

## 5 Optimal risk-sharing in private and collective pension contracts

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*Pension solidarity can no longer be taken for granted. Due to demographic changes – and hence a growing retiree/employee ratio – additional contributions offer steadily fewer opportunities for clearing pension shortfalls. Together with the growing costs of contribution volatility and the trend towards short-termism, this means that the added value of solidarity is increasingly being called into question. A carefully argued and well-substantiated answer is therefore in order.*

*What is the added value of solidarity and what is an ‘optimal’ pension contract? This contribution seeks to provide a survey of what we can learn about these issues from the current academic literature and to identify those areas where further in-depth research is warranted. The starting point consists of the private and collective pension contracts that are perceived to be optimal in the academic literature. However, the practical questions regarding pension funds and the economic environment in which pension funds operate are considerably more complex than assumed in the literature. Additional research is necessary to answer the central questions concerning the added value of pension solidarity and the optimal form of pension contracts.*

*This contribution analyses how the assumptions and findings of the WRR study (Boender et al., 2000) relate to the customary assumptions in the academic literature. It specifies what we can learn from this about the added value of pension solidarity as calculated in that study.*

*The insights in this contribution do not result in a single uniform answer regarding the exact added value of pension solidarity and the precise form of optimal pension contracts. Our aim here is rather to arrive at a number of concrete research questions in order to gain a deeper understanding of the underlying considerations and to be able to build a bridge in the near future between the academic literature and complex reality.*

## 5.1 Introduction

Solidarity in pension systems exists in many different guises.<sup>1</sup> Several contributions in this book discuss examples of solidarity and seek to define what form of solidarity leads to the most desirable cost-benefit distribution in pension contracts. An important aspect is that the pension contract is designed to meet the preferences and circumstances of all individuals in an optimal way. This is often referred to as risk solidarity, where the pension contract is designed to protect the vulnerable elderly against a sudden loss of pension capital due to economic shocks. Young people are better able to absorb these shocks, because of their available human capital and longer investment horizon. In return, young people must receive an adequate reward for their role as shock absorber.

This reward is all the more vital now that solidarity in the pension system is under pressure. One important cause of this pressure is the growing retiree/employee ratio. In the year 2006 pension assets in the Netherlands had already grown considerably above the value of the gross domestic product (GDP) and, when ageing reaches its peak, pension assets will be more than twice as large as the Dutch GDP. Assuming there is no structural decrease in annuity rates and returns in an ageing society and no further increase in estimated longevity, the pension system will not become more expensive due to ageing and a growing retiree/employee ratio, but it will become less risk-resistant. Back in the seventies and eighties, the national wage bill and GDP were so large compared to the accrued pension capital, that a pension capital loss of e.g. 10% could be easily made up for by charging the working population limited extra contributions. In the year 2006, however, this passing of responsibility to the employed would soon cost more than 10% of GDP, rising to over 20% of GDP in the year 2030. This is an important and objective cause of the growing doubts within society regarding the sustainability of the pension system.

New pension regulations have highlighted this reduced risk-resistance, which is positive in itself. But this increased awareness has also divided opinions as to who should bear responsibility for the pension system's greater vulnerability. The debate took on an ever sharper edge in the wake of the equity and bond slump at the start of the new millennium. The upshot, in short, is that solidarity is under pressure, particularly among the young who fear their current contributions are predicated on solidarity

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<sup>1</sup> An extensive description of the many different types can be found in the appendix of Chapter 2 in this volume, by Jan Kuné.

principles that may no longer hold sway when they reach old age. For this reason, pension solidarity can no longer be taken for granted and must be shown to offer an economic win-win proposition for young and old alike.

#### PREVIOUS RESEARCH

The value of pension solidarity in collective pension systems is demonstrated in a study carried out on behalf of the Scientific Council for Government Policy (WRR) (Boender et al., 2000). This report provides quantitative evidence that an individual within a collective scheme achieves a significantly better pension than an identical individual who is entirely responsible for making his own pension arrangements. Within the pension solidarity debate this report is often cited as an argument against switching to defined contribution (DC) systems where all pension risks are off-loaded onto the individual participants.

However, the risk-sharing assumptions made in this report do not correspond with the pension policy that is demonstrated to be optimal in simplified theoretical models that are explicitly based on individual utility functions (see e.g. Teulings and De Vries, 2005). The outcomes of the WRR report have therefore attracted strong criticism, raising doubts as to whether pension solidarity yields genuine economic benefits. Clearly, therefore, there is a great practical need for a more explicit understanding of what type of pension solidarity delivers what economic benefit under what assumptions. This contribution is a first step in that direction.

#### STRUCTURE OF THE ARGUMENT

This chapter is built up as follows. In section 5.2 we will first establish what the optimal pension contract looks like according to the recent academic literature. The central question is: what investment and contribution decisions are optimal in the event of shocks on the financial markets and given the age of an individual? This section describes what pension policy is optimal if a number of simplifying assumptions are met.

The assumptions of the theoretical model are not consistent with practical reality. The extent to which this is the case and the resulting consequences for, respectively, the optimal pension policy for an individual and a collective are discussed in sections 5.3 and 5.4.

The optimal pension policy given the assumptions made in the academic literature diverges significantly from the outcomes of the aforementioned WRR study. With the assumptions applied in the WRR study, it is

found that, notably, risk solidarity between generations delivers substantial economic benefits and that buffers have great added value. This solidarity comes about because people in the workforce – if necessary – pay extra contributions and temporarily accept underfunding in order to protect the pensions of the elderly against inflationary erosion. In return, the elderly put a buffer at the disposal of the young.

However, with the assumptions made in the academic literature, the economic benefits of solidarity and of buffers is much smaller because the volatility of contributions is also priced in. This creates confusion over the actual importance of these two pillars within optimal pension contracts. For this reason, a number of assumptions underlying the academic literature and the WRR study are put under the microscope in section 5.5 to make a qualitative analysis of the consequences of these differences for the resulting valuation of risk solidarity.

Quantification of the consequences of the differences in the applied assumptions is high on the research agenda. In section 5.6 this leads to a summary of the most important research questions. Section 5.7 outlines the principal conclusions.

## 5.2 Optimal risk-sharing in theory

### A BENCHMARK

This section describes how a pension fund, given certain simplifying assumptions, would provide an optimal pension service to its participants. An optimal pension policy for the individual consists of a combination of contribution, indexation and investment policy. To define the explicit characteristics of the optimal pension policy for the individual, it is assumed that the individual exclusively saves for retirement via the pension fund.<sup>2</sup>

The optimal pension fund policy in relation to the contribution, indexation and investments obviously depends strongly on the objective function of the individual. One common basic assumption in the literature is that an

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<sup>2</sup> For instance, the contributions to this book by Hoevenaars and Ponds (Chapter 6) as well as that by Boeijen et al. (Chapter 7) make precisely the opposite extreme assumption, namely that the individual has optimal access to the capital market and can and will trade all undesirable risks at no cost. Only the market value of the pension commitment is relevant in this case. The two approaches are complementary.

individual maximises the utility of the expected consumption in each future year. Apart from taxation, the consumption in the working period is equal to the salary less the pension savings and after retirement the level of consumption is determined by the pension. The utility increases in each period with the consumption, but the extra utility of an extra unit of consumption decreases with the level of consumption. Another basic assumption is: the more stable the development of this consumption, the greater the positive utility awarded by the individual to the future development of consumption. Moreover, an individual also discounts future consumption. This implies that the further in the future the consumption, the less utility it carries for the individual. For this reason in this model young people attribute relatively little utility to their consumption in retirement. The absolute value of the sensitivity of the marginal utility in relation to the consumption level is known as the relative risk aversion of the individual. Other frequently used basic assumptions are:

- this relative risk aversion is constant. It does not depend on the level of consumption;
- the contributions can be constantly optimally adjusted to new information;
- interest rates and inflation are constant and equity returns have no memory (no 'mean reversion').

## OUTCOME

With these basic assumptions the optimal investment policy of an individual is surprisingly simple. At each moment the same portion of the total assets must be invested in equities, where the total assets consist of financial capital and human capital (the discounted value of future earnings<sup>3</sup>). The share of financial capital in the total assets increases with the individual's age. In other words, with the passage of time the individual steadily converts his human capital into financial capital. According to this theory, the portion of the financial capital that is invested in equities decreases with age. A very simple example will clarify this. Assume that, according to this theory, an individual should invest 50% of his total assets in equities; and also that this young person's total capital consists of 10% financial capital, whereas that of an old individual consists of 100% financial capital.

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<sup>3</sup> Uncertainty about future earnings is ignored in this simplest model.

The young individual must then invest 500% in equities and the old individual 50%.

One result of the optimal investment policy is that all cohorts (given equal risk preferences) lose the same percentage of consumption over the rest of their lives as a result of a negative shock on the financial markets. Assuming e.g. a 10% underperformance in any given year, this implies that the consumption and the pension during the active period and after retirement are reduced to such an extent that a fixed percentage is expected to be relinquished in each future year. In this pension model this reduction is the same for each age group.

Young people invest more in equities, but spread lower- and higher-than-expected returns over a longer period. Elderly people invest less in equities and spread the results over a shorter period, in such a way that the pension consequences in relation to consumption are the same for everyone. The optimal investment behaviour in complete capital markets thus creates solidarity between the various age groups. Though young people suffer a larger loss in euro terms, they can also spread that loss over a longer horizon. They basically have longer to recover than the elderly. The economy's loss of capital is spread as equally as possible over all age groups and also over each person's remaining life. Younger generations entering the labour market do not yet have any financial capital.

In this model, therefore, it is optimal for younger generations to borrow from the older generations in order to invest in risk-bearing capital. The optimal situation for the elderly is that the young do this by issuing indexed bonds to the elderly. In this way the young give the older generations the greatest possible certainty that they can enjoy an indexed pension while the young profit at an early age from the risk premium on equities. In this theoretically optimal pension model, the young basically own an insurance company for the elderly. Put differently: they invest the pension capital of the elderly at their own risk and provide an indexed pension in return.

The basis for risk-sharing can be even further expanded in this theoretical pension model by also including future generations in the risk-sharing mechanism. In this context, the term 'future generations' refers to generations who do not yet participate in the labour market, including generations who are not yet born when a shock on the financial markets occurs. Basically these generations are then already investing in the financial markets before they start paying contributions. This increases the opportunities for wealth-creating trading between the elderly and the young. The elderly are entirely dependent on their financial capital and therefore more vulnerable to financial risks. The young can still use their human capital to

absorb risks and thus benefit from the reward for risk. In this case risk-sharing takes place between non-overlapping generations: the shocks are not only borne by the cohorts who are alive when the risks occur, but also by cohorts who must still enter the fund in the future.

#### EXPANSIONS OF THE BASIC MODEL

We will discuss a number of well-known expansions of the basic model before turning in the subsequent sections to the question how practical, implementable private and collective pension contracts relate to the recommendations made by the simplest theoretical model. In the simplifying assumptions underlying this optimal pension policy, equity returns have no 'memory', i.e.: there is no question of mean reversion. Mean reversion entails that equity returns become predictable up to a certain point, because the chance of higher returns increases as the period with lower returns lengthens. In these circumstances, equities are less risky over a longer horizon, because the returns average out to a certain extent over time (see, for instance, Siegel, 2002; Steehouwer, 2006). The differences in optimal investment policy between different age groups become stronger if mean reversion is taken into account.

Older people often want to maintain the standard of living they enjoyed when younger, which makes them even less inclined to take investment risk. Above all, they want to minimise the risk of sinking below their accustomed – relatively high – level of consumption in times when returns are low. Young people will take even more risks than posited in the basic assumptions if they are not only able to adjust their contribution levels, but also the number of hours they work. Basically they have a larger stock of human capital, which they can use as buffer in the financial markets.

The assumption that older people place a smaller portion of their financial capital in equities is reasonably robust to changes in other assumptions in this theoretical pension model. As for young people, however, there are certain circumstances in which they should invest relatively little in equities; e.g. where, contrary to the basic assumptions, their salaried earnings are uncertain and strongly correlated to equity returns. In such cases, the human capital of young people already has much in common with a high-risk asset such as equities. In this theoretical pension model, they will therefore invest a smaller proportion of their financial capital in equities. Liquidity restrictions can also make young people risk-averse investors. These also play no role in the basic assumptions. If young people are unable to borrow against their human capital to adjust their con-

sumption level to their expected future earnings, they will be inclined to take less risk. For this would have a direct adverse impact on their current consumption level and they would be unable to spread negative shocks over a longer period. The optimal portfolio for the elderly will contain a relatively large equity component if the elderly can count on a relatively high state pension that is not correlated with financial risks. Basically, the elderly then have a relatively certain pension claim via the state, so that they can afford to place a large part of their financial capital in high-risk investments.

The optimal investment behaviour will not only vary across the life cycle but also between individuals. For the share of total assets placed in equities depends in part on individual risk preferences as well as on the nature of the human capital within a household. The pension income of or through a partner will also play a role, as will any assets held in addition to the pension capital.<sup>4</sup>

### 5.3 Private pension savings in practice

In practice private pension savings differ in several ways from the policy that is optimal given the assumptions in section 5.2. In the first place, the real economic environment confronting pension funds is much riskier and more dynamic than assumed in section 5.2. Consequently, pension contracts that are optimal in practice may diverge from the optimal pension contracts in section 5.2. In addition, more and more information is becoming available (Van Rooij et al., 2004) about how people value possible future developments concerning their pension savings and pension payments. Discrepancies may therefore be found between the utility functions assumed in section 5.2 and actual practice. This has obvious consequences for the pension contracts that are optimal in real-life conditions.

Moreover, in contrast to the assumptions in section 5.2, 'adverse selection' and 'moral hazard' generally make it difficult, if not impossible, for young people to borrow against the value of their human capital. This limits their ability to benefit from the risk premium on equities.<sup>5</sup> In addition, unborn generations are unable to trade with current generations. This basically entails the absence of a public market for trading risk, so that

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<sup>4</sup> A more extensive discussion of the basic model and the many ways in which it can be refined is provided in Bovenberg et. al (2007). This paper also presents additional empirical results on the value of risk sharing.

<sup>5</sup> See e.g. Constantinides et al. (2002).

young people are unable to take over the risks of elderly people in exchange for a reward. The risk-trading capabilities of capital markets are also limited in other ways. The market for index-linked loans, for instance, is at best embryonic, particularly in relation to the indexation of Dutch inflation. The same applies to the trading of longevity risk through longevity bonds. With this type of bonds the interest paid by the issuer increases with the percentage of people of a pre-determined age group who live longer than expected. There is also question of a fundamental uncertainty, where not only the set of possible outcomes, but the objective probability distribution is also unknown. Certain types of macro-economic shocks (such as political uncertainties) are inconceivable to us, let alone that negotiable products exist to insure such risks. In short: by no means all risk factors can be traded. Adverse selection also results in financial markets that are inadequate or even non-existent. The market for annuities, for instance, suffers from adverse selection because providers will try to bar relatively healthy elderly people from this market.

*Examples of non-existent markets are:*

- Borrowing by younger and even unborn generations using their human capital as collateral;
- Sufficient availability of index-linked loans, notably for Dutch price inflation and industry-specific wage inflation;
- Sufficient availability of longevity bonds;
- Insurance products to protect against macro-economic shocks, such as political risk;
- Financial guarantees, such as put options on stock exchange indexes, with a very long term of several decades;
- Availability of complex derivatives strategies which are available to institutional investors, but not to individuals.

In practice, an individual is also unable to approximate optimal investment behaviour because constant trading leads to excessive transaction costs or because certain markets are entirely closed to individuals and only accessible to large institutional investors (e.g. complex derivatives strategies that pension funds use to optimise performance). In addition, individuals often lack the expertise to save and invest rationally. People have difficulty making complex decisions in uncertain circumstances. The re-

cent literature describes various ways in which individual investors make systematic errors and often do not know what is best for them.<sup>6</sup> Buying professional knowledge is also problematic, because this market is often opaque and involves high transaction and marketing costs. Every percentage point of the invested capital that an individual loses annually as a result of these impediments and irrational behaviour, translates into a decline in the pension payments of about 25% (see the contribution of Bikker and De Dreu in this volume). Suboptimal private pension management consequently implies a substantial deterioration of the pension result. In this light it is obviously of crucial importance to eliminate these impediments insofar as possible.

## 5.4 Collective pension funds in practice

### CREATION OF HITHERTO NON-EXISTENT MARKETS

Collective pension funds seek to overcome the imperfections of individual behaviour and the incomplete capital markets mentioned in the previous section. The more successful they are in achieving this objective, the closer actual practice can approximate the theoretically optimal pension contract.

Pension funds can absorb these market imperfections in various ways. In collective DB systems they organise risk-sharing between overlapping and non-overlapping generations that is not (yet) possible in capital markets. This takes the form of young people paying catch-up contributions as and when necessary. This opportunity for absorbing negative shocks enables the fund to take more risks in the investment portfolio and thus generate a higher return than would otherwise have been possible. Shocks in financial markets thus do not directly undermine the inflation-proof nature of the pensions paid to pensioners. In collective DB systems, where pensions are linked to prices (wages), the young basically issue (wage-)indexed longevity bonds to older participants that are not yet for sale on the financial markets. Depending on the investment behaviour of the fund, the young invest the obtained funds at their own risk in the capital market. So here, the practical working of pension funds corresponds with the theory described in section 5.2, where the young are basically the shareholders of an insurance company for the elderly. Pension funds thus construct financial instruments (such as wage-indexed annuities with a long term which

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<sup>6</sup> See e.g. Munnell and Sundèn (2004) and also Van Els et al. (Chapter 9) in this book.

cover the longevity risk) that are not yet (readily) available in the financial markets. By filling these gaps in the financial markets, risk-sharing between the generations can be made more efficient: the young share in the financial risks of the elderly and the elderly share in the wage risk of the young. Mandatory participation can further reinforce the funding base for intergenerational risk-sharing, so that future generations can also be involved in intergenerational risk trading.

In addition pension funds can create value which is, in itself, separate from the selected degree of risk sharing. Economies of scale dampen the management and marketing costs, thus closing the gap between their contracts and the optimal pension contracts given the assumptions in section 5.2. Moreover, the funds provide employees with access to complex investment strategies that few individuals could use if left to their own devices. In addition, they also protect employees against unwise savings and investment decisions by offering professional asset management (see Van Els et al. in this volume). Their non-profit character boosts the confidence of participants in the fund's policy: the participants are also the owners, so there are fewer conflicts of interest between pension fund management and participants. Finally, the mandatory participation of employees prevents adverse selection in the market for life insurance and annuities. All this reduces the implementation costs. Due to their close ties with the social partners (employer and employee representatives) as managers of the human capital in a sector, pension funds are also able to make optimal use of the buffer function of human capital in undertaking financial risks – for instance by enabling employees to take out loans against their human capital. Even if the financial markets start offering more risk-sharing instruments (especially wage-indexed bonds and longevity bonds), pension funds will continue to play a vital role in offering cheap, professional management of human and, above all, financial capital, forcing people to save for retirement and preventing adverse selection in longevity risk insurance.

#### COSTS OF INSTITUTIONS

Collective pension funds are not able to create all non-existent markets. This is mainly due to the fact that even if participation is made mandatory, young people can still evade this obligation by choosing to work in a different sector or company or as a self-employed person. They can also decide to work less. The greater the labour mobility and wage elasticity of the labour supply, the more catch-up contributions will distort labour market behaviour and be translated into compensating wage differences. In simple terms: in a labour market where people can change jobs quickly, it

is more difficult to charge employees catch-up contributions as they will then simply defect to companies where no catch-up contributions are levied.

This danger is smaller with larger collectivities where it is less easy for participants to switch between collectivities. Moreover, apart from voting with their feet, participants can also exert influence on the management of the fund. Delegating decision-making powers to a pension fund results in collective decision-making which always involves certain political risks. Older participants, for instance, are vulnerable to the risk that younger participants will refuse to pay large catch-up contributions. The greyer the fund, the greater this risk.

The limited freedom of choice over the contributions and investments within collective systems protects participants against unwise decisions, but prevents these same participants from adapting individual behaviour to personal circumstances.

The availability of pension benefits accrued by a partner, the nature of the human capital (is working longer an option?) or the risk attitude of the participant usually play no role in the pension contract. By offering more freedom of choice or by basing the pension on more information about the participant's individual circumstances, collective pension funds could provide more customised pensions.

This, however, has a price tag in the form of higher transaction and information costs. Most current collective systems (still) offer little in the way of customisation because they impose homogeneous contributions, investment portfolios and indexation on heterogeneous participants.

Freedom of choice raises the danger of individuals making unwise choices. But, there too, delegating complex decisions to collective funds also inevitably creates extra transaction costs. These are incurred because the participants must be sure that the professional managers and investors who are acting on their behalf are genuinely working in their interest. Clear arrangements about governance, risk monitoring, and investment performance evaluation by a mandated supervisor are therefore of crucial importance.

## 5.5 Reconciling the WRR study and the theory

The WRR study (Boender et al., 2000) mentioned in section 5.1 quantifies the added value of solidarity that is realised by means of catch-up contributions and buffer formation. However, the added value of this solidarity and the optimal pension contracts based on this value do not correspond with the optimal pension policy, given the assumptions made in section 5.2. As a result, pension policy-makers are in the dark about one crucial point.

This section therefore looks in greater detail at the differences between the starting points underlying the WRR study and the assumptions of the theoretical pension model from section 5.2. In addition, we will try to establish what consequences these differences have for the resulting optimal pension policy. A future study will seek to quantify the consequences of the differences in the applied assumptions.

To permit a proper analysis of the differences between the assumptions of the WRR study and those of the academic literature, let us first give a brief description of the design and results of the WRR study:

### **Design of WRR study**

- The study simulates the life cycle of an individual who starts saving an entirely self-managed pension at the age of 25 and compares this with an identical individual in a solidarity-based collective whose participants differ in age only. In the basic policy, both the individual and the collective pay a single premium which, given a fixed actuarial interest rate, is sufficient for a nominal 70% average-pay old-age pension and 49% survivor's pension.
- If financial market volatility (inflation, interest and returns) leads to a lower-than-expected pension accrual rate, both the individual and the collective adjust the contribution. The central control variable here is the funding ratio given a 4% discount rate. This implies that an individual is stronger than the collective at a young age and weaker at a later age. Within the context of the collective, this premium mechanism means that the elderly can continue benefiting from the equity risk premium via catch-up contributions. If necessary, these are paid for by the young.
- Next, a follow-up policy is analysed for the individual, where the individual takes less investment risk as he grows older. Specific policy variants are analysed for the collective, where buffers are built up and then passed on to subsequent generations.
- The results are evaluated on the basis of a large number of stochastic scenarios whose characteristics (uncertainties, correlations, memory) are based on historical figures (1966-1998) for the applied factors (inflation, interest and return). The central return expectations in the long term are determined according to the insights applicable at the time.

- The applied evaluation criteria are important. These concern, on the one hand, the average pension during the retirement period and, on the other hand, the downside deviation from the pension enjoyed in retirement compared to the 70% real average- pay pension with survivor's pension. In plain language, this means that a twofold increase in the negative difference between the received and envisaged pension will be felt  $2 \times 2 = 4$  times more severely by the individual.

#### RESULTS OF WRR STUDY

With these starting points and evaluation criteria, it is found that an individual within a collective realises an approximately 30% better pension result than an identical individual who carries full responsibility for his own pension saving scheme. In other words: given the same average contributed pension capital and the same expected pension result, the individual within the collective fund runs 30% less pension risk during the retirement period than the identical individual outside the collective fund.

It may happen (and actually does happen in the stochastic scenarios) that the collective fund takes an advance on the future by granting its participants indexation even when insufficient funds are available to continue doing this in the future. In that case the solidarity within the collective fund could start to crumble. This is not discounted in the calculation.

#### DIFFERENCES

The first difference in the starting points applied in the WRR approach and the most common academic literature concerns the weighting of the contribution volatility. In the WRR approach this plays no role in the evaluation, while contribution fluctuations are relatively strongly penalised in the literature. As a result, the WRR approach assigns a higher expected added value to solidarity than the models in the literature.

A second difference concerns the measurement of the difference between the envisaged and the realised pension. In the WRR study, the fact that the actual pension undershoots the target pension is penalised quadratically. This entails that a retiree receives a pension that is lower than the 70% indexed average pay, will feel this four times more severely if the shortfall were to become twice as great. This measure for the downside pension risks implies a specific form of aversion to loss of consumption levels during the pension (see Tversky and Kahneman, 1992). Only downside volatility is penalised where, due to the squaring operation, larger

deviations carry relatively more weight. If people also valued upside deviations in the pension result, as in most utility functions applied in the literature, then the added value of solidarity will obviously decrease.

The WRR study shows that it is more optimal for younger employees to invest in equities than for older employees or retirees. This advantage is mainly due to the assumed 'mean reversion' of equity returns and the longer time horizon. By implication, the cause does not lie in the greater propensity of young people to carry risk, because even in the collective system, shocks must be absorbed within one year. The WRR study assumes a uniform investment mix for the collective fund, irrespective of the participant's age. The added value of solidarity as calculated in the WRR study is sensitive to divergent assumptions regarding the degree of mean reversion in equity returns as well as for the incorporation of the risk characteristics of human capital and a longer recovery term for pension shortfalls.

Finally, the WRR study applies a richer description of the financial market risks by not only including equity risks but also inflation and interest rate risks. These risk factors are not taken on board in the simple theoretical models. Thanks to the solidarity within collectivities, risks such as inflation risk and longevity risk, which are difficult if not impossible to trade on financial markets, can be implicitly traded within the fund by the participants. This turns out to be an important determinant of the added value of collective contracts, which is probably why the simple academic models arrive at a lower added value for solidarity than the WRR study. By contrast, the fact that longevity risks were ignored in the WRR study means that theoretical models that do incorporate longevity risk can result in a higher added value of solidarity than estimated in the WRR study.

#### ADDED VALUE OF SOLIDARITY

On the basis of the above comparison there is no way of telling in advance whether the added value of pension solidarity as calculated in the WRR study will be higher or lower if the assumptions are adjusted to correspond more closely to the most common assumptions in the academic literature.

This is an important reason for carrying out a follow-up study. In addition, the WRR study needs to be deepened further even though it contained a richer description of economic uncertainty. Among other things, a negative weight must be assigned to the contribution volatility during the working life as also happens in the models from the literature. In addition, products that were not yet applied in 2000 in the pension world, such as derivatives, should be added to the analysis.

## 5.6 Research agenda

The previous section showed that the WRR study must be enriched in certain areas. The relevant research questions focus on the way the added value of collective pension systems develops if:

1. financial markets become more complete through the introduction of option contracts and indexed bonds or because participants can act dynamically and create certain options.  
In that case younger and older individuals can in principle also trade in risk via the financial markets without the intervention of a pension fund. The question remains whether individuals have the required expertise or can hire this at low costs. These new financial instruments also enable collective pension funds to control certain risks via negotiable securities in the financial markets instead of via implicit trading in non-negotiable claims within the pension funds between participants;
2. the preferences of the participants correspond more closely (or less closely) with the assumptions used in the academic literature. Recent experiences suggest that contribution volatility can be costly for the sponsor of a pension scheme. If this is the case, the optimal pension contract could shift from DB towards DC. By contrast, if participants are less concerned about contribution volatility and contribution pressure and attach more importance to keeping pensions inflation-proof, then the principle of inflation-proof pensions must be maintained insofar as possible (DNB, 2004). Further research into the preferences of participants in an ageing society is therefore of great importance;
3. the funding ratio on the basis of a 4% discount rate is replaced by a funding ratio at market value;
4. the labour market distortions caused by catch-up contributions are included in the analysis. Even in collective pension systems loans taken out by young people against the future value of their human capital are not entirely cost-free. For young people are able to evade catch-up contributions by choosing to work less or elsewhere;
5. the possibility of a more flexible retirement age is included in the analysis. By utilising the retirement age as a risk buffer, people in the workforce can afford to take more investment risk and the optimal pension contract will change.

In this case the participants take a risk in relation to their personal health (at age 40 one doesn't know how healthy one will be at age 65), but disability insurance can be taken out to cover this risk;

6. an estimate of the difference in costs between private and collective pension contracts is taken on board. It is clear that the costs of collective contracts are considerably lower and will therefore become relatively more attractive;
7. realistic assumptions are made concerning the actual behaviour of individual decision-makers. It is well-known that individuals often save insufficiently for the future and tend to maintain undiversified investment portfolios, which impairs the quality of the pension result;
8. heterogeneity of the participants is assumed. Collective systems are generally characterised by an identical contribution and indexation rule for all participants, irrespective of their age, risk aversion, realised pension accrual, etc. This can easily lead to wealth loss as compared to the optimal scheme for the individual participant whose characteristics deviate strongly from the average participant;
9. pension contracts (policy ladders) are determined optimally. Above, we have already looked at the optimal risk-sharing contracts given the evaluation criteria used by Boender et al. (2000);
10. longer recovery terms become possible if the pension accrual rate is lower-than-expected due to unfavourable developments in the financial markets. This would mean that surpluses and shortfalls can be spread more evenly over the remaining life. Collective systems can thus add even more value and become less procyclical than when shortfalls are eliminated as quickly as possible (as is also the case in the WRR study);
11. risk solidarity in relation to longevity risk is included in the analysis. In this case, collective systems can add value as there are virtually no opportunities for trading longevity risk in financial markets.

## 5.7 Conclusions

Collective and private pension solutions differ in many dimensions. To permit a choice between the two and, above all, to further optimise the existing pension solutions, it is important to answer the central question: under what assumptions are specific private or collective pension contracts the most suitable and efficient way of achieving risk solidarity?

Above all, this contribution sought to sum up the current state of affairs regarding this central research question in the literature. The adopted approach was to test the reality value of the assumptions underlying pension contracts that are assumed to be optimal in the literature. The conclusion is that reality is so much more complex and complete than the assumptions made in the literature and the WRR study, that extra research is necessary to answer the central question regarding the added value of pension solidarity. In addition we also analysed how the assumptions and findings of Boender et al. (2000) relate to the assumptions that are more common in the academic literature, and what we can learn from this, regarding the added value of pension solidarity as calculated in this study.

The table below compares the strengths and weaknesses of private and collective pension schemes as discussed in sections 5.3 and 5.4.

**Table 1.** Strengths and weaknesses of private and collective pension schemes,

	Strengths	Weaknesses
Private pension saving	<ul style="list-style-type: none"> <li>• Individual customisation of investment and contribution policy</li> <li>• Competition between providers</li> </ul>	<ul style="list-style-type: none"> <li>• Suboptimal choices due to low pension awareness</li> <li>• Suboptimal choices due to behavioural effects</li> <li>• Adverse selection</li> <li>• Not all financial products can be accessed</li> </ul>
Collective pension savings	<ul style="list-style-type: none"> <li>• Creates hitherto non-existent markets</li> <li>• Enables young people to take much more risk (elimination of restrictive conditions)</li> <li>• Low costs</li> <li>• Professional investors</li> </ul>	<ul style="list-style-type: none"> <li>• Continuity of solidarity not guaranteed</li> <li>• Not geared to heterogeneous participants</li> <li>• Ownership rights are not transparent</li> </ul>

This study does not produce full answers to the central question regarding the value of pension solidarity. This is because private and collective pension schemes both have strengths and weaknesses (see table) and because the assumptions underlying the assertions about the optimal pension contract as made in the literature may still be too far from reality. Instead, this study provides a list of concrete questions to be addressed in follow-up research. This will seek to gain a deeper understanding of the underlying considerations and thus provide a more well-founded basis for the further optimisation of pension contracts.

## Literature

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