for older participants. The underlying motivation for this investment advice is that young participants have a lot of human capital (future labor income) that is relatively safe (see e.g. Benzoni, Collin-Dufresne and Goldstein *et al.* (2007); de Jong (2012)). To have adequate risk exposure over all therefore the (initially small amount of) retirement capital should be invested primarily in risky assets. This is exactly in line with the popular advice to set the percentage of the portfolio invested in risky assets equal to one hundred minus one's age, and with popular life cycle and target date funds. Standard life cycle theory also suggests some risky investing also after retirement, even if the human capital is then depleted. In many countries though, retirement products that provide adequate investment risks are not available. Annuity markets, if present, are often restricted to nominally guaranteed income streams. Extension to variable annuities, in which future income is dependent on investment returns, should be quite attractive.

In the variable annuity contract that will be offered by Dutch pension funds, shocks in financial markets are smoothed over a 10 year window, like in case of shocks in life expectancy as discussed in Section 4. The exposure to financial markets that such an annuity offers is optimal if the agents can be characterized by a preference function that exhibits a specific form of habit formation: these agents prefer to retain the same consumption level and are more willing to accept risk in the more distant future. Shocks in wealth levels are gradually absorbed to adjust the habit levels. The specification of the variable annuity contract moreover has the advantage that identical shocks are imposed per year on all pension entitlements, in line with the legal requirements to avoid age discrimination. As young workers accumulate many shocks before their first pension income is to be received, the mechanism automatically generates a level of differentiation in risk exposure across age groups, in line with life cycle theory. Dutch insurers are currently lobbying to be allowed to offer this same product in the third pillar.

■ VI. LIABILITY DRIVEN INVESTMENTS

Because of the Defined Benefit tradition of the Dutch pension sector, the liabilities of the pension provider have always been the natural starting point in The Netherlands,

Figure 1. Preferred risk profiles for retirement income for a 65 and a 35 years old individual assuming habit formation.



to determine the adequate investment strategy for retirement products. In this section we will argue that this starting point is still vital, also if the liability for the provider is no longer a guaranteed income stream that is to be honored.

The proposed new starting point for contribution, investment and decumulation strategies for pension funds is the preferred risk profile of the individual. The risk profile specifies the individuals preferred trade-off between the expected pension income (the “ambition”), the risk level and the required contribution to achieve this. It seems natural to assume that agents are willing to accept more investment risks in retirement income that is to be received further in the future, because they would have more years to adjust to negative shocks in financial markets. This corresponds with the variable annuity product that was described in the previous Section. Figure 1 summarizes such a risk profile.

The left panel of Figure 1 specifies the preferred risk profile for a 65 year old. It is assumed that the pension capital that is accrued is sufficient to pay for a (risky) expected pension income of 80% of the average wage over the active career. This number is reflected on the vertical axis. It is based on the assumption that the contributions to the scheme for every working year generates 2% of that income as pension income per year during retirement. Such an accrual of 2% per year and an assumed span of the working life of 40 years yields an expected pension income of 80% of the average wage. It is assumed that the investment strategy for the pension capital during retirement corresponds to the agent’s preferred risk profile which is labeled “AR”, in which 10% of a shock in financial markets is absorbed in pension income every year. The figure shows that the trade-off between cost level, degree of certainty and

expected income (ambition) that is reflected in the risk profile is such that the agent accepts the risk that the actual purchasing power of his pension income will be substantially less than targeted. The probability to have a purchasing power of only 60% of average working life income rather than the targeted 80% in ten years time (at the age of 75) is approximately 5%. This risk taking lowers the required pension capital for a given expected income level. Stated differently, the annual income that can be generated with a fixed pension capital would be substantially lower if the agent would demand a riskless pension income (see Section 5). If the agent would be willing to accept somewhat more risk than in the base case, as in the profile labeled “RAM”, somewhat less pension capital will be required. Note also that the 35 year old agent has accrued less pension capital so far (adequate only for $10 \times 2\% = 20\%$ of average wage per year during retirement) and that his preferred pension income is almost equally risky in all years. This is due to the much larger horizon until the first pension payments which implies that the smoothing mechanism hardly has an effect.

The key ingredient of adequate investment strategies to stay in line with the targeted risk profile is the annuity factor. Likewise this annuity factor plays a vital role in setting optimal draw down rules and in pricing. The annuity factor $A(t)$ links pension capital $W(t)$ to expected pension income $Y^e(t)$: $Y^e(t) = W(t)/A(t)$. As discussed in the previous section, the annuity factor $A(t)$ is determined by the survival probabilities (or the fixed term over which payments will be made for non-life contingent drawn down products) and the expected return or risk premium on the investment strategy. Here we consider the investment strategy that is consistent with the smoothing of shocks in financial markets over a number of years, in line with

preferences with habit formation. The earlier expression for the annuity factor for an individual real variable annuity now generalizes to (see Nijman, van Stalborgh, van Toor and Werker (2013)) for details).

$$A(t) = \sum_{i=0}^{\infty} p(i) (1 + R_t^{(i)} - \bar{\pi}_t^{(i)} + w Q_i \lambda)^{-i}.$$

In this equation $p(i)$ reflects the probability for the individual to survive for at least i years, $R_t^{(i)}$ is the current (t) nominal interest rate for maturity i , $\bar{\pi}_t^{(i)}$ is the current average expected inflation for the next i years, λ reflects the equity risk premium³, w the fraction of risky asset allowed by the risk profile for long term investments and Q_i reflects the preferred smoothing of shocks over time ($0 \leq Q_i \leq 1$). Note that in the expression for the annuity factor we assumed for simplicity that the inflation risk premium is negligible. For agents who prefer non-annuitized products and plan to receive income from the financial product under consideration for a fixed T year period, the relevant annuity factor (here better referred to as one over the consumption / wealth ratio) is obtained by setting $p(i)$ equal to one for the first T years and to zero afterwards.

For nominally flat income streams the annuity factor is determined by discounting the expected cash flow against the nominal term structure of interest rates, the term reflecting $\bar{\pi}_t^{(i)}$ and λ vanish. The annuity factor for a fixed real income stream can be computed using the real term structure: the term reflecting λ is absent. As shown in the formula the annuity factor for a variable real annuity is determined by discounting the expected cash flow using the expected return on the investment strategy, which will equal the real interest rate plus a horizon dependent risk premium that reflects the risk exposure times the equity risk premium in the market. In case of a variable nominal annuity, the risk premium is to be added to the nominal term structure, i. e. the $\bar{\pi}_t^{(i)}$ term vanishes. For a 65 year old individual typical values for the annuity factor would be⁴ 9 for the nominal fixed annuity, 13 for the real fixed annuity and 8 and 10 for the variable nominal and real annuity. These values of the annuity factor clearly reflect the trade-off between ambition, cost and certainty: the same expected pension income (Y) can be achieved at lower cost (P) if more risk is accepted (higher value for A).

As mentioned before, the annuity factor has two other applications which are as important as its use to determine the required capital (cost) to achieve a certain pension ambition given a preferred risk profile: the annuity factor determines the optimal pay-out level as well as the preferred (liability driven) investment strategy. We now elaborate on these two aspects of the annuity factor.

Pension wealth in variable annuities, $W(t)$, is invested at least partially in risky investments. The level of pension wealth in a future year is determined by the initial wealth, the income streams that are generated and by the return financial markets that was realized. The initial link between pension capital, pension income and the annuity factor, $Y(t) = W(t) / A(t)$, will not hold at future dates $s > t$ unless the income stream $Y(t)$ is adjusted. The optimal draw down from the annuity for an agent that prefers to smooth shocks is determined again by

the annuity factor: $Y(s) = W(s) / A(s)$. Another way to state this is that $1/A(s)$ reflects the optimal consumption over wealth ratio. A smooth income pattern is therefore achieved if the exposure to risk factors in the annuity factor is matched by risk taking in the investment strategy implying that fluctuations in interest rates (and possibly inflation rates) are matched. Such an investment strategy is one of the characteristics of a liability driven investment strategy (LDI).

The term LDI is routinely used for the more restricted case where fixed guaranteed income streams (liabilities of the pension provider) are to be matched by investing in the bond portfolio that matches all cash flows in the liabilities. In the discussion on the Dutch pension reform the concept has been generalized in two directions. First of all the exposure to interest rate risk is set not to match fixed liabilities but rather to match the expected (flat) cash flow of the variable annuity. Because of the presence of the risk premium in the annuity factor the expected cash flows to be matched are somewhat different. If the matching strategy would be based on duration analysis, the duration to be matched is lower because future payments require less capital. The more important second dimension of the more general concept of liability driven investment is that the exposure to equity markets should reflect the preferred risk profile of the individual. The risk profile in Figure 1 implies that the equity risk is reduced when the agent ages, because for older agents a smaller fraction of total capital is allocated to long term income where investment risk is more acceptable.

Figure 2 illustrates the asset allocation that is consistent with the targeted risk profiles in figure 1. We assume for simplicity that equity market is the only relevant risk factor and that agents pass away at the age of 85. In order to have risks exposures that are consistent with the smaller risk exposure in pension income for older individuals due to smoothing, low less of risk taking are adequate. The risk level is reduced further the older the agent gets. The investment strategy for the young individual (left panel) is substantially more risky. More details can be found in Nijman, van Toor, van Stalborgh and Werker (2013).

In many pension products asset allocation in the investment strategy and the targeted risk profile for pension income are treated as two unrelated design features of the product. In many DC products substantial investment risk are taken in the accumulation phase and the focus is one the pension capital to be achieved rather than on pension income that can be generated. LDI investment strategies however take the pension income as the starting point and accept lower pension capital at retirement in states of nature where interest rates are high, i. e. pension income is cheap. In the Netherlands the regulator even prescribes LDI investment styles in DC products because the providers have to manage the risk of the mandatory conversion of the pension capital to pension income at retirement: equity risk is to be reduced towards retirement just as in life cycle funds, but moreover the cash flow pattern of the fixed income portfolio is to match the cash flow pattern of the (fixed nominal) annuity to be bought. When risk profiles as in

Figure 2: Asset allocation for 35 and 65 year old consistent with targeted risk profile in figure 1

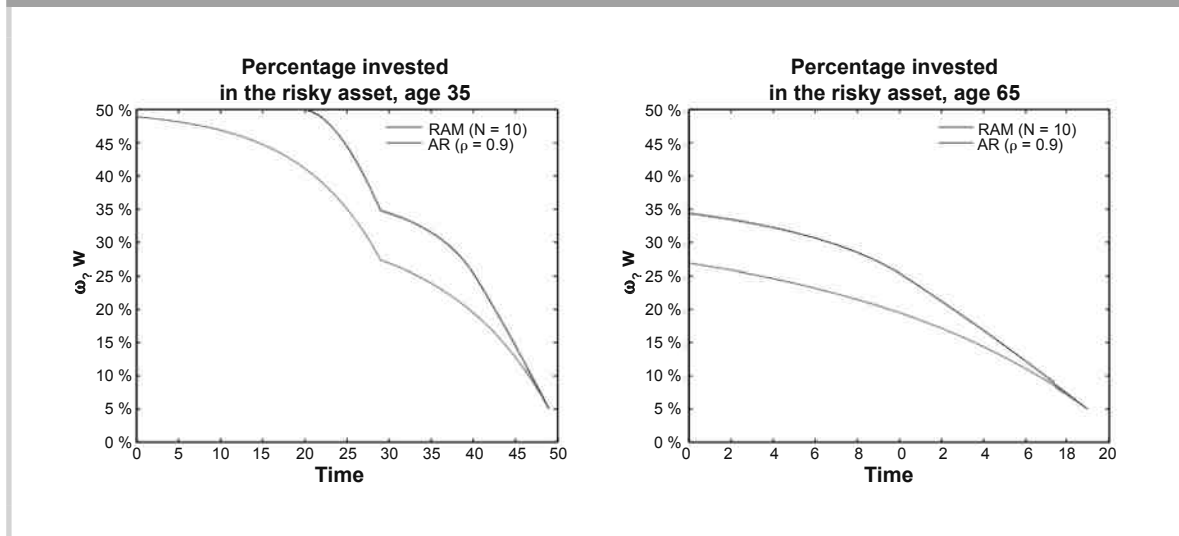


Figure 1 are taken as the starting point LDI investing not only refers to adequate exposure to the nominal or real interest rate but also requires adequate equity investing to generate the risk premium that is required for a stable income pattern without taking more (diversifiable) risk than needed.

VII. EXTENSION OF FINANCIAL MARKETS BY TRADING RISKS THAT ARE NOT TRADED ON FINANCIAL MARKETS

Participation in collective pension funds allows risk trades that can typically not be implemented in financial markets. The treatment of macro longevity risk that was described in Section 4 is a first example. Macro longevity risk can hardly be traded in financial markets. The board of a Dutch pension fund can (subject to some regulatory constraints of course) implement how participants in the pension fund share this risk by specifying in advance whose benefits will be reduced more if the value of the liabilities is affected by changes in survival rates. This is substantially harder to achieve in individual systems, although theoretically feasible.

Dutch inflation risk is another example of a relevant risk factor that cannot be traded in financial markets. Dutch pension funds can implement risk sharing rules that specify how benefits are adjusted as a function of inflation rates and inflation expectations. As high expected inflation in say 20 years affects the young participants much more than the elderly, clear potential for risk sharing is present. The elderly should be willing to offer (partial) protection against this risk to the young, provided they receive an adequate risk premium. This example however also shows the limitations on the potential welfare gains

of such trades within the pension fund. Expectations of future inflation are quite subjective if inflation risk is not traded in Inflation Linked Bond markets. The political and governance risk associated with the selection of the adequate inflation forecast hampers the potential use of this “solidarity mechanism”. For this reason also the initial government proposal to redistribute economic wealth on the basis of inflation forecasts (typically referred to as the “real contract”) has been withdrawn in October 2013.

Risk sharing with non-overlapping generations is a related issue. In principle pension funds with mandatory participation can charge contribution levels for new accruals that fall below or above the actuarially fair price of the rights that are accrued. In harsh economic times recovery contributions can be charged⁵ on top of the actuarially fair price while in flourishing economic states costs reductions can be offered. When effective such a mechanism shares risks with future employees, some of whom might currently not even be active on the labor market yet. Obviously this would provide better risk sharing than is available in financial markets. The counterargument to this obviously is that future employees will try to avoid the contract if their contribution rates get to unfair by moving to other employers or sectors in the economy or by lobbying for adjustments in the pension deal. Moreover the level of contributions is low compared to the value of the liabilities for the mature Dutch funds, implying that at best rather limited risk sharing can be achieved.

VIII. CONSUMER INFORMATION AND TRANSPARENCY

A final important element of the Dutch pension reform is improved information to consumers and participants

in pension funds as well as adequate consumer protection. A first element of this improved information is a national website that provides access to information on accrued first and second pillar benefits from all providers. In particular individuals that frequently changed jobs can have benefits from many different pension funds as value transfer to the pension fund linked to the new employer is possible when changing jobs but often not implemented. The national website summarizes one's labor history and links subsequently to the websites of the relevant providers. Unfortunately for now the voluntary third pillar pension coverage is not yet included in this website.

Another important element of the reform will be to be transparent about the purchasing power of the pension income to be received as well as on the investment risks associated with the pension entitlements. Currently all participants annually receive a "Uniform Pension Information Leaflet" stating the nominal pension income one would receive as of the statutory retirement date in two different labor market scenario's. In the first scenario the individual stops working and accruing second pillar benefits today, in the second scenario one accrues benefits at the same level as in last year until retirement. The information leaflet also contains information on the consequences of life time events, such as the pension income that would be available for the spouse if one passes away. In an improved information leaflet participants will be informed about the expected purchasing power rather than the nominal level of their pension income and will get information on the purchasing power of their pension in a pessimistic scenario for future investment returns, interest rates and inflation. Statistically the pessimistic scenario will be the 5% or 10% quantile of the distribution. The computation of the expectation and quantiles of the purchasing power is to be based on Monte Carlo simulation based on a number of subjective model and parameter assumptions. These include assumptions on the expected equity returns, expected inflation, uncertainty in equity returns, inflation rates and interest rates. There is no claim that the assumptions to be prescribed by the Dutch legislator would be fully correct and provide the one and only objectively correct value for the expected purchasing power and its quantiles. Being "approximately right" to give participants at least an impression of the (quite sizable) investment risks linked to long term

investing for pensions is seen as more attractive than being "exactly wrong" by providing the legally correct but uninformative number of accrued nominal benefits.

Currently the market value of all accrued pension entitlement is not reported by Dutch pension funds, while this is of course a key statistic in the DC plans. Many academics have advocated to include the (economic) market value of the accruals in the information provided to consumers and to ask pension funds to explain explicitly what caused the economic value to change from year to year.

■ IX. CONCLUDING REMARKS

Like in many countries, reform of the pension system in the Netherlands is a lengthy process that takes many years. Many initially novel ideas on linking retirement age to estimates of the life expectancy were initially much disputed but are now widely accepted and partially already implemented. The notion that risk taking is attractive when investing for the long run has reached the public at large although the precise implementation of 'soft pension rights' is still not settled, four years after the Goudswaard and Frijns reports that initiated this line of thinking.

Pension systems differ widely across the globe and what makes a pension system attractive is dependent on historical developments, social law and societal values. Improved understanding of pension systems in a specific country (the Netherlands in this case) nevertheless might provide useful suggestions for other countries to rethink their pension system and the pension products that are offered. ■

- 1 The author was a member of the Goudswaard committee.
- 2 Recently one exception to this rule was introduced so called bank saving, which refers to investment products offered by banks that are not allowed to take biometric risks. See Brown and Nijman (2011) for more details.
- 3 In this paper we assume that the risk premium does not depend on interest rates or horizon.
- 4 Of course the precise numerical values depend on assumptions on survival rates, nominal and real interest rates, the equity risk premium, the long run equity exposure in the annuity and the degree of smoothing in the variable annuity.
- 5 Alternatively one can also charge contribution rates below the actuarially fair level if interest rates are low, to allow the accrual rates that one is used to without raising the contribution rates. This is currently the case.

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