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Ministerie van Sociale Zaken en Werkgelegenheid
T.a.v. mevrouw drs. J. Klijnsma
Anna van Hannoverstraat 4
2595 BJ Den Haag

Amsterdam, 6 september 2013

Betreft: Reactie op consultatiedocument

Geachte mevrouw Klijnsma,

We hebben kennis genomen van het consultatiedocument.

Het consultatiedocument is het vervolg op de Hoofdlijnennota uit 2012. Veel zaken waarover in de Hoofdlijnennota uit 2012 onduidelijk bestond, zijn nog niet nader uitgewerkt. De lijn die wordt gekozen is om:

- in het nominale contract meer stabiliteit te laten bieden over de reeds opgebouwde (nominale) aanspraken en rechten door de inzet van beleidsinstrumenten te beperken;
- in het reële contract wordt zoveel als mogelijk gestreefd om zeker te stellen dat een toeslag in lijn met de inflatie wordt toegekend aan alle generaties.

Door Triple A – Risk Finance B.V. (Jack Tol) is een onderzoek uitgevoerd waaruit blijkt dat ingeval van een overgang naar het:

- nieuwe nominale contract over het algemeen en in de meeste scenario's de oude generaties aan waarde inleveren ten opzichte van de huidige situatie. Dit effect kan enigszins worden gemitigeerd door middel van het inzetten van bepaalde beleidsinstrumenten maar niet geheel;
- reële contract over het algemeen en in de meeste scenario's de jongere generaties aan waarde inleveren ten opzichte van de huidige situatie. Dit effect kan enigszins worden gemitigeerd door middel van het inzetten van bepaalde beleidsinstrumenten maar niet geheel.

Uit het onderzoek blijkt dat de overgang altijd gevolgen zal hebben voor de verdeling van de pensioenuitkomsten over de verschillende generaties.

De opgelegde restricties leiden waarschijnlijk tot een suboptimale inrichting van het pensioencontract, waardoor pensioenfondsen worden gedwongen om een keuze te maken tussen een contract die niet aan de eisen en wensen voldoet.

- Bij het nominale contract worden de mogelijkheden tot het verlenen van toeslagverlening beperkt, terwijl de eisen met betrekking tot buffervorming worden verscherpt. Tevens zijn stringente eisen opgenomen ten aanzien van het hanteren van een minimaal kostendekkende premie.
- Een positieve eigenschap van het reële contract is de gecreëerde voorwaardelijkheid, waardoor pensioenfondsen sneller tot uitdelen van behaalde rendementen kunnen overgaan. Deze contractsvorm wordt echter beperkt in de mogelijkheden ten aanzien van het kunnen inzetten van beleidsinstrumenten. Een voorbeeld hiervan is het feit dat slechts gekozen kan worden voor een toeslagambitie gelijk aan de volledige prijsinflatie. Voor pensioenfondsen met een laag risicoprofiel, een lage financiële positie bij aanvang of pensioenfondsen met een minder rooskleurige visie op de beleggingsrendementen voor de nabije toekomst zal het reële contract waarschijnlijk niet verkozen worden doordat de overgang als onvoldoende evenwichtig wordt beschouwd (te snel uitdelen aan de oudere generaties).

We geven daarom in overweging om te onderzoeken hoe het aantal in te zetten beleidsinstrumenten verruimd kan worden bij zowel het nominale als het reële contract, zodanig dat het pensioenfondsbestuur nog meer zelfstandig de afweging kan maken ten aanzien van de exacte inrichting van het contract en de waardeverdeling over de generaties. Hierbij kan gedacht worden aan een meer ruime invulling van het toeslagenbeleid bij het nominale contract, een meer ruime invulling van de te hanteren toeslagambitie bij het reële contract maar ook een meer ruime invulling van de te hanteren kostendekkende premie.

Aangezien de overgang naar een nieuwe contractsvorm sowieso tot een waardeverschuiving leidt over de verschillende generaties, is het naar onze mening beter om het bestuur van het pensioenfonds meer vrijheid te geven bij de beleidskeuzen ten aanzien toeslagenbeleid, hoogte van toeslagambitie bij het reële contract en de te hanteren kostendekkende premie. Door de inrichting van deze beleidsinstrumenten bij de toets op evenwichtigheid te betrekken wordt voorkomen dat beleidskeuzen tot een ongewenste impact op de waardeverdeling tussen generaties leidt.

Tot het geven van nadere toelichting zijn wij vanzelfsprekend bereid.

Met vriendelijke groet,
Triple A – Risk Finance B.V.
namens deze

Drs Hen Veerman AAG RBA
Managing Consultant

Bijlage: onderzoek “the new pension deal for Dutch pension funds”

The new pension deal for Dutch pension funds

A framework for pension fund boards to analyze the effects of the new pension deal

Triple A – Risk Finance B.V.
Drs. Jack Tol AAG
September 6, 2013

Table of contents

1 Introduction

1.1 Why the new pension deal

The Dutch pension system is characterized by collectivity, solidarity and the fact that almost everybody participates in a company pension plan or sector wide pension plan (whether or not mandatory). The Dutch total pension assets are therefore relatively high with respect to other countries in the world. The financial assessment framework should make the Dutch pension system even stand against financial shocks and risk of longevity (with a nominal security level of 97.5%). The framework is assigned in such a way the nominal pension rights are as good as certain. Although, that's what we believed. The crisis of 2008, the high volatility on the financial markets recent years and the more and more increasing life expectancy of the Dutch people have shown us the system isn't that robust as we thought it would be. Many Dutch pension funds came in the situation the liabilities exceeding the pension assets and many pension funds were even forced to reduce the pension rights of its members, which is the ultimate remedy according to Dutch law.

In 2009 two committees were founded to investigate and analyze the Dutch pension system and the risks involved (committee "Goudswaard" and committee "Frijns"). Together with the planned evaluation of the financial assessment framework, the two committees concluded the current system should be improved[1]. First of all, the height of the pension fund required capital must be increased so the aspired level of nominal security of 97.5% can be met. Therefore the set of rules on which the required capital is based on must be aggravated. Secondly, the committees concluded that the current financial assessment framework forces the pension funds to steer at nominal security of the pension rights, whereas the ambition of the pension fund is to compensate the pension rights for price and/or wage inflation. In other words, there should be a new balance between ambition and security.

In the spring of 2010 a complete new pension deal was proposed which contained all the recommendations made by the two committees. Ultimately, this new pension deal led to a proposed revised financial assessment framework for pensions[2]. This new financial assessment framework is not yet crystal clear on all its components so further implementation is still needed. The lawgiver made an interpretation of the new financial assessment framework and published this in a consultation paper[3] in July 2013. This consultation paper forms the base of this research.

In the new financial assessment framework pension funds can choose between a nominal contract and a real contract. All the contracts, i.e. the current nominal, the new nominal contract and the new real contract, deal differently with surpluses and deficits. Especially the division of the surpluses and

[1] Evaluation and recommendations done by Committee Goudswaard: "Een sterke tweede pijler – Naar een toekomstbestendig stelsel van aanvullende pensioenen", Commissie Toekomstbestendigheid Aanvullende Pensioenregelingen, January 1, 2010
Evaluation and recommendations done by Committe Frijns: "Pensioen: 'Onzekere zekerheid'", Commissie Beleggingsbeleid and Risicobeheer, January 19, 2010

[2] Hoofdlijnennota herziening financieel toetsingskader pensioenen, Minister SZW, May 30, 2012

[3] Consultatie voorontwerp van wet herziening ftk, Ministerie van Sociale Zaken and Werkgelegenheid, July 12, 2013

deficits between the different age groups are not alike. Therefore the new pension deal will cause some generational effects. This research will investigate and analyze these generational effects.

1.2 Generational effects

Basically two types of analysis can be used to quantify the (generational) effects. The first one is to calculate the value transfer at the moment of implementation of the new pension deal between the different generations. This type of analysis is used by CPB and is based on risk neutral valuation. The second one is to compare the timing, height and variability of the pension payments. Since no valuations are made in the second type of analysis, no risk neutral valuation is needed. This analysis is therefore based on real world economic scenarios.

Commissioned by the Dutch government the Dutch Central Planning Office (CPB) has analyzed the generational effects of the introduction of this new financial assessment framework[4]. CPB has presented results where nominal and real contracts have been compared. Although this CPB report is extremely helpful, it does not give us (enough) insight in the timing, the height and variability of the pension payments. These three elements are very important inasmuch they are responsible for the *perception* the participant has regarding his pension payments and finally for the fact if he is willing to accept the new deal or not.

In finance the general assumption is that investors are risk averse and therefore don't accept a "fair gamble"[5]. The first type of analysis does not take this perception of the participants/stakeholders into account and therefore can lead to wrong conclusions: although the value transfer is zero, there still can be (much) aversion to the proposed deal.

There are fundamental differences between both contracts concerning the division of surpluses and deficits between the different groups of participants. Mainly in extreme good and extreme worse scenarios there may be large differences between the different contracts (i.e. the height and variability of the pension payments). The effects of the policy change on the pension payments of the participant can reflect a sort of "fair gamble" problem. It is important that worst and best case scenarios will be further investigated as to what the impact on the different age groups will be.

Furthermore, the present value of the pension payments does not say *when* the pension payments will be paid (i.e. the timing of the pension payments). Besides the height and the variability, the timing of the pension payments is essential in the perception of the participant[6]. Although the present values of

[4] "Generatie-effecten Pensioenakkoord", CPB notitie, May 30, 2012

[5] An investor who is risk averse will not take part in a lottery where he has chance of 50% to win an amount of x and a chance of 50% to lose an amount of x. The Expected Utility theory states that this investor will select the alternative with the highest expected utility value, i.e. doing nothing. The assumption investors are risk averse is supported by empirical research (behavioral finance).

[6] Consider the following example. A 40 year old man gets to choose between the following pension payments: he receives a payment of € 1,031 next year (41 year old) or he receives a payment of € 1,343,330 in 60 years (100 year old!). Based on an annual interest rate of 3% and mortality rates based on GBM 2005-2010, the actuarial present value of both payments equals € 1,000. Although the present values are equal, there still can be strong preference to the payment next year.

two pension payment schemes are equal, there still can be (strong) preference to one of the schemes in consideration.

The above mentioned elements, timing, height and variability of the pension payments, are underexposed in the CPB report. Although the expected utility of the participants is not quantified in this research, the second type of analysis with real world scenarios will give us more insights in this matter.

There are different criteria to compare the different contracts. For example, from the view point of the pension fund one could compare the development of the funding ratio. From the view point of the participants one can investigate the value transfer and/or the differences in probability of a pension reduction[7]. This research will focus on probably the most important criteria: the actual expected pension payments of the members. Together with the analysis done by CPB this research forms a framework for pension fund boards to analyze the effects of the new pension deal.

Finally the influence of the asset allocation / investment strategy on the generational effects is analyzed in both the nominal and the real contract. Not all possible asset allocations will be considered. The main focus will be on the effects of asset allocation for the pension fund as a whole (solidarity principle) versus asset allocation diversified over generations (ring fence principle).

To analyze the above mentioned characteristics of the new pension deal and the effect of the investment strategy an ALM-model will be used. In line with the analysis done by CPB the intention is to analyze an “average” Dutch pension fund. Although the “average” Dutch pension fund does not exists, we try to construct one. It should be clear that the analysis done in this research doesn’t have to be representative to an existing pension fund. Therefore, every pension fund should be analyzed separately.

The structure of this research is as follows:

First, chapter 2 will address the new nominal and new real contract so we get a better understanding of the differences with the current nominal contract.

To get an idea of the research done so far by CPB chapter 3 will summarize the results of the CPB report. The description of the assumptions made follows in chapter 4. Chapter 4 will also describe the ALM model and the characteristics of the real world economic scenario set.

The effects of the policy changes to be made in the new financial assessment framework are analyzed in chapter 5 and 6. First, specific output of the ALM model will be chosen so the analysis of the height, variability and timing of the pension payments can be made. Next, each policy change will be analyzed given the specific criteria. The results of the stochastic analysis are discussed in chapter 5. In chapter 6 close attention will be given to the extreme economic scenarios. Intuitively the extreme scenarios will lead to the most aversion of implementing the new pension deal.

[7] This analysis is also done by CPB. See paragraph 3.3 for the results of the CPB analysis regarding the probability and height of pension reductions.

The effects of the asset allocation / investment strategy is the subject of chapter 7. Two different investment strategies will be analyzed: one strategy based on a principle of solidarity (assets of the pension fund considered as a whole) and one strategy based on a ring fence principle (assets and its allocation considered per generation group).

2 The new pension deal

2.1 Introduction

As mentioned in the previous chapter the evaluation of the financial assessment framework and the recommendations made by the two committees has led to a new proposed financial assessment framework. In this new pension deal Dutch pension funds will get to choose between a nominal contract and a real contract. To get a better understanding of the proposed new contracts this chapter will address the differences between the contracts.

2.2 The current nominal contract

First of all we take a look at the basic elements of the current nominal contract. The main objective of the current contract is to insure the nominal accrued pension rights of the members. Another important goal is to adjust the accrued pension rights with price and/or wage inflation. The indexation policy of Dutch pension funds in the current nominal contract is almost always conditional and based on the funding ratio. No indexation is given if the funding ratio is equal to the minimum required capital or below (i.e. ≤105%) and full indexation is given if the funding ratio is equal to the required capital or above. In this research the required capital is assumed to be 120% in the current nominal framework.

In the current nominal contract the value of the liabilities is defined as the present value of future expected pension payments. The pension payments are based on the accrued pension rights so no future accrual is taken into account. The present value is based on a nominal interest rate term structure, i.e. the zero swap spot curve. The funding ratio, on which the indexation policy depends as well, is therefore known as a nominal funding ratio.

In September 2012 the Ultimate Forward Rate (UFR) methodology for pension funds was introduced in imitation of the solvency II guidelines for insurance companies. This methodology suggests that, based on a historical values of 2.0% inflation and 2.2% real interest rate, on the long term the nominal interest rate should be equal to 4.2%. The UFR method causes the nominal zero swap term structure to converge to the UFR level of 4.2%. However, this does not mean the nominal interest rates are actually at this level. See ‘Appendix A – The Ultimate Forward Rate’ for more information and an example of the UFR methodology.

The introduction of the UFR has caused the nominal zero swap spot curve to raise significantly. As a result many funding ratios raised several percentage points. This was very welcome to the pension funds who were in the situation of funding shortage. The intended reduction of the pension rights could now be decreased with several percentage points which in some cases even led to no reduction all.

The premium policy is normally based on an average premium. This average premium is most of the time based on a fixed percentage of the pension base (pension base is equal to pensionable salary

minus the franchise). This fixed percentage of the pension base is derived from the nominal actuarial premium plus a solvency premium plus a premium for costs. In this research we abstract from any costs involved in the pension plan.

Results during the year will lead to a change in funding ratio. If the funding ratio is high enough indexation is given according to the indexation policy. If the funding ratio is lower than the minimal required level there is a situation of underfunding. This situation will force the pension fund to recover within three years. If the recovery has not come to pass within these three years and all possible instruments have been applied the pension fund has no other option than to reduce the pension rights.

2.3 The new nominal contract

The new nominal contract is in essence equal to the current nominal contract. This means the indexation policy will for most of the time still be conditional and based on the funding ratio. Also, pension funds will in most cases base their premium policy on an average premium. The valuation of the liabilities is no different as well. This still will be based on the present value of future expected pension payments whereby the present value is based on the nominal interest rate curve (the zero swap spot curve with UFR).

The main difference of the new nominal contract with respect to the current nominal contract is the lesser ability to compensate the pension rights with inflation. Pension funds will need more pension assets to be allowed to compensate the pension rights compared to the current nominal contract. The upper limit of the indexation scale at which a full price inflation is given is in the current nominal contract assumed to be equal to 120%. In the new nominal contract however, this upper limit is assumed to be equal to 130% instead of 120%.

The consultation paper states that in the new nominal contract indexation can be given only if there are enough assets to pay the indexation in the future as well. In this research we will abstract from this extra condition in the new nominal contract.

The current financial assessment framework forces pension funds to recover within a period three years. This recovery period of three years is unchanged in the new nominal framework.

2.4 The new real contract

The real interest term structure

The real contract is a whole new deal altogether. In this contract the value of the liabilities is defined as the present value of future expected pension payments *including* future expected inflations. The present value is again based on the zero swap spot curve (including the UFR). This is exactly the same as the present value of future expected *nominal* pension payments, thus without the future expected inflations, based on a *real* interest rate term structure. The real interest term structure is defined as the nominal interest rate term structure (including UFR) with a discount for future inflations. The latter method is used in practice (and in the consultation paper) and we will apply the same

method in this research. To illustrate the equality between both methods consider the following example.

Consider the following two payment schemes with a maturity of ten years. One payment scheme is without an annual indexation of 2% and the other scheme is with an annual indexation of 2%. Furthermore, assume no mortality and the annual nominal interest rate to be equal to 3% fixed.

Table 2.1

Time	Nominal payments (no future exp. Indexations)	Real payments (with future exp. Indexations)	Discount factors (3.00%)	Discount factors (0.98%)
0	100.00	100.00	1.00	1.00
1	100.00	102.00	0.97	0.99
2	100.00	104.04	0.94	0.98
3	100.00	106.12	0.92	0.97
4	100.00	108.24	0.89	0.96
5	100.00	110.41	0.86	0.95
6	100.00	112.62	0.84	0.94
7	100.00	114.87	0.81	0.93
8	100.00	117.17	0.79	0.92
9	100.00	119.51	0.77	0.92

The present value of the indexed payments scheme based on 3% interest is equal to 957.42. This is equal to the present value of the non indexed payments scheme based on a interest equal to 0.98% (i.e. (1+3%)/(1+2%) – 1).

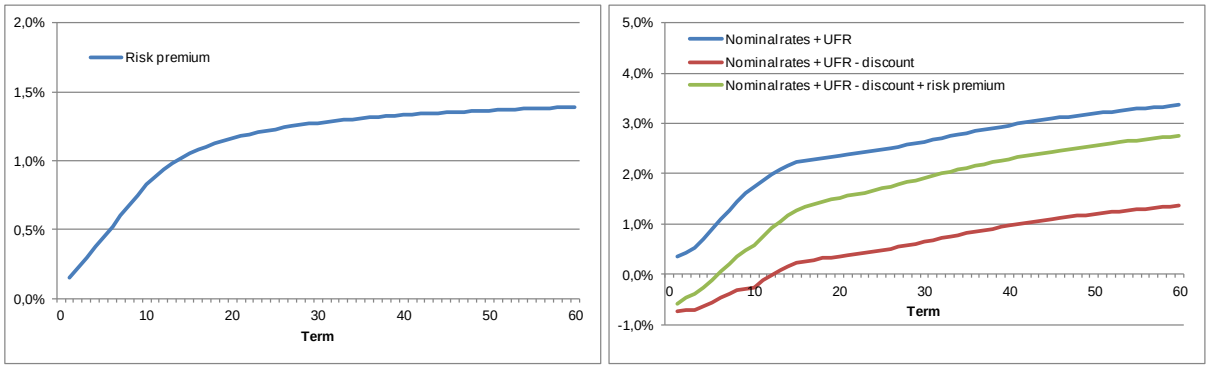
According to the consultation paper the expected inflation term structure must be based on the one and two years expected inflation rates conform CPB expectancy and on the long term European goal of 2.0% (from maturity 10 years and onwards). Linear interpolation is used to construct the term structure between term two and ten years

Since the real pension payment scheme has a certain degree of uncertainty, the real interest rate term structure in the new real financial assessment framework does not only consists of the nominal interest term structure with a discount equal to the expected inflation term structure, but consists also of a risk premium term structure. This risk premium is based on the formula developed by Bovenberg, Nijman and Werker[8]. The higher the term of a cash flow is the more uncertain it becomes. Therefore it's desirable the risk premium will be higher if the term is higher. This property is captured nicely in the risk premium term structure according to Bovenberg, Nijman and Werker. The risk premium term structure is fixed in time.

In Graph 2.1 on the left the risk premium according to Bovenberg, Nijman and Werker is shown. On the right the decomposition of the interest rate curve in the new real contract is shown as per June 30, 2013.

[8] Lans Bovenberg, Theo Nijman, Bas Werker, Voorwaardelijke pensioenaanspraken: Over waarderen, beschermen, communiceren and beleggen, Netspar Occasional Research, April 2, 2012, http://arno.uvt.nl/show.cgi?fid-122389

Graph 2.1 The nominal and real interest term structure



The Adjustment mechanism Financial Shocks (AFS)

Another important difference with the current and new nominal contract is how surpluses and deficits are processed. In the nominal contracts surpluses and deficits effect the funding ratio and therefore indirectly the indexations given. In the new real contract surpluses and deficits will be processed according to the so called Adjustment mechanism Financial Shocks (AFS). The AFS processes the surpluses and deficits over a certain chosen period of time (minimal three years or up to maximal ten years) which leads to corresponding adjustments or indexations. This must lead to a more equally and smooth development of the funding ratio of the pension fund. The AFS adjusts the liabilities in such a way a real funding ratio will end up being equal to 101%[9]. The AFS processing period will be a part of the contract and therefore fixed when chosen. Surpluses and deficits will be processed by the AFS on an annual basis.

According to the new proposed real financial assessment framework shocks must be dealt with within the period of three (minimum period) or up to ten years (maximum period). Therefore the fund must keep a track record of the shocks over time and which part of the shocks to be processed in a particular year. As a result the AFS mechanism will lead to more administrative burden. For this reason they have tried to interpret the AFS mechanism in such a way the administrative burden will be less. Instead of processing each shock over the chosen processing period, they suggested to offset shocks with former shocks (i.e. the parts which still have to be processed) and process “1/processing period” part of the remainder. In this way, no track record has to be kept, just one number. Because of the offsetting financial shocks will not be processed within the lawful processing period. For this reason we don’t take this method into account, but analyze the method proposed. See ‘Appendix B – The AFS mechanism’ for more information about the two AFS methods.

‘Open’ versus ‘closed’ AFS

As a standard, all future accrual of pension rights will share in the ‘current’ AFS mechanism. In other words, all new acquired pension rights will be adjusted based on shocks of the past. This method is called an ‘open’ AFS. In this manner the solidarity of the system is maximized.

[9] The consultation paper states the minimum level of funding ratio in the new real contract must be 101% instead of 100%. This corresponds with the minimum level of funding ratio in the current nominal contract for insured pension funds.

An ‘open’ AFS will not be mandatory in the new real contract. Pension funds can choose whether financial shocks of the past will be applied on new accrued pension rights or not. If not, the system is called a ‘closed’ AFS. Parties fear that the ‘closed’ AFS will lead to undesired extra administrative burden, since a separate AFS mechanism must be applied for every year pension rights are accrued.

The ‘open’ AFS leads to an undesirable effect in the new real contract as well. When changing jobs you have the opportunity to transfer your pension rights. It’s a special feature of the Dutch pension system. The ‘open’ AFS will lead to direct adjustments of the transferred pension rights. Past financial shocks will therefore become an import element in the decision of the member who changes jobs to transfer its pension rights or not. A ‘closed’ AFS will not have this problem.

The trick therefore is to construct a ‘closed’ AFS without numerous AFS mechanisms in place for each layer of accrued pension rights. This can be done by adjusting the pension rights of entrees and adjusting the new accrued pension rights of active members. The adjustment is equal to the total current adjustments in the system and will lead to a fictive new accrued pension right. So, when all the coming adjustments have been applied the adjustment will be cancelled out. In this manner new accrued pension rights will suffer no effects of financial shocks of the past while just one AFS mechanism is in place[10]. See ‘Appendix B – The AFS mechanism’ for an example of the ‘open’ and ‘closed’ AFS.

Indexations in the real contract

In the real framework the pension rights of the working generations and the pension payments of the retirees are assumed to be adjusted for the realized price inflation. However, due to financial shocks there can be situations the funding ratio (on a real basis) will drop below (or above) the 101%. In that case the Adjustment mechanism Financial Shocks (AFS) will do its job and as a result a part of the deficit (excess) will be processed as a negative (positive) indexation. The total indexation in the real framework consists therefore out of two components: the realized price inflation and the AFS indexation which can be negative or positive.

2.5 The Life expectancy Adjustment Mechanism (LAM)

One of the reasons pension funds suffer a lot is because of the ageing of the population. The life expectancy has increased significantly the last decades and this shows in the value of the liabilities which had to be increased several times accordingly. To smooth the results due to ageing the new financial assessment framework has a similar mechanism in place as the AFS, the so called Life expectancy Adjustment Mechanism (LAM). It is however uncertain how the future life expectancy develops. Furthermore, the expected generational effects of ageing are minor. These are the reasons we don’t take the LAM into account in the analysis.

[10] This method was proposed by a client of mine. However, because of confidentiality the name of this client cannot be released.

3 Summary results CPB report

3.1 Introduction

Commissioned by the Dutch government the Dutch Central Planning Office (CPB) has analyzed the generational effects of the introduction of the new financial assessment framework. CPB has used an ALM model that, given economic scenarios, quantifies the expected future pension payments and premiums. The generational effects are analyzed by the market value (risk neutral valuation) of these pension payments and premiums and is better known as value-based generational accounting or value-based ALM. An important property of the research done by CPB is the “zero sum” property. This means that if a policy change will lead to improvement with some participants, other participants must lose an equal amount of money expressed in market value. This “zero sum” property enables us to analyze the generational effects by analysing the value transfers for different generations.

The research done by CPB is quite extensive. Rather than discuss the CPB report entirely only the main results of the CPB report will be discussed. For all the assumptions made by CPB we refer to the CPB report itself[11].

3.2 Results transition to new nominal financial assessment framework

The main change proposed in the new financial assessment framework for nominal contracts is the aggravation of the indexation conditions. This results in lesser indexation payments and leads to a slight improvement of the nominal security. However, a risky asset allocation still can lead to severe pension reductions of more than 10%. The aggravation of the indexation conditions is favorable for younger generations and unfavorable for older generations. This effect is largely cancelled out by the introduction of the Ultimate Forward Rate (UFR). Given the current low interest rates introduction of the UFR leads to a increase in funding ratio of about 5%-point. This results in more indexation payments and is therefore favorable for older generations. The overall generational effects of the new financial assessment framework are therefore minimal.

3.3 Results transition to new real financial assessment framework

The generational effects of the transition from current nominal framework to the new real framework is dependent on specific pension fund characteristics as the funding ratio and its contract. CPB has analyzed an “average” Dutch pension fund which can be used as a benchmark analysis. For the valuation of the liabilities a risk premium is used (increasing up to about 1,5%-point) and a discount for indexation of 2.5%-point. Furthermore, the processing period of the Adjustment mechanism Financial Shocks (AFS) mechanism is set on ten years. With these conditions the transition to the new framework will lead to minor improvements for older participants. This is caused by the longer

[11] See note 4

processing period in case of lower funding ratios. Whereas in the current framework underfunding must be settled within three years, the new real framework grants ten years. In case of higher funding ratios and/or less risky asset allocation this effect diminishes.

Nominal pension reductions are in the new real framework more frequent, but not as high as in the current nominal framework. In the current nominal framework the average pension reduction is 10% in contrast to 1% in the new real framework.

A specific element in the transition to the new real financial assessment framework is whether the current accrued pension rights will be part of the transition or not. The effects are dependent on the funding ratio at the moment of transition. A nominal funding ratio at the moment of transition of more than 120% is favorable to younger participants. The reason for this is the higher probability of a funding ratio of more than 120%. This will result in more buffer value which will not be used for an immediate indexation. Therefore future indexations are more certain and this is in favor to younger participants. The effects with respect to an initial funding ratio of 100% are not major. However, the effects of a nominal funding ratio of less than 80% in contrast to an initial funded ratio of 100% are significant. In this situation transition to the new financial assessment framework will be in favor of older participants. The reason again is the difference in the recovery period which is three years in the current nominal framework and (maximum) ten years in the new real framework. This situation is unlikely though since the current framework will oblige the pension funds to recover to the minimal funding ratio of 105% within three years.

4 Assumptions

4.1 The ALM model

To analyze the specific characteristics of the new pension deal and the effect of the investment strategy an ALM-model is used. Given the pension fund policy, demography and economic scenario, the ALM model projects the future expected pension payments and premiums which form the basis of the analysis. Future accrual of pension rights is taken into account in the projection of the future expected pension payments. Furthermore, these future expected pension payments and premiums are dependent on various elements. These elements will be discussed in the next paragraphs. Paragraph 4.2 will deal with the pension fund policy. Paragraph 4.3 will address the demography of the pension fund. Finally, the characteristics of the economic scenarios will be the topic of paragraph 4.4.

In line with the analysis done by CPB the intention is to analyze an “average” Dutch pension fund. Although the “average” Dutch pension fund does not exists, we try to construct one. The CPB report does not clarify the demography/population used in their study. It is therefore not possible to analyze any similarities and differences between the assumed population in this research and the population used in the study of CPB.

It should be clear that the analysis done in this research doesn’t have to be representative to any existing pension fund whereas this pension fund can have a complete different and specific pension plan, pension fund policy and demography. Therefore, every pension fund should be analyzed separately.

4.2 Policy and assumptions

4.2.1 Pension plan

The most frequently applied pension plan is the average-wage scheme. That is why the analysis will be based on an average-wage scheme whereby the accrual rate is assumed to be equal to 2,0% per year of the pension base (pension base is equal to pensionable salary minus the franchise). In the pension plan pension rights will be accrued for old age pension as well as for widow pension. The accrued widow pension is assumed to be equal to 70% of the accrued old age pension. In case the participant dies a widow pension will be paid equal to the amount as if the member would have accrued widow pension rights till the date of retirement.

Although the Dutch retirement age will increase the coming years, we will not take this into account. The retirement age in the analysis will be set on a fixed level of 65 years and will not increase over time.

4.2.2 Premium policy

A member who is participating in a pension plan has to contribute premiums (or the company does). Eventually he will end up collecting pension payments, that is, if he's still alive at retirement age. The pension system is therefore a balance between contributions, returns and pension payments. More contributions will lead to subsequently higher pension payments.

Since the contributions in both contracts differ, it will be difficult to compare the nominal contract with the real contract. Actuarial premiums in the nominal contract are based on the nominal interest rate curve (i.e. the zero swap spot curve with UFR). In the real contract the contributions are based on a soft real basis, that is, the nominal interest rate curve with a discount for expected inflations and with a risk premium. Given the fact the future inflation is assumed to be equal to 2.0% on average and an average risk premium of about 1.0% the soft real interest rate curve is on average 1.0% point lower than the nominal interest rate curve. Hence, the actuarial premiums in the real contract are approximately 15% (assuming a duration of the liabilities of 15 years) higher than the actuarial premiums in the nominal contract, with corresponding higher pension payments. In order to compare the nominal contract with the real contract we are forced to look not only at the pension payments, but also at the premiums paid.

In practice the difference in premiums won't be that big after all. The reason for this is the fact a much higher solvency premium must be paid in the nominal contract. This solvency premium must be equal to the required capital level and we assume this to be equal to 20%. In the consultation paper it's suggested that in the real contract a solvency premium of 1% has to be paid. The difference in solvency premium offsets for a great part the discount of future indexations and the risk premium in the real interest rate term structure. Hence, the premiums in the nominal contract will be slightly higher than the premiums paid in the real contract.

In this research we will analyze the situation in case an actuarial premium is paid with a solvency premium and also the situation of an equal average premium of 20% of the pension base. In the latter case we are sure that the contributions are equal in both contracts. It's however unlikely this will cause major differences with respect to the situation of the actuarial premium since the premium capacity is very low in the assumed 'average' Dutch pension fund. So differences in premiums, if any, are not expected to have much impact on the results.

The nature of the pension payments in the nominal and real contract are very different altogether and makes comparison of both the contracts difficult even tough an equal contribution is assumed. This is illustrated in the following example.

Consider a premium of € 1,000. Based on a fixed annual interest rate of 3% and no mortality this premium of € 1,000 equals a fixed annual payment of € 113.82 starting immediately with a maturity of ten years. If we want the payment to increase yearly with 2% the payment starts at € 104.45 and ends with € 124.82. See Table 4.1 for the payment schemes.

Table 4.1

Time	Nominal payments	Real payments
0	113.82	104.45
1	113.82	106.54
2	113.82	108.67
3	113.82	110.84
4	113.82	113.06
5	113.82	115.32
6	113.82	117.62
7	113.82	119.98
8	113.82	122.38
9	113.82	124.82

Although the payments differ quite a lot, the value of both payment schemes equals € 1,000. It's very likely someone may favor one payment scheme over the other. This element, i.e. the difference in timing of the payments, is inherent to the real contract in comparison to the nominal contract and makes comparison between the two difficult.

4.2.3 Indexation policy

Nominal contract

As mentioned in paragraph 2.2 the indexation policy of Dutch pension funds is almost always conditional and based on the funding ratio. No indexation is given if the funding ratio is equal to the minimum required capital or below (i.e. ≤105%) and full indexation is given if the funding ratio is equal to the required capital or above. In the analysis the required capital is assumed to be 120% in the current nominal framework and 130% in the new nominal framework. In between the minimum required capital and the required capital a pro rata indexation is given.

In the nominal contract a part of the pension assets forms the buffer. To compare the nominal contract with the real contract we should do something with this buffer value a member has. However, although a part of the buffer belongs to the member, we are actually only interested in the effects in the height, variability and timing of the pension payments of the member. But to prevent the buffer will get sky high we'll assume the pension fund will use its assets above a buffer of 45%[12] in such a way a buffer of 45% remains after compensation[13]. In this research no restrictions are assumed on the height of the indexations given. We assume such a high indexation is allowed for although in practice it is very likely the Dutch tax authorities will consider that as to extreme (with corresponding tax consequences).

Recovery plan nominal contract

The current financial assessment framework forces pension funds to recover within a period three years. This recovery period of three years is unchanged in the new nominal framework. For the analysis we'll assume the pension fund will reduce the pension rights and payments when it's still in a situation of underfunding after three years, regardless the fact the fund may have been out of the

[12] The 45% buffer is based on 30% buffer for enabling the pension fund to pay out indexed pension rights and payments and another 15% buffer, according to the average level of required capitals, for withstanding financial discounts.

[13] For example, consider the situation a pension fund has a funding ratio of 160%. In that case an indexation of 10.3% can be given with a resulting funding ratio of 145%.

situation of underfunding in the meantime[14]. The pension rights and payments will be reduced in such a way a funding ratio of 105% remains after adjustment. In this research pension reductions will be regarded as negative indexations.

Real contract / AFS

In the real framework the pension rights of the working generations and the pension payments of the retirees are adjusted for the realized price inflation. Any surpluses or deficits at the end of the year will be processed by the AFS and results in a 'second' indexation. Depending on the past surpluses and deficits and the processing period the adjustment by the AFS can be a positive or a negative indexation. The AFS is operating is such a way a real funding ratio of 101% remains after all the adjustments have been processed.

Dutch tax authorities consider extreme high indexations as excessive and corresponding tax consequences will follow. To prevent these extra tax liabilities pension funds can and will cap the indexations. However, in this research we assume all indexations as a result of the AFS are allowed for, no matter how high these may be.

'Open' versus 'closed' AFS in the real contract

As a standard, all future accrual of pension rights will share in the 'current' AFS mechanism. In other words, all new acquired pension rights will be adjusted based on shocks of the past. This method is called an 'open' AFS.

An 'open' AFS will not be mandatory in the new real contract. Pension funds can choose whether financial shocks of the past will be applied on new accrued pension rights or not. If not, the system is called a 'closed' AFS. Both the 'open' and 'closed' AFS are analyzed in this research. See 'Appendix B – The AFS mechanism' for an example of the 'open' and 'closed' AFS.

4.2.4 Asset allocation

The asset allocations of the Dutch pension funds are quite divers. Just consider the different levels of interest rate hedges and/or the allocation to alternative investments. To keep things simple the asset allocation in the analysis consists of two asset categories: stocks and bonds. The strategic asset allocation in the analysis is set to 40% stocks and 60% bonds. Every year the asset allocation is rebalanced to this strategic asset allocation.

Almost every Dutch pension fund has a strategic interest rate hedge. Some pension funds hedge just a small part of the total interest risk whereas some pension funds almost hedge the complete interest risk. For the "average" pension fund we will assume the strategic interest rate hedge to be 50%. A interest rate hedge of 50% means that the return on the assets (stocks excluded) measured in euro's is equal to 50% of the total change of the liabilities caused by interest measured in euro's. For the real contract we will assume the pension fund will hedge the interest risks at 50% as well. In the ALM

[14] A pension fund is out of the situation of underfunding if the funding ratio is equal or more than the minimum required level for more than nine consecutive months. However, the ALM model has an accuracy of years and not months so it is impossible to monitor this requirement in the ALM model.

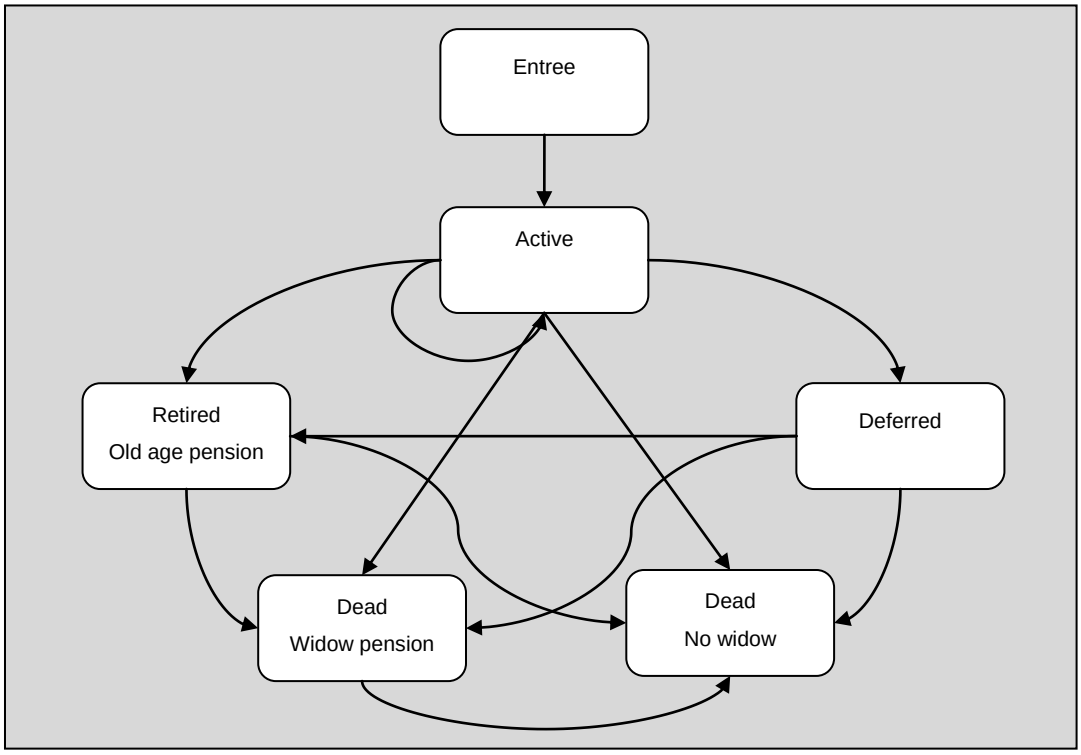
model this is modeled as a bond return equal to 50% of the change in value of the liabilities due to interest.

4.3 Demograpy

The demography of the pension fund has been derived from data published by the Dutch Central Bank (DNB). Using this data we will end up with 9,000 participants in the “average” Dutch company pension fund. This will take too much calculation time, especially if we have to analyze multiple frameworks and conditions. Therefore we group the data and use model points instead in the ALM model. See ‘Appendix C – Demography and constructing model points’ for the derivation of the demography, the construction of the model points and all the assumptions made.

The expected future pension payments and premiums are based on the assumption a participant develops over time. A participant can be in one of the following states: active, deferred, retired, dead with widow pension and dead without widow pension. The development over the states of a participant over time is called a Markov chain. In the graph below the Markov chain is illustrated.

Graph 4.1 Markov chain



The transition chances in the Markov chain are based on the actuarial assumptions and the pension plan assumptions made. The contributions in the analysis are based on the same assumptions. The reason for this is that no actuarial wins or losses will result which otherwise would interfere with the funding ratio of the pension fund and the process of dealing with surpluses and deficits. This keeps the comparison between the contracts fair.

The analysis done in this research is based on a 'open' pension fund. Every year new (younger) model points enter the pension plan and share in the risk of the other existing model points. In this way we can analyze the long term effects of the new pension deal. The number of active members is held constant in time in the analysis.

4.4 Economic Scenarios

4.4.1 Stochastic scenarios

For the analysis 1,000 real world economic scenarios are used[15]. The scenarios include future projections of stock returns, price inflations (realized and expected rates) and interest rate term structures. These economic scenarios are based on 15 years historical market data (on monthly basis). The expected values are in line with Dutch regulation[16] and the characteristics of the real world scenarios are shown in Table 4.2.

Table 4.2

	Category	Arithmetic Mu	Geometric Mu	Sigma	Correlations					
					1	2	3	4	5	6
1	Price inflation (realized)	2.3%	2.3%	1.4%	1.00					
2	Short interest rate	Forward	Forward	1.4%	0.19	1.00				
3	Long interest rate	Forward	Forward	1.2%	0.27	0.65	1.00			
4	1Y expected inflation	1.3%	1.3%	0.4%	0.18	0.42	0.42	1.00		
5	2Y expected inflation	1.3%	1.3%	0.2%	0.29	0.48	0.84	0.57	1.00	
6	Stocks	8.0%	6.4%	18.1%	-0.14	-0.12	-0.09	0.02	-0.03	1.00

The characteristics of the stock returns are derived from historical data of the MSCI World Index (hedged).

The nominal interest term structure at commencement is equal to the term structure as per June 30, 2013 as published by DNB. Future projected interest term structures are assumed to be on average equal to the implied zero spot curve[17]. This is a common assumption in ALM[18]. The interest term structures are derived from the simulated short and long interest rates. The resulting curves will be adjusted in such a way the curves will be equal to the implied zero spot curves. The short and long interest rate will have a standard deviation based on historical market data.

See 'Appendix D – Characteristics ' for the characteristics of the simulation.

[15] The economic scenarios are projected with an Economic Scenario Generator developed by Triple A – Risk Finance.

[16] Regeling Parameters Pensioenfondsen

[17] Based on the forward rates of the current zero spot curve future term structures can be constructed. Future zero spot curves based on the forwards of the current zero spot curve are called implied spot curves.

[18] The Dutch Central Bank (DNB) makes the same assumption in the guidelines regarding continuity analysis for Dutch pension funds. See page 24 "Beleidsregel uitgangspunten beoordeling contintеitsanalyse pensioenfondsen", by DNB, http://www.dnb.nl/binaries/Beleidsregel%20uitgangspunten%20beoordeling%20contintеitsanalyse%20pensioenfondsen_tcm46-159454.pdf

As mentioned in paragraph 2.4 the term structure of the expected inflation rates is based on the one years and two years expected inflation rates according to the CPB expectancy. For the analysis we have derived the mean of these rates from the one and two years European Index linked swap rates. The standard deviation and correlations is based on historical data. Furthermore, the expected inflation rate for term ten years and over is set equal to the long term European goal of 2,0%. Linear interpolation is used to construct the term structure between term two and ten years .

The risk premium term structure which is an element in the new real contract is constructed according to the formula developed by Bovenberg, Nijman and Werker. This risk premium is considered to be fixed and is therefore not part of the simulation of economic scenarios. See paragraph 2.4 for more information about the risk premium term structure.

The salaries of the active members are corrected for realized price inflation and an additional 1,0% inflation. The total wage inflation is therefore on average 3.0%. The extra 1,0% inflation is not simulated with the Economic Scenario Generator and is therefore not stochastic. Since the correlation between price and wage inflation is high this assumption will still be a good approximation of the real world.

4.4.2 Deterministic scenarios

The results of coping differently with surpluses and deficits in both contracts is best seen in extreme good and extreme worse scenarios. That's the reason why we will analyze some deterministic scenarios as well besides the analysis of the stochastic scenario set.

We will analyze the effects of a few deterministic scenarios and are interested in the effects of the asset returns in particularly. Therefore we assume the following characteristics in all the deterministic scenarios:

- Annual interest rate: fixed 3%
- Expected inflation rate: fixed 2%
- Realized inflation rate: fixed 2%
- Asset allocation: 100% stocks

The assumed asset returns are as follows:

- Simulation 1: fixed 1%
- Simulation 2: fixed 3%
- Simulation 3: fixed 5%
- Simulation 4: first year -30% and after that 5% per year
- Simulation 5: first year +30% and after that 5% per year

The following chapter will show the results of the stochastic analysis. Chapter 7 will address the results of the deterministic analysis.

5 Results stochastic analysis

5.1 Criteria

In this research we are interested in the effects of the new pension deal. The research done by CPB has given us great insights in the value transfers between generations and form a very import role in the comparison of the different contracts. Unfortunately, the value transfer does not give (enough) insight in the height, variability and timing of the pension payments. Therefore this research will focus on these specific elements.

It's obvious to take the pension result as a criteria to measure the outcomes in the different contracts[19]. The pension result quantifies the loss (or win) of purchasing power over a certain period of time. However, the pension result alone as a criteria is not sufficient. The reason for this is that the pension result doesn't say anything about the height of the payment[20]. Furthermore the pension result does not say anything about the timing of the indexations[21]. We therefore analyze the height of the pension payment at retirement age as well. The pension payment is what the member actually will receive and forms therefore the most important criteria of the analysis.

To analyze the difference in pension payments between the different contracts graphs are used which reflects the relative difference in pension payments. This is done for the average future expected pension payments as well as for the future expected pension payments in the 5% and 95% percentile. In the graph the "5% percentile" line represents the relative difference of the pension payment in the 5% percentile in one situation compared to the pension payments in the 5% percentile in the other situation. The same holds for the 95% percentile and the average pension payments.

As mentioned in paragraph 4.2.2 the height of the pension payments are directly linked to the contributions made. In order to compare situations where the contributions differ, we will analyze some kind of replacement ratio. This replacement ratio is equal to the present value of all future expected pension payments divided by the present value of all the premiums paid.

To analyze the variability of the pension payments we look at the 5% and 95% percentile of the pension payment scheme. Also the results in the best and worst case scenarios are important in this respect. See for the results of the deterministic scenario chapter 6.

Finally the timing of the pension payment is analyzed by looking the pension payment scheme itself.

[19] The pension result is defined as $\prod_t (1 + indexation_t)/(1 + inflation_t) - 1$. A cash flow which is fully compensated for inflation has a pension result of 100%. If more (less) indexation is given the pension result will be higher (lower) than 100%.

[20] Consider two payment schemes. On the one hand we have an annual payment of € 5 and is fully compensated for inflation each year. The pension result for this cash flow is equal to 100%. On the other hand we have an annual payment of € 1,000 which is not compensated for inflation at all. The pension result measured over a period of 15 years is equal to 74% assuming inflation to be 2% per year. Based only on pension result we prefer the first cash flow.

[21] An active member profits more if indexations in the far future are higher than the indexations of the near future since he accrues pension rights. It is therefore possible the actual pension payments at retirement age differ significantly while the pension results regarding the active period are equal.

For the analysis we look at the above mentioned criteria. We will do this for two specific model points: a 27 year old active member and a 65 years old retiree. For the pension fund policy and all the assumptions made we refer to chapter 4.

5.2 Base analysis current and new contracts

5.2.1 Current nominal contract

The current nominal contract is characterized by an indexation policy which is conditional and based on the funding ratio. Pro rata is given from a funding ratio of 105% (0% indexation) up to a funding ratio of 120% (100% price inflation). The funding ratio at commencement is assumed to be equal to the average nominal funding ratio of Dutch pension funds of 114.4%[22]. Furthermore an actuarial premium is contributed with a solvency premium of 20%. The results of the stochastic analysis are shown in Table 5.1 to Table 5.4.

Table 5.1

Active member (27 years)						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	40.8%	34.0%	105.3%	41.9%	209.7%	49.7%
Deferred period	40.8%	34.0%	105.3%	41.9%	209.7%	49.7%
Retired period	39.4%	39.6%	93.9%	48.2%	177.2%	56.2%
Retired period first 15Y	59.6%	62.1%	97.7%	71.0%	148.7%	79.1%
Total period	23.8%	15.4%	103.9%	20.2%	272.8%	25.5%
First 5Y	86.1%	83.4%	98.6%	89.1%	116.7%	93.8%
First 10Y	72.4%	71.1%	98.5%	79.4%	133.1%	86.1%
Firtst 15Y	62.7%	61.7%	98.9%	70.8%	148.4%	78.4%
Other	5% percentile		Average		95% percentile	
PV payments (A)	16,020		31,367		55,569	
PV premiums (B)	16,383		18,390		20,876	
Factor (A/B)	87.4%		171.1%		302.7%	

Table 5.2

Retired member (65 years)						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	23.8%	15.4%	103.9%	20.2%	272.8%	25.5%
Retired period first 15Y	62.7%	61.7%	98.9%	70.8%	148.4%	78.4%
Total period	23.8%	15.4%	103.9%	20.2%	272.8%	25.5%
First 5Y	86.1%	83.4%	98.6%	89.1%	116.7%	93.8%
First 10Y	72.4%	71.1%	98.5%	79.4%	133.1%	86.1%
Firtst 15Y	62.7%	61.7%	98.9%	70.8%	148.4%	78.4%
Other	5% percentile		Average		95% percentile	
PV payments (A)	172,252		223,131		290,772	

On average the compensation for price inflation is more than 100%. For the active member the pension result is 105.3% during its active working period and 93.9% during its retired period. The purchasing power of the retiree is 98.9% after 15 years and 103.9% for the whole period. If we look at

[22] According to DNB data the estimated average funding ratio of Dutch company pension funds per Q1 2013 is 114.4%. We assume the average funding ratio is not changed over Q2 2013. Source: http://www.statistics.dnb.nl/financieele-instellingen/pensioenfondsen/toezichtgegevens-pensioenfondsen/index.jsp# (table 8.8 on the website).

the 5% and 95% percentiles we see quite a spread in pension results. In the 5% worst scenarios the pension result for the active member during its retirement period is even lower than the situation in which no indexation is given. This can be explained by pension reductions.

Table 5.3 and Table 5.4 below show the pension payment schemes of the old age pension of both members. Per member two pension payment schemes are shown. At the left the payment is equal to payments as if it were 100% certain this member will be in the retired state at that age. At the right side of the table we see payments corrected for the chance the member will be in the retired state at a specific age. In this manner we can judge the variability of the payments better since the variability of payments at older age are dampened by the expectancy.

Table 5.3

Active member (27 years)						
	Old age pension			Old age pension (expected values)		
Age	5% percentile	Average	95% percentile	5% percentile	Average	95% percentile
65	12,666	21,564	33,616	11,138	18,962	29,560
66	12,666	22,090	34,741	10,985	19,158	30,129
67	12,728	22,593	36,297	10,871	19,296	31,000
68	12,556	23,075	37,808	10,544	19,377	31,749
69	12,617	23,614	39,339	10,398	19,460	32,418
70	12,612	24,167	40,966	10,179	19,505	33,064
71	12,818	24,661	42,043	10,109	19,447	33,155
72	12,793	25,198	43,627	9,830	19,362	33,523
73	12,862	25,763	45,517	9,600	19,230	33,975
74	12,868	26,334	46,588	9,297	19,026	33,659
75	12,853	26,943	47,730	8,951	18,764	33,241
76	12,891	27,528	49,112	8,614	18,396	32,819
77	13,107	28,188	51,299	8,362	17,982	32,726
78	13,212	28,790	53,061	8,000	17,432	32,129
79	13,361	29,510	54,460	7,630	16,853	31,103
80	13,369	30,164	57,454	7,151	16,134	30,732

Table 5.4

Retired member (65 years)						
	Old age pension			Old age pension (expected values)		
Age	5% percentile	Average	95% percentile	5% percentile	Average	95% percentile
65	19,850	19,850	19,850	19,850	19,850	19,850
66	19,850	20,158	20,530	19,577	19,880	20,247
67	19,850	20,566	21,647	19,280	19,975	21,024
68	19,903	21,006	22,990	19,006	20,059	21,954
69	19,978	21,461	24,456	18,722	20,112	22,918
70	19,747	21,981	26,316	18,124	20,174	24,153
71	19,165	22,506	27,281	17,187	20,183	24,465
72	18,904	23,010	28,350	16,519	20,106	24,772
73	18,829	23,547	29,764	15,982	19,987	25,264
74	18,658	24,075	31,019	15,329	19,780	25,486
75	18,601	24,619	32,171	14,731	19,497	25,478
76	18,324	25,176	33,949	13,925	19,132	25,799
77	18,172	25,786	35,198	13,183	18,707	25,535
78	17,997	26,414	37,318	12,392	18,188	25,696
79	18,166	26,998	38,423	11,798	17,534	24,954
80	18,207	27,667	40,221	11,075	16,829	24,465

5.2.2 New nominal contract

The indexation policy in the new nominal contract is still conditional and based on the funding ratio. We adjust the upper limit of the indexation scale at which point 100% price inflation is given. We assume in the new nominal contract that the funding ratio must be equal to 130% instead of 120% to give a full price inflation indexation. In Table 5.5 and Table 5.6 the results of the stochastic analysis are shown as the *absolute difference* with the base analysis of the current nominal contract.

Table 5.5

Active member (27 years) – Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.8%	0.0%	-0.4%	0.0%	0.5%	0.0%
Deferred period	0.8%	0.0%	-0.4%	0.0%	0.5%	0.0%
Retired period	0.9%	0.0%	1.2%	0.0%	0.7%	0.0%
Retired period first 15Y	0.8%	0.0%	0.7%	0.0%	4.6%	0.0%
Total period	-0.3%	0.0%	1.0%	0.0%	3.3%	0.0%
First 5Y	-0.5%	0.0%	-0.9%	0.0%	-0.6%	0.0%
First 10Y	-0.1%	0.0%	-1.1%	0.0%	-1.3%	0.0%
Firtst 15Y	-0.4%	0.0%	-1.1%	0.0%	0.0%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	2		235		763	
PV premiums (B)	-		-		-	
Factor (A/B)	0.7%		1.3%		2.7%	

Table 5.6

Retired member (65 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	-0.3%	0.0%	1.0%	0.0%	3.3%	0.0%
Retired period first 15Y	-0.4%	0.0%	-1.1%	0.0%	0.0%	0.0%
Total period	-0.3%	0.0%	1.0%	0.0%	3.3%	0.0%
First 5Y	-0.5%	0.0%	-0.9%	0.0%	-0.6%	0.0%
First 10Y	-0.1%	0.0%	-1.1%	0.0%	-1.3%	0.0%
Firtst 15Y	-0.4%	0.0%	-1.1%	0.0%	0.0%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-1,300		-1,967		-1,790	

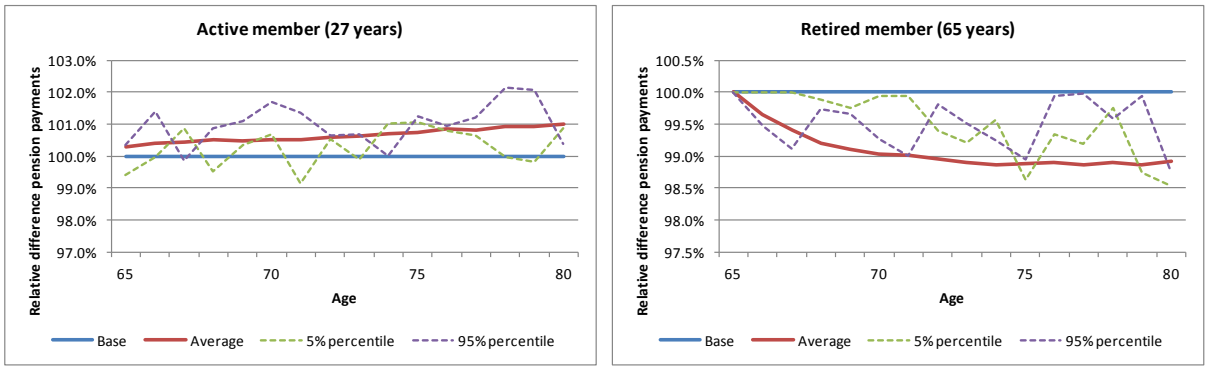
On average the compensation for price inflation is more than 100% again. For the active member the pension result is 104.9% during its active working period and 95.1% during its retired period. For as the retiree he will lose about 2.1% of his purchasing power after 15 years and wins 4.9% for the whole period. Compared to the current nominal contract we see on the short term (≤ 15 years) a slightly lower pension result and for the long run a slightly higher pension result.

If we look at the 5% and 95% percentiles we see a similar result as in the current nominal contract. There's quite a spread visible in pension results. In the 5% worst scenarios the pension result is sometimes even lower than the situation in which no indexation is given. This again can be explained by pension reductions. The 5% and 95% percentile are on the short term slightly lower than in the current nominal contract. For the 95% percentile this is easily explained by the raise of the upper funding ratio limit from 120% to 130%. In the 5% worst scenarios the funding ratio is low. If the funding ratio is below the limit of 105% and still is after three years, the liabilities are reduced in such a way a

funding ratio of 105% remains. Therefore the funding ratio in the worst scenarios will hang around the 105%. Since the upper funding ratio limit is raised, the pro rata indexation between a funding ratio of 105% up to 130% is lower than in the current nominal contract (105% up to 120%). That's the reason why the pension result in the 5% percentile is also slightly lower than in the current nominal contract.

Looking at the 'replacement' ratio (factor A/B) we see the same contributions are paid in the new nominal contract. The present value of the future expected pension payments is however a bit higher for the active member and a bit lower for the retired member.

Graph 5.1 Relative difference pension payments with current nominal contract



The effects of the new nominal contract on the pension payment scheme are small. Graph 5.1 represents the relative difference in pension payment between the new nominal contract and the current nominal contract (= base). We see a small increase in the expected payments of the active member and a small decrease in the payments of the retiree. This corresponds with the aforementioned pension results.

Retirees and old members will favor the current nominal contract over the new nominal contract. The reason is simple: on the short term lesser indexation will be given in the new contract.

5.2.3 New real contract - Base

In this paragraph we will analyze the effects of the new real contract. In the former paragraphs we assumed a nominal funding ratio at commencement of 114.4% which is more or less the average funding ratio of Dutch company pension funds at the moment. Given the assumptions of the real contract in chapter 4 and especially those in paragraph 4.4.1 a nominal funding ratio of 114.4% is equal to a funding ratio in the real contract of 100.0%. The pension assets at commencement remain unchanged, only the value of the liabilities is changed (different interest rate term structure).

As mentioned in paragraph 4.2.2 we've assumed in the new real contract a solvency premium of 1.0% on top of the real actuarial premium is part of the total real premium. The AFS processing period is set on ten years and adjustments are made to convert to a real funding ratio of 101%. In the standard new real contract an 'open' AFS is assumed and no equalization reserve. The results are shown in the tables below as the *absolute difference* with the base analysis of the current nominal contract.

For the active member the pension result is on average 102.3% during its active working period and 86.2% during its retired period. The pension result for the retiree is on average equal to 90.8%. Compared to the current nominal contract we see on the short term (≤ 15 years) a higher average pension result of about 1.6% point. For future periods the average pension result is significantly lower! The pension result in the retired period of the active member is in the current nominal contract on average 93.9% and in the new real contract 86.2%! The reason for this result is the fact that in the new real contract every year an indexation is given equal to the realized price inflation. Deficits will end up in the AFS and will be processed in ten years. The losses are therefore pushed to future years while in the meanwhile full compensations for price inflations is given. In the current nominal contract about 2/3 price inflation is given as indexation at a funding ratio of 114.4%. Any losses in this contract will directly influence the funding ratio and therefore the indexation next year.

Table 5.7

Active member (27 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	-1.6%	0.0%	-3.0%	0.0%	-8.4%	0.0%
Deferred period	-1.6%	0.0%	-3.0%	0.0%	-8.4%	0.0%
Retired period	-3.0%	0.0%	-7.7%	0.0%	-15.8%	0.0%
Retired period first 15Y	-5.3%	0.0%	-4.5%	0.0%	-7.7%	0.0%
Total period	-1.3%	0.0%	-13.1%	0.0%	-41.0%	0.0%
First 5Y	4.6%	0.0%	1.2%	0.0%	-6.5%	0.0%
First 10Y	4.4%	0.0%	1.2%	0.0%	-5.6%	0.0%
Firtst 15Y	2.9%	0.0%	1.6%	0.0%	-2.9%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-818		-2,087		-4,011	
PV premiums (B)	1,097		1,199		1,247	
Factor (A/B)	-10.7%		-21.2%		-40.0%	

Table 5.8

Retired member (65 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	-1.3%	0.0%	-13.1%	0.0%	-41.0%	0.0%
Retired period first 15Y	2.9%	0.0%	1.6%	0.0%	-2.9%	0.0%
Total period	-1.3%	0.0%	-13.1%	0.0%	-41.0%	0.0%
First 5Y	4.6%	0.0%	1.2%	0.0%	-6.5%	0.0%
First 10Y	4.4%	0.0%	1.2%	0.0%	-5.6%	0.0%
Firtst 15Y	2.9%	0.0%	1.6%	0.0%	-2.9%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	4,591		2,733		-3,779	

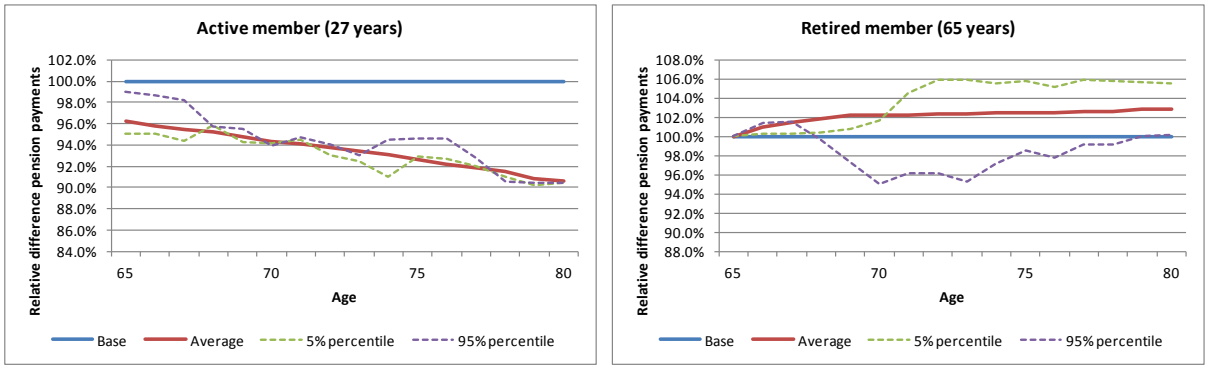
To compare the new real contract with the current and new nominal contracts we also have to analyze the differences in contributions. The present value of the future expected premiums is about 6% to 7% higher in the new real contract. However, the present value of the future expected pension payments for the active member have decreased. The ‘replacement’ factor is therefore significantly lower in the new real contract. The average present value of future expected pension payments of the retiree are a bit higher in the new real contract.

Based on this analysis transition to the new real contract is in favor with the older members (especially retirees) and highly unfavorable to young members.

If we look at the spread between the 5% and 95% percentile we can conclude that this spread is much lower in the new real contract than in the new nominal contract. The AFS will cause shocks to be processed in ten years time. Also negative shocks will be processed within a period of ten years while in the new nominal contract the recovery period is three years.

If we take a look at the relative difference in pension payments between the new real contract and the new nominal contract (see Graph 5.2) we see that the retiree will have a much higher pension payment compared to the new nominal contract (higher pension result). The active member on the other hand will have a lower pension payment at retirement age and a lower pension result during its retirement period!

Graph 5.2 Relative difference pension payments with new nominal contract



The spread has decreased as well, especially for the retired member. This is clearly seen in the graph: the 5% percentile has relatively increased whereas the 95% percentile has relatively decreased.

5.3 Alternative analysis current and new contracts: Different funding ratio

In the base analysis in paragraph 5.2 a nominal funding ratio of 114.4% was assumed as the average funding ratio of the Dutch company pension funds. The corresponding real funding ratio was equal to 100.0%. To investigate sensitivity of the results with respect to the funding ratio at commencement this paragraph will show the results with a starting nominal funding ratio of 105% (minimum required capital) and a corresponding real funding ratio of 91.8%.

5.3.1 Current nominal contract

The results of the current nominal contract are shown in the tables below. Lowering the funding ratio has a direct effect on the indexations given. The results show a decrease in pension result of approximately 10% point and has led to an average pension result of lower than 100%. The spread in pension results are smaller as well.

Table 5.9

Active member (27 years)						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	37.9%	34.0%	95.9%	41.9%	189.9%	49.7%
Deferred period	37.9%	34.0%	95.9%	41.9%	189.9%	49.7%
Retired period	39.3%	39.6%	93.2%	48.2%	175.7%	56.2%
Retired period first 15Y	59.4%	62.1%	97.3%	71.0%	147.8%	79.1%
Total period	21.6%	15.4%	93.7%	20.2%	246.3%	25.5%
First 5Y	76.9%	83.4%	93.3%	89.1%	105.9%	93.8%
First 10Y	65.9%	71.1%	91.1%	79.4%	121.4%	86.1%
Firtst 15Y	58.0%	61.7%	90.8%	70.8%	135.7%	78.4%
Other	5% percentile		Average		95% percentile	
PV payments (A)	15,688		30,237		53,585	
PV premiums (B)	16,383		18,390		20,876	
Factor (A/B)	85.2%		164.9%		288.1%	

Table 5.10

Retired member (65 years)						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	21.6%	15.4%	93.7%	20.2%	246.3%	25.5%
Retired period first 15Y	58.0%	61.7%	90.8%	70.8%	135.7%	78.4%
Total period	21.6%	15.4%	93.7%	20.2%	246.3%	25.5%
First 5Y	76.9%	83.4%	93.3%	89.1%	105.9%	93.8%
First 10Y	65.9%	71.1%	91.1%	79.4%	121.4%	86.1%
Firtst 15Y	58.0%	61.7%	90.8%	70.8%	135.7%	78.4%
Other	5% percentile		Average		95% percentile	
PV payments (A)	161,063		208,693		268,999	

The pension payment schemes in the tables below show the effect of decrease in funding ratio of 9.6% point. As expected the expected pension payments are significantly lower.

Table 5.11

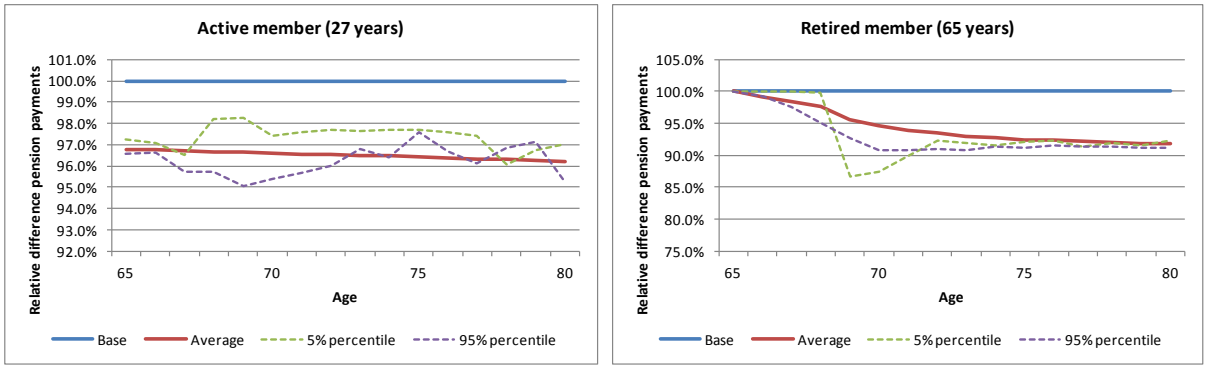
Active member (27 years)						
	Old age pension			Old age pension (expected values)		
Age	5% percentile	Average	95% percentile	5% percentile	Average	95% percentile
65	12,319	20,870	32,463	10,833	18,353	28,547
66	12,295	21,372	33,575	10,663	18,535	29,118
67	12,284	21,851	34,751	10,491	18,662	29,680
68	12,328	22,310	36,197	10,352	18,734	30,395
69	12,399	22,820	37,399	10,218	18,806	30,820
70	12,288	23,343	39,088	9,918	18,840	31,548
71	12,508	23,812	40,214	9,864	18,778	31,713
72	12,497	24,323	41,876	9,603	18,689	32,178
73	12,556	24,859	44,050	9,372	18,555	32,879
74	12,571	25,403	44,921	9,083	18,354	32,455
75	12,555	25,980	46,584	8,744	18,093	32,442
76	12,578	26,532	47,471	8,405	17,730	31,723
77	12,766	27,155	49,297	8,144	17,323	31,449
78	12,694	27,730	51,389	7,686	16,791	31,116
79	12,927	28,408	52,891	7,383	16,224	30,206
80	12,975	29,026	54,751	6,940	15,526	29,286

Table 5.12

Retired member (65 years)						
	Old age pension			Old age pension (expected values)		
Age	5% percentile	Average	95% percentile	5% percentile	Average	95% percentile
65	19,850	19,850	19,850	19,850	19,850	19,850
66	19,850	19,999	20,381	19,577	19,723	20,100
67	19,850	20,227	21,114	19,280	19,646	20,507
68	19,850	20,494	21,880	18,956	19,570	20,894
69	17,312	20,494	22,677	16,224	19,206	21,251
70	17,282	20,789	23,887	15,862	19,080	21,925
71	17,226	21,142	24,762	15,448	18,960	22,206
72	17,439	21,537	25,803	15,238	18,819	22,547
73	17,292	21,896	27,003	14,678	18,586	22,920
74	17,076	22,318	28,338	14,029	18,337	23,283
75	17,132	22,759	29,326	13,568	18,024	23,225
76	16,925	23,247	31,060	12,862	17,666	23,604
77	16,619	23,761	32,139	12,056	17,238	23,316
78	16,532	24,295	34,071	11,383	16,729	23,460
79	16,627	24,810	35,064	10,798	16,113	22,772
80	16,796	25,390	36,664	10,217	15,444	22,302

The relative difference in pension payments between the current nominal contract with an adjusted funding ratio and the current nominal contract in the base analysis (= base) is shown in the graph below.

Graph 5.3 Relative difference pension payments with current nominal contract in the base analysis



5.3.2 New nominal contract

The same results are visible as in the base analysis. The average pension result of the active member during its working period has decreased a little bit and during its retirement period increased a little bit. The pension result for the retired member has decreased on the short term but on the long term it will increase lightly. The effects between the current nominal contract and the new nominal contract are not very different in the base analysis compared to this alternative analysis with a lower starting funding ratio.

The 'replacement' ratios (factor A/B) show the same effects: the present value of the future expected pension payments is a bit higher for the active member and a bit lower for the retired member.

Table 5.13

Active member (27 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	-0.6%	0.0%	-0.4%	0.0%	-0.9%	0.0%
Deferred period	-0.6%	0.0%	-0.4%	0.0%	-0.9%	0.0%
Retired period	1.0%	0.0%	1.1%	0.0%	0.4%	0.0%
Retired period first 15Y	0.9%	0.0%	0.7%	0.0%	4.1%	0.0%
Total period	-0.1%	0.0%	0.8%	0.0%	5.1%	0.0%
First 5Y	-0.3%	0.0%	-0.8%	0.0%	0.0%	0.0%
First 10Y	-0.1%	0.0%	-1.0%	0.0%	-0.6%	0.0%
Firtst 15Y	-0.9%	0.0%	-1.0%	0.0%	-0.4%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-43		210		545	
PV premiums (B)	-		-		-	
Factor (A/B)	0.6%		1.1%		3.0%	

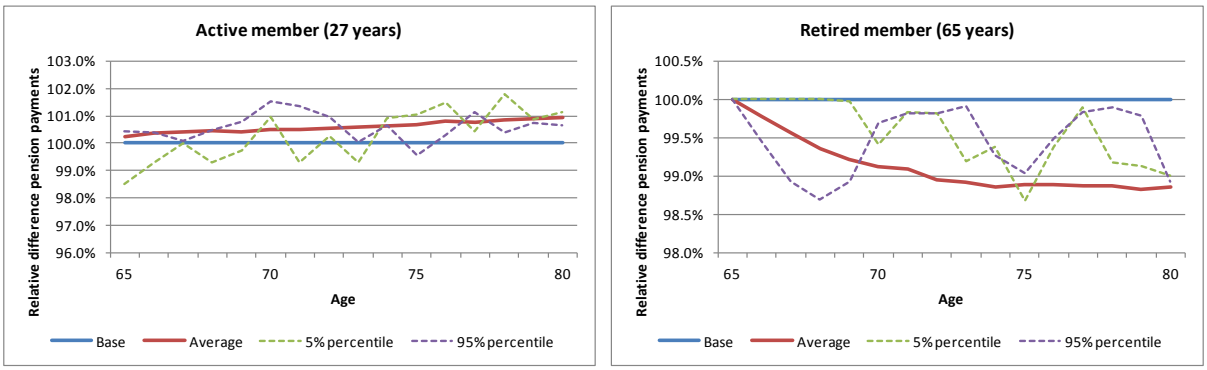
Table 5.14

Retired member (65 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	-0.1%	0.0%	0.8%	0.0%	5.1%	0.0%
Retired period first 15Y	-0.9%	0.0%	-1.0%	0.0%	-0.4%	0.0%
Total period	-0.1%	0.0%	0.8%	0.0%	5.1%	0.0%
First 5Y	-0.3%	0.0%	-0.8%	0.0%	0.0%	0.0%
First 10Y	-0.1%	0.0%	-1.0%	0.0%	-0.6%	0.0%
Firtst 15Y	-0.9%	0.0%	-1.0%	0.0%	-0.4%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-1,273		-1,828		-1,566	

The effects of the new nominal contract on the pension payment schemes are shown in the graph below. The graph represents the relative difference in pension payment between the new nominal contract and the current nominal contract (= base). A small increase in the expected payments of the active member can be seen and a small decrease in the payments of the retiree. This is in line with the pension results in the tables above.

Retirees and old members will favor the current nominal contract over the new nominal contract. The reason is simple: on the short term lesser indexation will be given in the new contract.

Graph 5.4 Relative difference pension payments with current nominal contract



5.3.3 New real contract – Base

In this alternative analysis we start with a real funding ratio of 91.8%. This means a deficit of 8.2% will be processed by the AFS in ten years time. The pension result of the active member is on average 93.2% during its active working period and 86.2% during its retired period. The pension result for the retiree is on average equal to 82.6%. Compared to the current nominal contract we see on the short term (≤ 15 years) a higher average pension result of about 1.0% point. For future periods the average pension result is significantly lower. The pension result in the retired period of the active member is in the current nominal contract on average 93.2% and in the new real contract 86.2%! The reason for this result is the fact that in the new real contract every year an indexation is given equal to the realized price inflation. Deficits will end up in the AFS and will be processed in ten years. The losses are therefore pushed to future years while in the meanwhile full compensations for price inflations is given. In the current nominal contract we start at a nominal funding ratio of 105%. At this level no price inflation is given as indexation. Losses in this contract, especially on the short term, will lead to a funding ratio of lower than 105% and therefore a higher probability the pension rights must be reduced.

The contributions are important in the comparison of the nominal contract with respect to the real contract. The present value of the future expected premiums is again about 6% to 7% higher in the new real contract. However, the present value of the future expected pension payments for the active member have decreased. The 'replacement' factor is therefore significantly lower in the new real contract. The average present value of future expected pension payments of the retiree are a bit higher in the new real contract.

Also based on this analysis transition to the new real contract is in favor with the older members (especially retirees) and highly unfavorable to young members.

If we look at the spread between the 5% and 95% percentile we can conclude that this spread is much lower in the new real contract than in the new nominal contract. The AFS will cause shocks to be processed in ten years time. Also negative shocks will be processed within a period of ten years while in the new nominal contract the recovery period in case the funding ratio is lower than 105% is three years.

Table 5.15

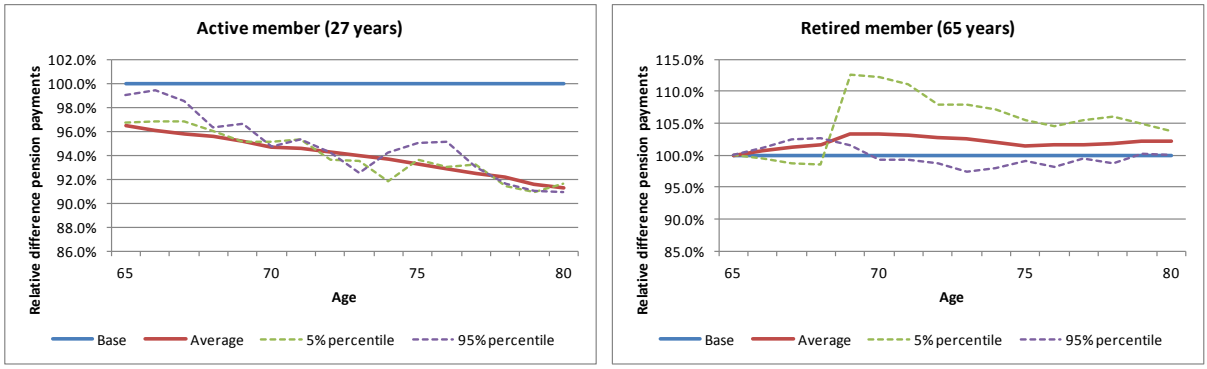
Active member (27 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	-1.9%	0.0%	-2.7%	0.0%	-7.0%	0.0%
Deferred period	-1.9%	0.0%	-2.7%	0.0%	-7.0%	0.0%
Retired period	-2.7%	0.0%	-7.0%	0.0%	-15.0%	0.0%
Retired period first 15Y	-4.8%	0.0%	-4.1%	0.0%	-7.0%	0.0%
Total period	-0.9%	0.0%	-11.1%	0.0%	-36.5%	0.0%
First 5Y	10.3%	0.0%	2.3%	0.0%	-0.8%	0.0%
First 10Y	4.7%	0.0%	0.2%	0.0%	-4.9%	0.0%
Firtst 15Y	2.0%	0.0%	0.9%	0.0%	-3.4%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-773		-1,858		-3,728	
PV premiums (B)	1,097		1,199		1,247	
Factor (A/B)	-10.3%		-19.7%		-35.4%	

Table 5.16

Retired member (65 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	-0.9%	0.0%	-11.1%	0.0%	-36.5%	0.0%
Retired period first 15Y	2.0%	0.0%	0.9%	0.0%	-3.4%	0.0%
Total period	-0.9%	0.0%	-11.1%	0.0%	-36.5%	0.0%
First 5Y	10.3%	0.0%	2.3%	0.0%	-0.8%	0.0%
First 10Y	4.7%	0.0%	0.2%	0.0%	-4.9%	0.0%
Firtst 15Y	2.0%	0.0%	0.9%	0.0%	-3.4%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	5,721		2,484		-1,933	

If we take a look at the relative difference in pension payments in the graph below we see that the retiree will have a higher pension payment compared to the new nominal contract (higher pension result). The active member on the other hand will have a lower pension payment at retirement age and a lower pension result during its retirement period!

Graph 5.5 Relative difference pension payments with new nominal contract



5.4 Alternative analysis current and new contracts: Average premium

As mentioned in paragraph 4.2.2 we would analyze the situation of an average premium as well. In the base analysis the contributions in the nominal contract were lower than the contributions in the real contract. In this paragraph an average premium of 20% of the pension base is assumed despite of the contract so the contributions in both contract will be equal[23].

An actuarial premium increases with increasing age of the member. An average premium does not has this characteristic since the whole idea of an average premium is to keep it fixed in time. In order to contribute the same in both situations the average premium must be higher than the actuarial premium for young members and lower for old members. An average premium system will therefore lead to solidarity from young members to old.

[23] Normally the average premium will be adjusted every five years. In this analysis the average premium is considered to be 20% of the pension base for the whole projection period despite the development of the demography of the pension fund.

5.4.1 Current nominal contract

An average premium of 20% instead of a nominal actuarial premium with a solvency premium of 20% has significant effect on the results. The pension results of both the active member as the retired member have decreased a lot.

Table 5.17

Active member (27 years)						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	37.4%	34.0%	97.8%	41.9%	198.4%	49.7%
Deferred period	37.4%	34.0%	97.8%	41.9%	198.4%	49.7%
Retired period	40.3%	39.6%	93.9%	48.2%	175.0%	56.2%
Retired period first 15Y	60.0%	62.1%	97.2%	71.0%	149.0%	79.1%
Total period	21.9%	15.4%	96.5%	20.2%	250.4%	25.5%
First 5Y	83.9%	83.4%	97.4%	89.1%	114.9%	93.8%
First 10Y	69.3%	71.1%	95.3%	79.4%	127.6%	86.1%
Firtst 15Y	59.0%	61.7%	94.2%	70.8%	142.7%	78.4%
Other	5% percentile		Average		95% percentile	
PV payments (A)	15,848		30,122		53,181	
PV premiums (B)	17,182		18,593		20,428	
Factor (A/B)	83.4%		162.6%		287.0%	

Table 5.18

Retired member (65 years)						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	21.9%	15.4%	96.5%	20.2%	250.4%	25.5%
Retired period first 15Y	59.0%	61.7%	94.2%	70.8%	142.7%	78.4%
Total period	21.9%	15.4%	96.5%	20.2%	250.4%	25.5%
First 5Y	83.9%	83.4%	97.4%	89.1%	114.9%	93.8%
First 10Y	69.3%	71.1%	95.3%	79.4%	127.6%	86.1%
Firtst 15Y	59.0%	61.7%	94.2%	70.8%	142.7%	78.4%
Other	5% percentile		Average		95% percentile	
PV payments (A)	165,828		215,395		278,316	

Although the average present value of future premiums is slightly higher, the average present value of future expected pension payments is lower for the active member. Apparently the development of the demography of the pension fund leads to disadvantageous effects for the current young active member. It has insufficient ability to profit from future solidarity of future young active members which results in lower expected pension payments.

The average pension payments of the retired member has decreased as well. Probably the demography is developing in such a way the total average premium of 20% is not enough. This leads to a decrease in funding ratio and hence a lower indexation.

The pension payments are shown in the tables below. Graph 5.6 show the relative difference of the pension payments with respect to the current nominal contract in the base analysis.

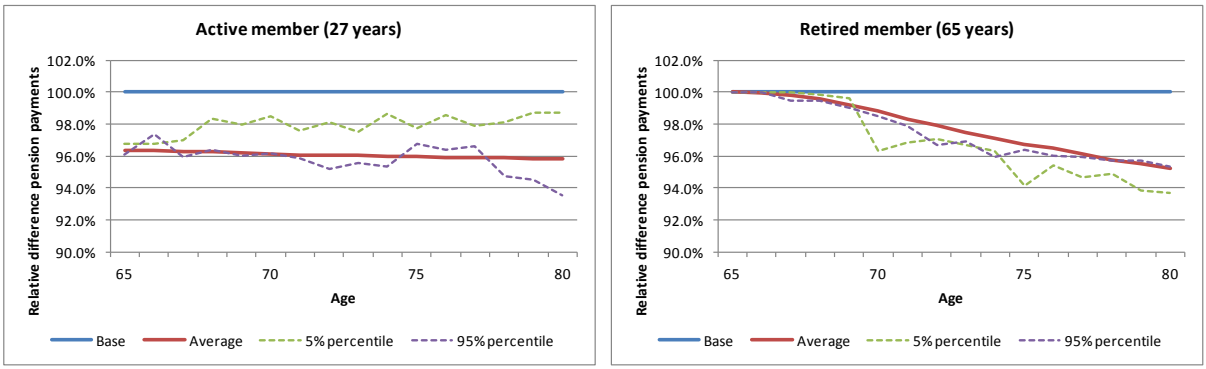
Table 5.19

Active member (27 years)						
	Old age pension			Old age pension (expected values)		
Age	5% percentile	Average	95% percentile	5% percentile	Average	95% percentile
65	12,255	20,777	32,300	10,777	18,270	28,403
66	12,255	21,282	33,819	10,629	18,457	29,329
67	12,348	21,757	34,812	10,546	18,582	29,732
68	12,348	22,218	36,451	10,369	18,657	30,609
69	12,359	22,715	37,777	10,185	18,719	31,132
70	12,424	23,240	39,388	10,028	18,757	31,790
71	12,506	23,693	40,305	9,862	18,684	31,784
72	12,554	24,199	41,521	9,646	18,594	31,905
73	12,547	24,747	43,516	9,366	18,471	32,481
74	12,693	25,284	44,403	9,170	18,268	32,081
75	12,559	25,857	46,196	8,747	18,008	32,172
76	12,709	26,409	47,358	8,493	17,648	31,647
77	12,833	27,026	49,552	8,187	17,241	31,612
78	12,960	27,618	50,290	7,847	16,723	30,451
79	13,188	28,277	51,469	7,532	16,149	29,394
80	13,197	28,896	53,743	7,059	15,457	28,747

Table 5.20

Retired member (65 years)						
	Old age pension			Old age pension (expected values)		
Age	5% percentile	Average	95% percentile	5% percentile	Average	95% percentile
65	19,850	19,850	19,850	19,850	19,850	19,850
66	19,850	20,146	20,530	19,577	19,869	20,247
67	19,850	20,530	21,540	19,280	19,940	20,921
68	19,872	20,927	22,872	18,977	19,983	21,841
69	19,904	21,297	24,222	18,653	19,958	22,700
70	19,024	21,717	25,918	17,461	19,932	23,788
71	18,565	22,133	26,713	16,649	19,849	23,956
72	18,349	22,530	27,404	16,033	19,687	23,946
73	18,211	22,955	28,852	15,458	19,484	24,490
74	17,966	23,386	29,754	14,761	19,214	24,446
75	17,505	23,820	31,016	13,863	18,864	24,563
76	17,490	24,297	32,607	13,291	18,464	24,779
77	17,202	24,796	33,784	12,479	17,988	24,509
78	17,075	25,297	35,712	11,757	17,418	24,591
79	17,054	25,788	36,775	11,076	16,748	23,883
80	17,054	26,345	38,351	10,373	16,025	23,328

Graph 5.6 Relative difference pension payments with current nominal contract in the base analysis



5.4.2 New nominal contract

With respect to the current nominal contract the average pension result of the active member during its working period has decreased a little bit and during its retirement period increased a little. The pension result for the retired member has decreased on the short term but on the long term it will increase. The effects between the current nominal contract and the new nominal contract are not very different compared to the previous two analysis (the base analysis and the alternative analysis with a lower starting funding ratio).

The 'replacement' ratios (factor A/B) show the same effects: the present value of the future expected pension payments is a bit higher for the active member and a bit lower for the retired member.

Table 5.21

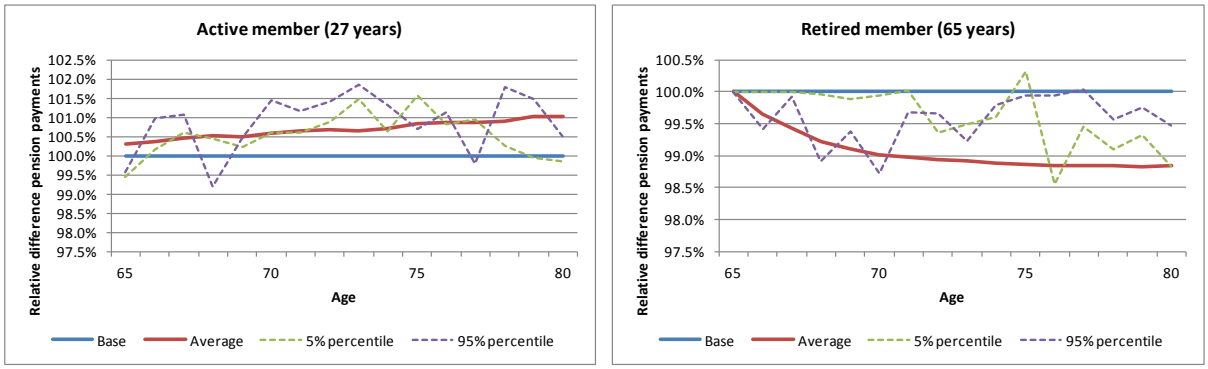
Active member (27 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	-0.5%	0.0%	-0.4%	0.0%	0.0%	0.0%
Deferred period	-0.5%	0.0%	-0.4%	0.0%	0.0%	0.0%
Retired period	0.5%	0.0%	1.1%	0.0%	2.5%	0.0%
Retired period first 15Y	0.3%	0.0%	0.7%	0.0%	1.6%	0.0%
Total period	0.2%	0.0%	0.9%	0.0%	4.4%	0.0%
First 5Y	-0.4%	0.0%	-0.9%	0.0%	-0.5%	0.0%
First 10Y	-0.3%	0.0%	-1.1%	0.0%	-0.5%	0.0%
Firtst 15Y	-0.4%	0.0%	-1.1%	0.0%	-0.6%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	110		236		540	
PV premiums (B)	-		-		-	
Factor (A/B)	0.2%		1.3%		3.1%	

Table 5.22

Retired member (65 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	0.2%	0.0%	0.9%	0.0%	4.4%	0.0%
Retired period first 15Y	-0.4%	0.0%	-1.1%	0.0%	-0.6%	0.0%
Total period	0.2%	0.0%	0.9%	0.0%	4.4%	0.0%
First 5Y	-0.4%	0.0%	-0.9%	0.0%	-0.5%	0.0%
First 10Y	-0.3%	0.0%	-1.1%	0.0%	-0.5%	0.0%
Firtst 15Y	-0.4%	0.0%	-1.1%	0.0%	-0.6%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-1,197		-1,950		-1,863	

Also the pension payment schemes show the same effect. An increase for the active member and a decrease for the retiree.

Graph 5.7 Relative difference pension payments with current nominal contract



5.4.3 New real contract – Base

As in the base analysis the spread in pension results has become significantly smaller. Especially the pension results in the 5% percentile have increased a lot. This is again explained by the difference in processing period.

Transition to the new real contract does not profit the active member. The pension result during its working period and retirement period will decrease. For the short term the pension results will increase and is therefore favorable to the retired member. The effects on the pension payments are shown in the tables and graph below.

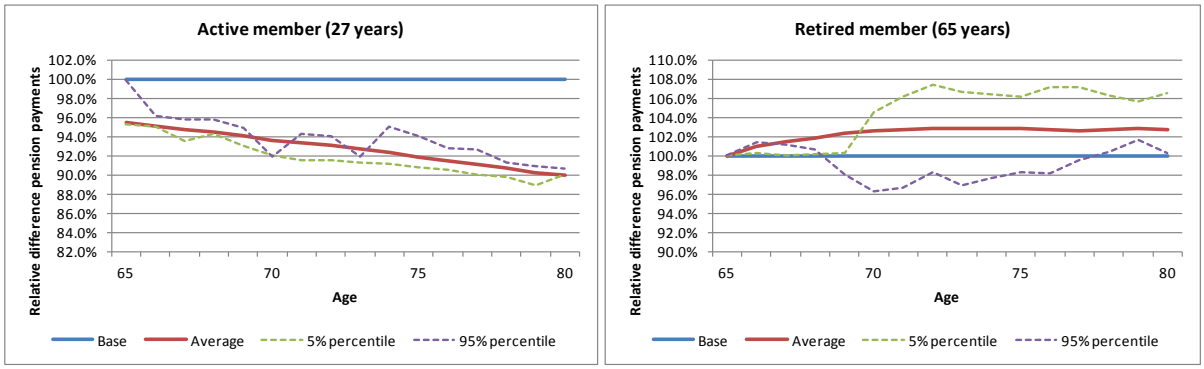
Table 5.23

Active member (27 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	-2.5%	0.0%	-3.7%	0.0%	-8.5%	0.0%
Deferred period	-2.5%	0.0%	-3.7%	0.0%	-8.5%	0.0%
Retired period	-2.8%	0.0%	-7.9%	0.0%	-15.0%	0.0%
Retired period first 15Y	-4.5%	0.0%	-4.6%	0.0%	-9.3%	0.0%
Total period	-0.8%	0.0%	-13.1%	0.0%	-42.1%	0.0%
First 5Y	6.0%	0.0%	1.5%	0.0%	-5.6%	0.0%
First 10Y	5.4%	0.0%	1.5%	0.0%	-2.9%	0.0%
Firtst 15Y	2.6%	0.0%	1.4%	0.0%	-4.8%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-1,276		-2,206		-4,272	
PV premiums (B)	633		633		633	
Factor (A/B)	-8.0%		-16.9%		-33.2%	

Table 5.24

Retired member (65 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	-0.8%	0.0%	-13.1%	0.0%	-42.1%	0.0%
Retired period first 15Y	2.6%	0.0%	1.4%	0.0%	-4.8%	0.0%
Total period	-0.8%	0.0%	-13.1%	0.0%	-42.1%	0.0%
First 5Y	6.0%	0.0%	1.5%	0.0%	-5.6%	0.0%
First 10Y	5.4%	0.0%	1.5%	0.0%	-2.9%	0.0%
Firtst 15Y	2.6%	0.0%	1.4%	0.0%	-4.8%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	4,863		2,634		-41	

Graph 5.8 Relative difference pension payments with current nominal contract



5.5 Alternative analysis current and new contracts: 50% stock exposure

In the base analysis we assumed an stock exposure of 40% and a interest risk hedge of 50%. In this paragraph the results are shown in case the stock exposure is 50% instead of 40%. We still assume the interest hedge to be equal to 50%.

5.5.1 Current nominal contract

An increase in stock exposure has extreme effects on the pension results! First of all the average pension results are much higher and the spread shows a major increase. Especially the pension results in the 95% percentile have increased much. The decrease of the pension result in the 5% percentile is way smaller. The replacement ratios have increased significantly as well.

Table 5.25

Active member (27 years)						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	43.3%	34.0%	143.4%	41.9%	321.3%	49.7%
Deferred period	43.3%	34.0%	143.4%	41.9%	321.3%	49.7%
Retired period	42.2%	39.6%	125.8%	48.2%	266.8%	56.2%
Retired period first 15Y	59.7%	62.1%	111.9%	71.0%	189.9%	79.1%
Total period	28.0%	15.4%	194.5%	20.2%	601.1%	25.5%
First 5Y	84.0%	83.4%	100.8%	89.1%	125.9%	93.8%
First 10Y	70.1%	71.1%	104.4%	79.4%	151.4%	86.1%
Firtst 15Y	61.3%	61.7%	109.4%	70.8%	178.9%	78.4%
Other	5% percentile		Average		95% percentile	
PV payments (A)	17,475		42,536		87,932	
PV premiums (B)	16,383		18,390		20,876	
Factor (A/B)	94.8%		232.1%		472.8%	

Table 5.26

Retired member (65 years)						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	28.0%	15.4%	194.5%	20.2%	601.1%	25.5%
Retired period first 15Y	61.3%	61.7%	109.4%	70.8%	178.9%	78.4%
Total period	28.0%	15.4%	194.5%	20.2%	601.1%	25.5%
First 5Y	84.0%	83.4%	100.8%	89.1%	125.9%	93.8%
First 10Y	70.1%	71.1%	104.4%	79.4%	151.4%	86.1%
Firtst 15Y	61.3%	61.7%	109.4%	70.8%	178.9%	78.4%
Other	5% percentile		Average		95% percentile	
PV payments (A)	170,334		242,628		345,614	

The pension payment scheme are shown in the tables below. If we compare them to the pension payment schemes of the base analysis we can conclude the expected future pension payments are higher. The spread in pension payments has increased significantly!

Table 5.27

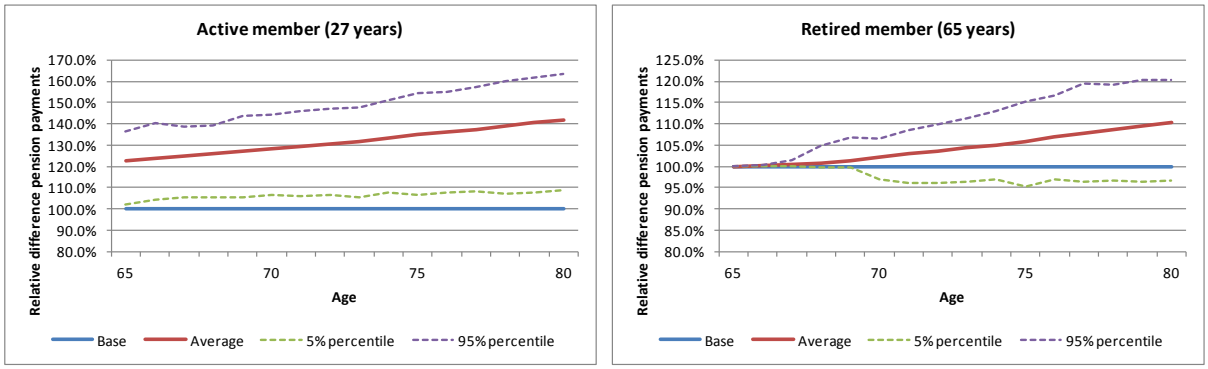
Active member (27 years)						
	Old age pension			Old age pension (expected values)		
Age	5% percentile	Average	95% percentile	5% percentile	Average	95% percentile
65	12,947	26,431	45,840	11,385	23,242	40,310
66	13,201	27,338	48,853	11,448	23,709	42,367
67	13,391	28,178	50,416	11,437	24,066	43,059
68	13,211	29,049	52,681	11,094	24,394	44,238
69	13,297	29,975	56,509	10,958	24,702	46,568
70	13,464	30,974	59,199	10,867	24,999	47,779
71	13,604	31,890	61,337	10,728	25,149	48,370
72	13,624	32,864	64,165	10,468	25,253	49,304
73	13,552	33,958	67,290	10,116	25,347	50,226
74	13,826	35,092	70,265	9,989	25,354	50,766
75	13,713	36,318	73,771	9,550	25,293	51,376
76	13,909	37,469	76,001	9,295	25,039	50,788
77	14,167	38,740	80,721	9,038	24,714	51,496
78	14,159	40,013	84,865	8,573	24,228	51,386
79	14,418	41,433	87,973	8,234	23,663	50,242
80	14,557	42,695	93,994	7,787	22,837	50,277

Table 5.28

Retired member (65 years)						
	Old age pension			Old age pension (expected values)		
Age	5% percentile	Average	95% percentile	5% percentile	Average	95% percentile
65	19,850	19,850	19,850	19,850	19,850	19,850
66	19,850	20,170	20,570	19,577	19,892	20,286
67	19,850	20,637	21,960	19,280	20,044	21,329
68	19,877	21,180	24,119	18,981	20,226	23,032
69	19,937	21,762	26,106	18,684	20,394	24,465
70	19,143	22,449	28,065	17,570	20,604	25,759
71	18,425	23,168	29,623	16,523	20,777	26,565
72	18,178	23,843	31,160	15,884	20,834	27,228
73	18,174	24,579	33,133	15,426	20,863	28,124
74	18,114	25,305	35,068	14,883	20,790	28,812
75	17,744	26,069	37,037	14,053	20,646	29,332
76	17,747	26,933	39,647	13,487	20,468	30,129
77	17,529	27,806	42,009	12,716	20,172	30,476
78	17,414	28,727	44,484	11,990	19,780	30,630
79	17,484	29,558	46,246	11,355	19,196	30,034
80	17,617	30,548	48,435	10,716	18,582	29,462

For the sake of completeness the relative difference in pension payments with respect to the current nominal contract in the base analysis (= base) are shown in the graph below.

Graph 5.9 Relative difference pension payments with current nominal contract in the base analysis



5.5.2 New nominal contract

Transition to the new nominal contract will lead to short term lower pension results and on the long term for higher pension results. The spread in pension result is smaller than in the current nominal contract. The present value of the future expected pension payments is slightly lower for the active member and slightly higher for the retired member.

Table 5.29

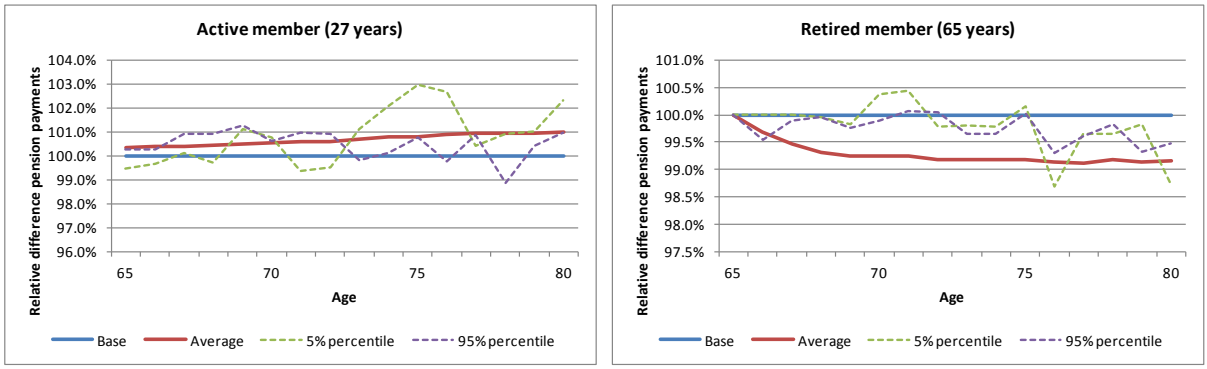
Active member (27 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	-0.1%	0.0%	-0.2%	0.0%	-1.5%	0.0%
Deferred period	-0.1%	0.0%	-0.2%	0.0%	-1.5%	0.0%
Retired period	0.5%	0.0%	1.4%	0.0%	1.9%	0.0%
Retired period first 15Y	0.7%	0.0%	0.7%	0.0%	0.5%	0.0%
Total period	0.2%	0.0%	1.9%	0.0%	1.2%	0.0%
First 5Y	-0.5%	0.0%	-0.7%	0.0%	-0.3%	0.0%
First 10Y	-0.3%	0.0%	-0.8%	0.0%	-0.1%	0.0%
Firtst 15Y	-0.7%	0.0%	-0.9%	0.0%	-1.1%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	75		325		920	
PV premiums (B)	-		-		-	
Factor (A/B)	0.4%		1.8%		3.8%	

Table 5.30

Retired member (65 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	0.2%	0.0%	1.9%	0.0%	1.2%	0.0%
Retired period first 15Y	-0.7%	0.0%	-0.9%	0.0%	-1.1%	0.0%
Total period	0.2%	0.0%	1.9%	0.0%	1.2%	0.0%
First 5Y	-0.5%	0.0%	-0.7%	0.0%	-0.3%	0.0%
First 10Y	-0.3%	0.0%	-0.8%	0.0%	-0.1%	0.0%
Firtst 15Y	-0.7%	0.0%	-0.9%	0.0%	-1.1%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-1,023		-1,624		-2,677	

The relative difference in pension payments as shown in the graph below show higher expected pension payments for the active member and lower pension payments for the retiree.

Graph 5.10 Relative difference pension payments with current nominal contract



5.5.3 New real contract – Base

In this analysis the active member won't be pleased either when the contracts changes from current nominal to new real. The pension result for the active member decreases. However, the spread between the 5% and 95% percentile has decreased as well. The situation of the retired member will slightly improve.

Table 5.31

Active member (27 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	-2.4%	0.0%	-4.2%	0.0%	-8.4%	0.0%
Deferred period	-2.4%	0.0%	-4.2%	0.0%	-8.4%	0.0%
Retired period	-5.8%	0.0%	-11.7%	0.0%	-24.3%	0.0%
Retired period first 15Y	-6.0%	0.0%	-5.7%	0.0%	-14.5%	0.0%
Total period	-1.4%	0.0%	-26.5%	0.0%	-93.4%	0.0%
First 5Y	5.7%	0.0%	0.2%	0.0%	-12.0%	0.0%
First 10Y	5.2%	0.0%	-0.3%	0.0%	-10.3%	0.0%
Firtst 15Y	3.1%	0.0%	0.2%	0.0%	-7.8%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-1,230		-2,825		-6,488	
PV premiums (B)	1,097		1,199		1,247	
Factor (A/B)	-14.3%		-28.7%		-60.1%	

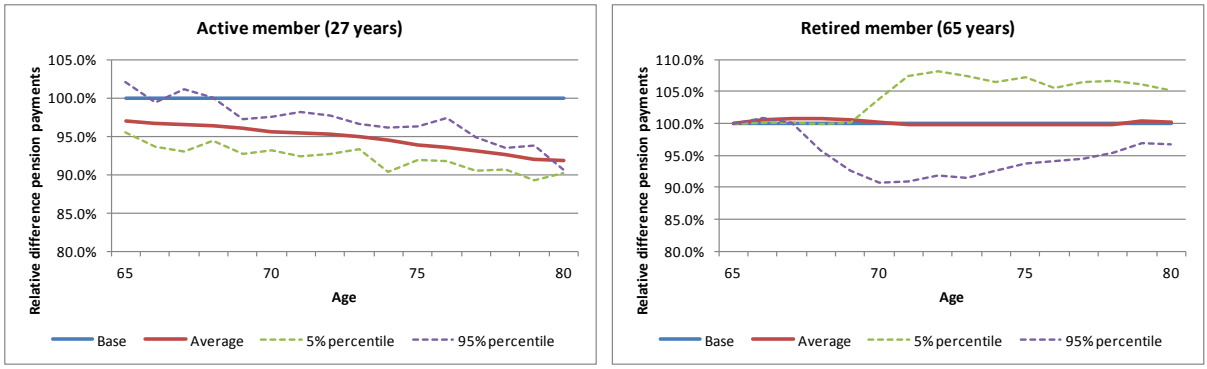
Table 5.32

Retired member (65 years) - Absolute differences with current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	-1.4%	0.0%	-26.5%	0.0%	-93.4%	0.0%
Retired period first 15Y	3.1%	0.0%	0.2%	0.0%	-7.8%	0.0%
Total period	-1.4%	0.0%	-26.5%	0.0%	-93.4%	0.0%
First 5Y	5.7%	0.0%	0.2%	0.0%	-12.0%	0.0%
First 10Y	5.2%	0.0%	-0.3%	0.0%	-10.3%	0.0%
Firtst 15Y	3.1%	0.0%	0.2%	0.0%	-7.8%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	6,135		-174		-13,728	

The pension payments of the active member are expected to be lower than in the current nominal contract. Also the 5% and 95% percentile are lower in the new nominal contract for the active member.

The average expected pension payment for the retired member are slightly higher in the new real contract.

Graph 5.11 Relative difference pension payments with current nominal contract



5.6 Alternative analysis new real contract

In the previous paragraphs we've analyzed the current nominal, new nominal and new real contract. In all the paragraphs the standard new real contract was analyzed: a processing period of the AFS of ten years; an 'open' AFS method and no equalization reserve. In this paragraph we will analyze the effects of a different processing period, a 'closed' AFS and an equalization reserve. All the effects are with respect to the base analysis of the new real contract.

5.6.1 Base analysis

In paragraph 5.2.3 we've analyzed the new real contract in the base analysis. The results however were relative to the current nominal contract in the base analysis. Therefore this (sub)paragraph will show the results of the new real contract on itself. The following (sub)paragraphs will be relative to these results.

The pension results are shown in Table 5.33 and Table 5.34 and the pension payment schemes are shown in Table 5.35 and Table 5.36.

Table 5.33

Active member (27 years)						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	39.2%	34.0%	102.3%	41.9%	201.4%	49.7%
Deferred period	39.2%	34.0%	102.3%	41.9%	201.4%	49.7%
Retired period	36.5%	39.6%	86.2%	48.2%	161.4%	56.2%
Retired period first 15Y	54.3%	62.1%	93.2%	71.0%	141.0%	79.1%
Total period	22.5%	15.4%	90.8%	20.2%	231.9%	25.5%
First 5Y	90.7%	83.4%	99.8%	89.1%	110.2%	93.8%
First 10Y	76.8%	71.1%	99.7%	79.4%	127.5%	86.1%
Firtst 15Y	65.6%	61.7%	100.5%	70.8%	145.5%	78.4%
Other	5% percentile		Average		95% percentile	
PV payments (A)	15,201		29,279		51,558	
PV premiums (B)	17,480		19,590		22,123	
Factor (A/B)	76.7%		149.9%		262.7%	

Table 5.34

Retired member (65 years)						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	22.5%	15.4%	90.8%	20.2%	231.9%	25.5%
Retired period first 15Y	65.6%	61.7%	100.5%	70.8%	145.5%	78.4%
Total period	22.5%	15.4%	90.8%	20.2%	231.9%	25.5%
First 5Y	90.7%	83.4%	99.8%	89.1%	110.2%	93.8%
First 10Y	76.8%	71.1%	99.7%	79.4%	127.5%	86.1%
Firtst 15Y	65.6%	61.7%	100.5%	70.8%	145.5%	78.4%
Other	5% percentile		Average		95% percentile	
PV payments (A)	176,843		225,863		286,993	

Table 5.35

Active member (27 years)						
	Old age pension			Old age pension (expected values)		
Age	5% percentile	Average	95% percentile	5% percentile	Average	95% percentile
65	11,963	20,802	33,398	10,520	18,293	29,369
66	12,033	21,239	34,746	10,436	18,420	30,133
67	12,119	21,668	35,600	10,351	18,506	30,405
68	11,974	22,080	36,493	10,055	18,541	30,644
69	11,931	22,498	37,987	9,832	18,540	31,304
70	11,960	22,919	39,148	9,653	18,498	31,597
71	12,005	23,339	40,343	9,467	18,405	31,815
72	11,965	23,778	41,302	9,194	18,271	31,736
73	11,875	24,234	42,655	8,864	18,089	31,838
74	11,836	24,698	44,056	8,551	17,844	31,830
75	12,076	25,156	45,747	8,410	17,519	31,859
76	12,040	25,606	46,885	8,046	17,112	31,331
77	12,134	26,087	48,199	7,741	16,642	30,748
78	12,019	26,578	49,098	7,278	16,093	29,729
79	12,040	27,070	50,287	6,876	15,460	28,719
80	12,202	27,602	52,176	6,527	14,764	27,909

Table 5.36

Retired member (65 years)						
	Old age pension			Old age pension (expected values)		
Age	5% percentile	Average	95% percentile	5% percentile	Average	95% percentile
65	19,850	19,850	19,850	19,850	19,850	19,850
66	19,907	20,276	20,719	19,633	19,997	20,434
67	19,898	20,753	21,797	19,326	20,156	21,170
68	19,967	21,235	22,860	19,067	20,278	21,830
69	20,075	21,731	23,711	18,813	20,365	22,220
70	20,072	22,251	24,833	18,423	20,423	22,792
71	20,028	22,778	25,986	17,960	20,427	23,304
72	19,905	23,301	27,208	17,393	20,360	23,774
73	19,791	23,837	28,224	16,799	20,233	23,957
74	19,616	24,378	29,895	16,117	20,029	24,562
75	19,403	24,935	31,388	15,367	19,748	24,858
76	19,153	25,523	33,175	14,555	19,396	25,211
77	19,095	26,144	34,918	13,853	18,966	25,332
78	18,999	26,807	36,876	13,082	18,458	25,392
79	18,944	27,462	38,428	12,303	17,835	24,957
80	18,940	28,138	39,800	11,521	17,116	24,210

5.6.2 AFS processing period

In paragraph 5.2.3 we've analyzed the new real contract with an AFS processing period of ten years. This is the maximum possible processing period. In this paragraph we will set the processing period at the minimum of three years. The results are shown in the tables below.

Table 5.37

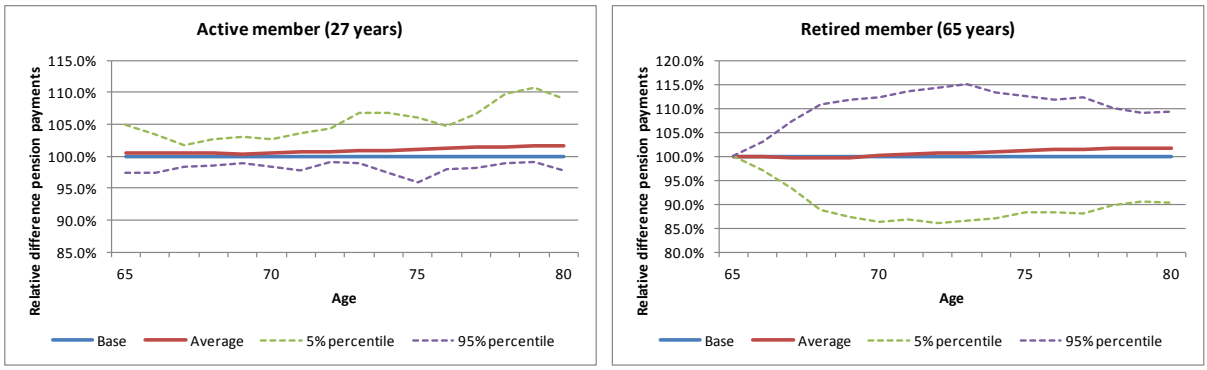
Active member (27 years) - Absolute differences with the new real contract in the base analysis						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	1.3%	0.0%	0.8%	0.0%	0.8%	0.0%
Deferred period	1.3%	0.0%	0.8%	0.0%	0.8%	0.0%
Retired period	3.0%	0.0%	2.7%	0.0%	-0.3%	0.0%
Retired period first 15Y	1.0%	0.0%	2.4%	0.0%	8.4%	0.0%
Total period	2.2%	0.0%	1.9%	0.0%	2.6%	0.0%
First 5Y	-13.6%	0.0%	0.2%	0.0%	16.7%	0.0%
First 10Y	-10.2%	0.0%	1.5%	0.0%	18.6%	0.0%
Firtst 15Y	-7.2%	0.0%	2.0%	0.0%	17.0%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	774		317		-2,395	
PV premiums (B)	-		-		-	
Factor (A/B)	4.2%		1.5%		-10.2%	

Table 5.38

Retired member (65 years) - Absolute differences with the new real contract in the base analysis						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	2.2%	0.0%	1.9%	0.0%	2.6%	0.0%
Retired period first 15Y	-7.2%	0.0%	2.0%	0.0%	17.0%	0.0%
Total period	2.2%	0.0%	1.9%	0.0%	2.6%	0.0%
First 5Y	-13.6%	0.0%	0.2%	0.0%	16.7%	0.0%
First 10Y	-10.2%	0.0%	1.5%	0.0%	18.6%	0.0%
Firtst 15Y	-7.2%	0.0%	2.0%	0.0%	17.0%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-11,694		2,409		20,485	

As expected we see a huge widening of the spread of the pension results on the short term in comparison with the base run of the new real contract. An AFS processing period of three years instead of ten leads to a higher average pension result for both the active member as well for the retiree. Compared to the current nominal contract in the base analysis we conclude a widening of the spread of the pension results and a higher average pension result.

Graph 5.12 Relative difference pension payments with new real contract in the base analysis



The expected pension payments for the active member are on average a bit higher in case of a processing period of three years instead of ten years. However, the spread in the pension payments of the active member is smaller. The pension payments of the retiree are on average also higher. In contrast to the active member the spread in pension result for the retiree has widened significantly.

5.6.3 Open AFS versus closed AFS

As mentioned in paragraph 4.2.3 the 'open' AFS will be the standard method. In the previous paragraphs the 'open' AFS method was used. Now we will look at the effects of a 'closed' AFS instead of an 'open' AFS.

The average pension result is quite the same but the spread of the pension results has widened. The pension result of the active member during its active working period has increased a little whereas the pension result during its retirement period has decreased.

The widening of the spread can be explained by the artificially adjustments made on the new accrual of pension rights with corresponding 'premium results' to be processed by the AFS[24].

Table 5.39

Active member (27 years) - Absolute differences with the new real contract in the base analysis						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	-4.1%	0.0%	0.2%	0.0%	9.1%	0.0%
Deferred period	-4.1%	0.0%	0.2%	0.0%	9.1%	0.0%
Retired period	-5.8%	0.0%	-1.7%	0.0%	6.5%	0.0%
Retired period first 15Y	-3.9%	0.0%	-1.0%	0.0%	4.5%	0.0%
Total period	-4.2%	0.0%	-0.7%	0.0%	16.5%	0.0%
First 5Y	-0.2%	0.0%	0.0%	0.0%	0.3%	0.0%
First 10Y	-0.9%	0.0%	0.0%	0.0%	1.0%	0.0%
Firtst 15Y	-2.0%	0.0%	0.0%	0.0%	2.6%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-194		-160		-952	
PV premiums (B)	-		-		-	
Factor (A/B)	0.8%		-0.9%		0.4%	

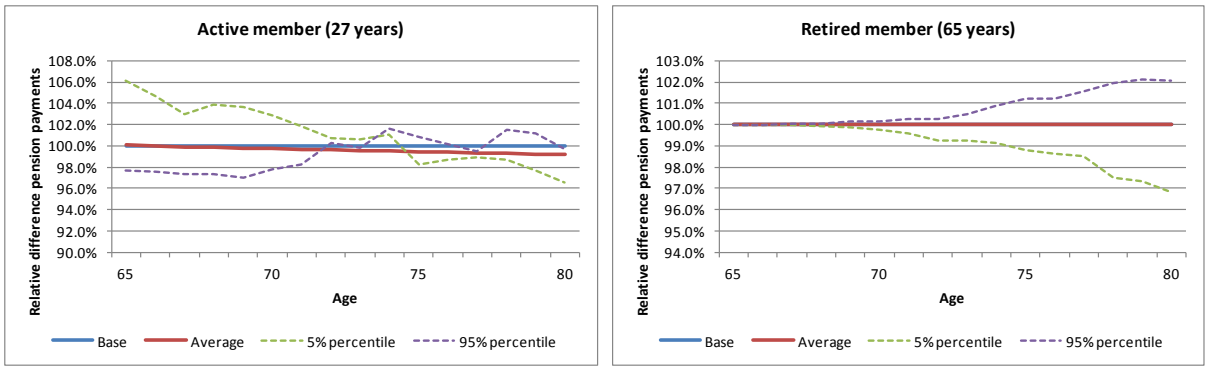
Table 5.40

Retired member (65 years) - Absolute differences with the new real contract in the base analysis						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	-4.2%	0.0%	-0.7%	0.0%	16.5%	0.0%
Retired period first 15Y	-2.0%	0.0%	0.0%	0.0%	2.6%	0.0%
Total period	-4.2%	0.0%	-0.7%	0.0%	16.5%	0.0%
First 5Y	-0.2%	0.0%	0.0%	0.0%	0.3%	0.0%
First 10Y	-0.9%	0.0%	0.0%	0.0%	1.0%	0.0%
Firtst 15Y	-2.0%	0.0%	0.0%	0.0%	2.6%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-2,679		15		4,836	

[24] See for an explanation Appendix B – The AFS mechanism

The extra adjustments for the AFS causes the spread in payments to increase, especially for the retired member. The average pension payment is unchanged for the retiree and lightly decreased for the active member.

Graph 5.13 Relative difference pension payments with new real contract in the base analysis



5.6.4 Equalization reserve

The proposed new financial assessment framework gives pension funds the possibility to form an equalization reserve. The purpose of this equalization reserve is to dampen financial shocks before they enter the AFS. The consultation paper is not clear on the exact form and on the conditions thereof.

For illustration purposes we have analyzed the situation of an equalization reserve which is 5% of the liabilities at maximum. Fifty percent of a positive result will be put into the equalization reserve till it has reached its limit. In case a negative result occurs the full equalization reserve if necessary will be used to offset this negative result. Any remainders will be processed by the AFS.

Table 5.41

Active member (27 years) - Absolute differences with the new real contract in the base analysis						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	-0.2%	0.0%	-0.4%	0.0%	-0.6%	0.0%
Deferred period	-0.2%	0.0%	-0.4%	0.0%	-0.6%	0.0%
Retired period	-0.1%	0.0%	1.6%	0.0%	4.5%	0.0%
Retired period first 15Y	0.8%	0.0%	0.9%	0.0%	2.5%	0.0%
Total period	-0.2%	0.0%	1.7%	0.0%	7.7%	0.0%
First 5Y	-0.2%	0.0%	-0.9%	0.0%	-1.8%	0.0%
First 10Y	-0.9%	0.0%	-1.9%	0.0%	-3.5%	0.0%
Firtst 15Y	-1.1%	0.0%	-2.0%	0.0%	-3.9%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	25		406		977	
PV premiums (B)	-		-		-	
Factor (A/B)	0.6%		2.1%		7.4%	

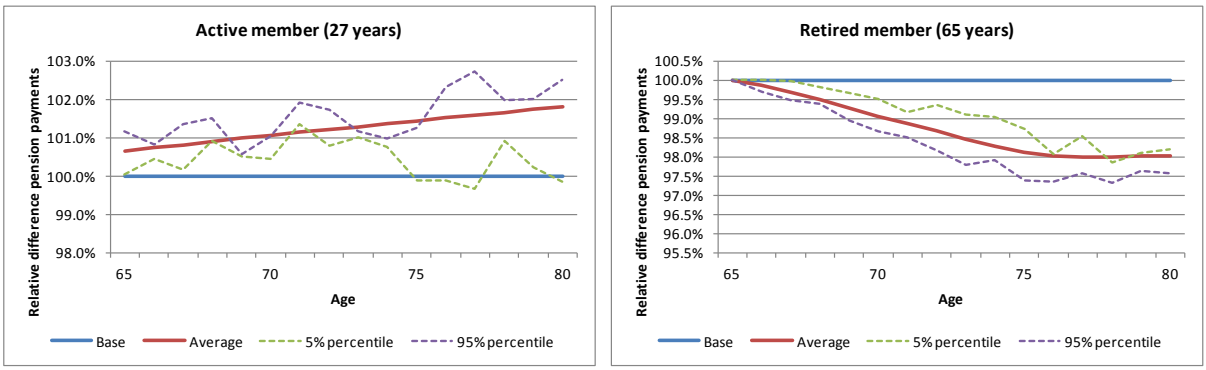
Table 5.42

Retired member (65 years) - Absolute differences with the new real contract in the base analysis						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period	-0.2%	0.0%	1.7%	0.0%	7.7%	0.0%
Retired period first 15Y	-1.1%	0.0%	-2.0%	0.0%	-3.9%	0.0%
Total period	-0.2%	0.0%	1.7%	0.0%	7.7%	0.0%
First 5Y	-0.2%	0.0%	-0.9%	0.0%	-1.8%	0.0%
First 10Y	-0.9%	0.0%	-1.9%	0.0%	-3.5%	0.0%
Firtst 15Y	-1.1%	0.0%	-2.0%	0.0%	-3.9%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-1,435		-3,085		-5,022	

Since the equalization reserve has yet to be formed some parts of future positive results will end up in the equalization reserve instead of the AFS. This is the reason why the pension results on the short term are a bit lower than in the situation no equalization reserve is formed.

The formation of an equalization reserve will lead to a smaller spread in pension results on the short term although the effects in this analysis are small.

Graph 5.14 Relative difference pension payments with new real contract in the base analysis



The relative differences in pension payments as shown in the graph above show a slight improvement with respect to the base run for the new real contract for the active member and a downturn for the retired member.

6 Results deterministic analysis

In the previous chapter we discussed the results of the stochastic analysis. This stochastic analysis gives insight in the spread and expected pension payments. However, the stochastic analysis does not show what really happens in a specific scenario. Therefore we will drill down and analyze the results of some single deterministic scenarios. We assume the same starting position as the stochastic base analysis in paragraph 5.2. The assumed asset returns per simulation are as follows:

- Simulation 1: fixed 1%
- Simulation 2: fixed 3%
- Simulation 3: fixed 5%

Finally we will investigate two more deterministic scenarios. The reason for this is the fact we are at the transition moment of switching contracts and therefore we want to know how a really bad or really good scenario on the short term will work out.

- Simulation 4: first year -30% and after that 5% per year
- Simulation 5: first year +30% and after that 5% per year

As in the stochastic analysis we will analyze the effects on the same two model points: a 27 year old active member and a 65 year old pensioner.

6.1 Results simulation 1

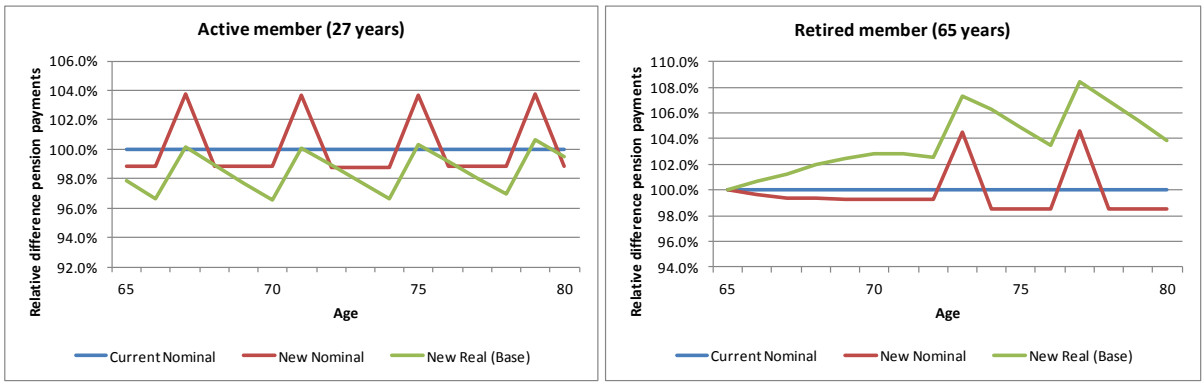
In the first deterministic scenario we analyze a scenario in which continually negative results occur. In Table 6.1 we see the pension payment schemes of the two model points. Since we analyze the new real contract as well we must also take the premiums into account. Therefore the table also shows the present value of the future expected pension payments and the present value of the future expected premiums.

Table 6.1

	Current Nominal		New Nominal		New Real (Base)	
	Active (27)	Retired (65)	Active (27)	Retired (65)	Active (27)	Retired (65)
PV payments (A)	11,120	151,634	11,119	151,433	11,038	158,293
PV premiums (B)	18,961		18,961		20,331	
Factor (A/B)	58.64%		58.64%		54.29%	
Age						
65	9,313	19,850	9,203	19,850	9,115	19,850
66	9,313	20,036	9,203	19,962	8,998	20,164
67	8,867	20,169	9,203	20,041	8,883	20,421
68	8,867	20,223	8,762	20,089	8,772	20,618
69	8,867	20,250	8,762	20,106	8,664	20,752
70	8,867	20,250	8,762	20,106	8,560	20,822
71	8,448	20,250	8,762	20,106	8,458	20,828
72	8,448	20,250	8,347	20,106	8,359	20,768
73	8,448	19,244	8,347	20,106	8,261	20,644
74	8,448	19,244	8,347	18,953	8,166	20,447
75	8,049	19,244	8,347	18,953	8,073	20,179
76	8,049	19,244	7,955	18,953	7,982	19,918
77	8,049	18,118	7,955	18,953	7,893	19,651
78	8,049	18,118	7,955	17,856	7,805	19,381
79	7,669	18,118	7,955	17,856	7,718	19,101
80	7,669	18,118	7,580	17,856	7,634	18,816

The results show that in case of a bad scenario transition to the new nominal contract will not benefit the active member and the retired member. Transition to the new real contract however will benefit the retired member but the active member will get lower expected pension payments while he must pay higher premiums.

Graph 6.1 Relative difference pension payments with current nominal contract

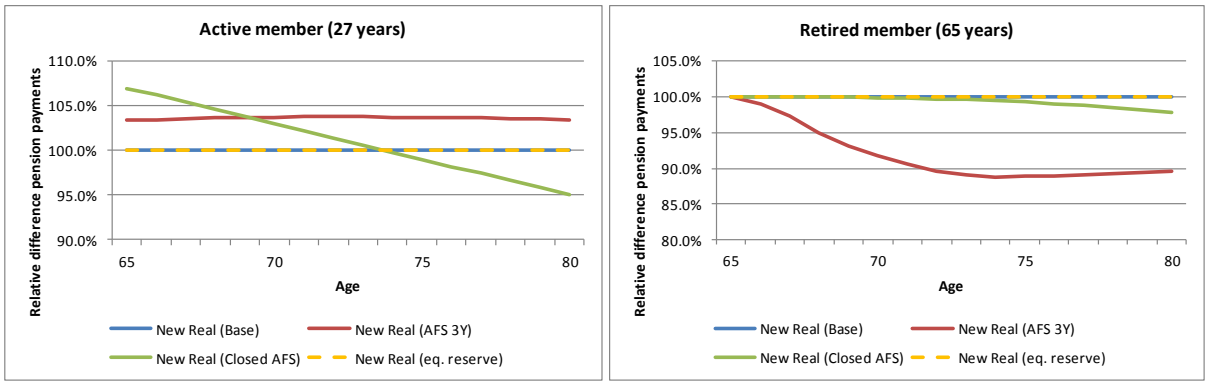


The relative difference in pension payments in the graph above show that the pension payments in the new nominal contract will sometimes be higher and sometimes be lower than the pension payments in

the current nominal contract. No specific preference can be made by either the active member or the retired member. The new real contract however is in favor with the retiree and unfavorable to the active member.

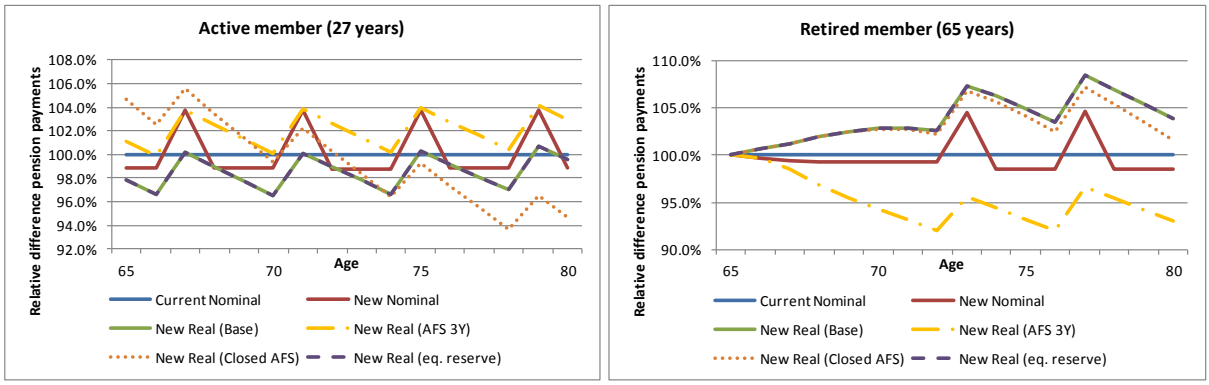
In the graph below the results are shown for different settings of the new real contract. These are the same settings of the new real contract as in the stochastic analysis. Applying an AFS processing period of three years instead of ten lead to a significant downfall in pension payments for the pensioner. The active member will profit from this policy change. Changing the policy from an 'open' AFS to a 'closed' AFS leads to no significant effects for the pensioner. The active member will have an higher expected pension payment at retirement age, but eventually he will end up with lower expected pension payments. Forming an equalization reserve does not have effect in this simulation since there are no positive results to build up the reserve.

Graph 6.2 Relative difference pension payments with new real contract base analysis



Finally, the relative differences of the pension payments with respect to the current nominal contract are shown in the graph below.

Graph 6.3 Relative difference pension payments with current nominal contract



In this specific simulation there is no situation in which the active member and the retired member will profit from the policy change.

6.2 Results simulation 2

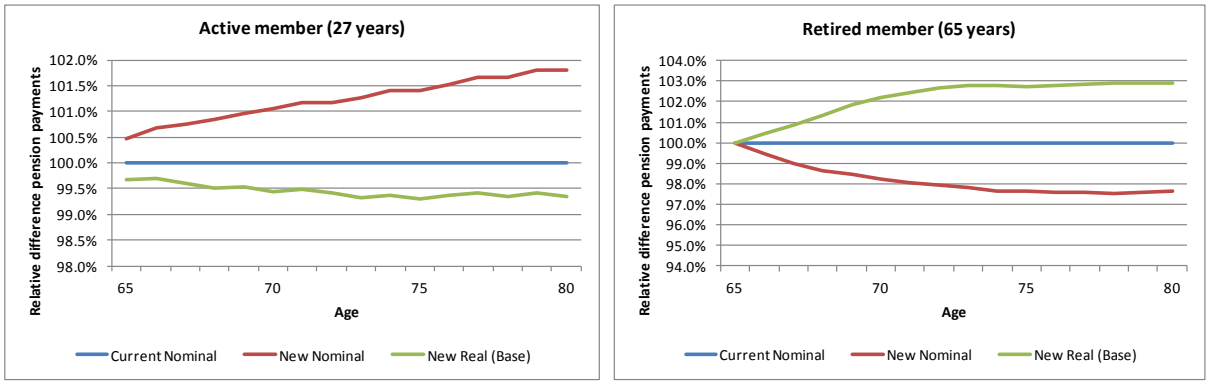
In the second simulation we simulate an asset return equal to the interest rate. This will lead to a positive result in case the funding ratio is higher than 100% and a negative result in case the funding ratio is lower than 100%.

Transition to the new nominal contract will profit the active member a little whereas the retired member will lose. The retired member will however benefit from a transition to the new real contract. This transition will on the other hand hurt the active member.

Table 6.2

	Current Nominal		New Nominal		New Real (Base)	
	Active (27)	Retired (65)	Active (27)	Retired (65)	Active (27)	Retired (65)
PV payments (A)	20,089	177,384	20,376	174,154	20,046	181,735
PV premiums (B)	18,961		18,961		20,331	
Factor (A/B)	105.95%		107.46%		98.60%	
Age						
65	13,925	19,850	13,989	19,850	13,879	19,850
66	14,018	20,115	14,112	20,009	13,976	20,203
67	14,130	20,356	14,236	20,153	14,074	20,537
68	14,243	20,574	14,362	20,298	14,172	20,851
69	14,338	20,766	14,477	20,444	14,272	21,145
70	14,452	20,959	14,604	20,592	14,373	21,416
71	14,549	21,155	14,721	20,740	14,476	21,664
72	14,665	21,324	14,839	20,889	14,579	21,890
73	14,783	21,495	14,969	21,023	14,683	22,091
74	14,881	21,667	15,089	21,158	14,789	22,266
75	15,000	21,811	15,210	21,293	14,896	22,413
76	15,100	21,957	15,331	21,429	15,004	22,574
77	15,201	22,103	15,454	21,566	15,113	22,733
78	15,322	22,250	15,578	21,704	15,223	22,892
79	15,425	22,399	15,702	21,861	15,334	23,047
80	15,548	22,548	15,828	22,018	15,447	23,201

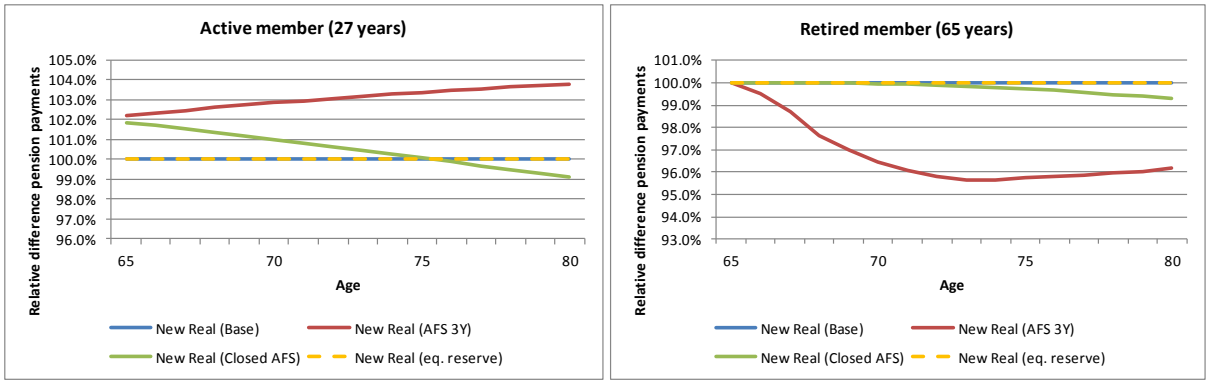
Graph 6.4 Relative difference pension payments with current nominal contract



The different settings of the new real contract have similar results as in simulation 1. The active member will benefit much in case of an AFS processing period of three years instead of ten while the retired member will lose much. The 'closed' AFS variant causes the expected payments of the active member to start at a higher point but in time they will drop below the values of the base analysis. The

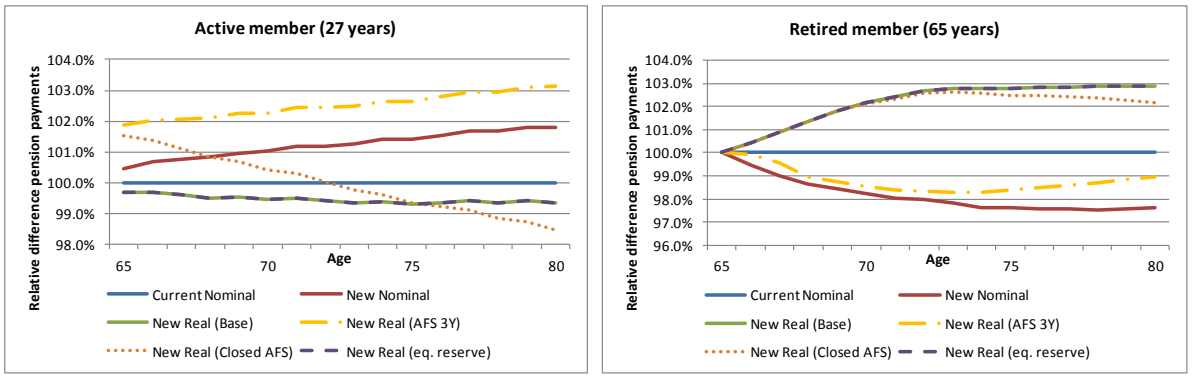
pension payments of the pensioner will slightly decrease. Finally, the equalization reserve will not be formed in this analysis since there are no positive results.

Graph 6.5 Relative difference pension payments with new real contract base analysis



As in the previous paragraph we will also show the relative differences in pension payments of all the analyzed new contracts with respect to the current nominal contract. See the graph below for the results.

Graph 6.6 Relative difference pension payments with current nominal contract



Again, there's no specific contract which stands out. Probably the new real contract with a closed AFS system is preferable.

6.3 Results simulation 3

Simulation 3 analyzes the economy in which the annual asset return will be constant 5%. In this simulation positive results occur (and a formation of a equalization reserve if applicable).

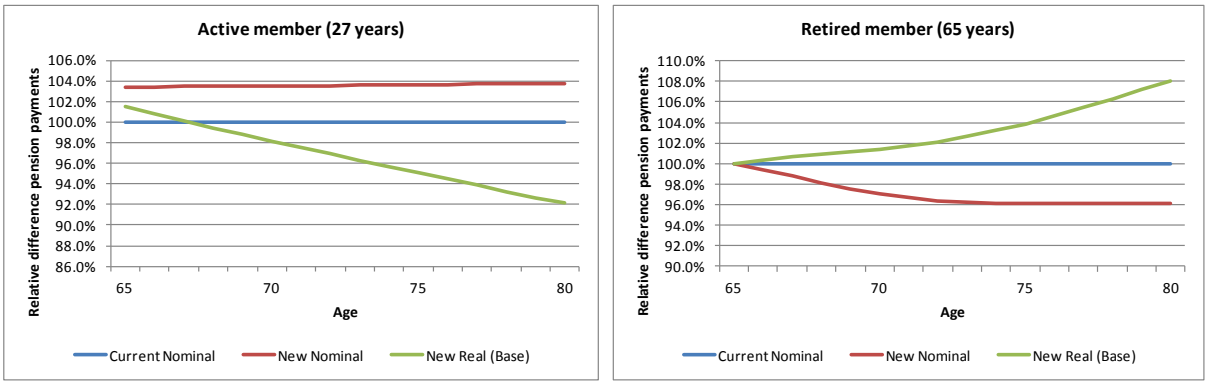
Again does a transition to the new nominal contract no good to the pensioner. The active member profits in this situation. The new real contract will be in favor to the pensioner since he will get much higher expected pension payments. The active member will lose out a lot in comparison to the current and new nominal contract. And in the meantime the contributions for the active member will be quite higher. The reason for this is that all the pension assets above a funding ratio of 145% will be used for indexation. In this simulation this funding ratio limit will be reached in time which means lesser indexation on the short term and much more indexation on the long term compared to the new real

contract. For active members it is favorable to have higher indexations on the long run when the accrued pension rights are material.

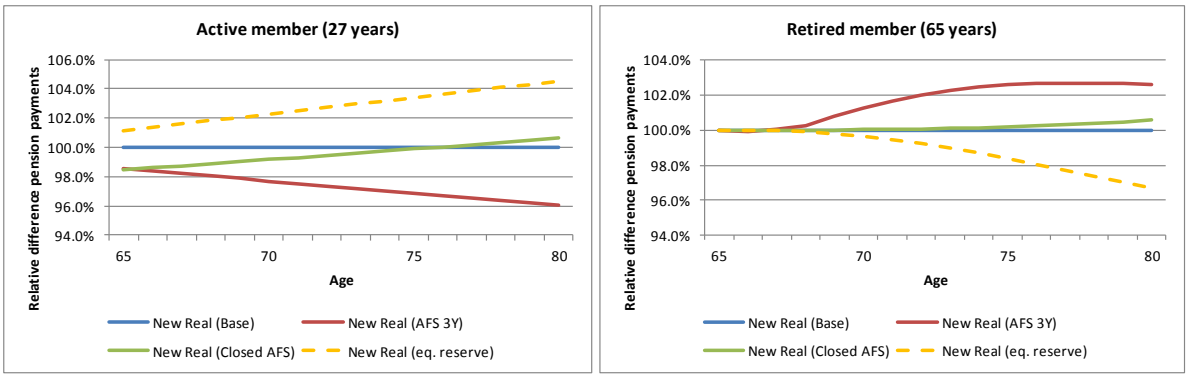
Table 6.3

	Current Nominal		New Nominal		New Real (Base)	
	Active (27)	Retired (65)	Active (27)	Retired (65)	Active (27)	Retired (65)
PV payments (A)	45,383	201,336	47,076	196,422	42,567	42,567
PV premiums (B)	18,961		18,961		20,331	
Factor (A/B)	239.35%		248.28%		209.37%	
Age						
65	22,690	19,850	23,466	19,850	23,031	19,850
66	23,553	20,168	24,362	20,041	23,747	20,241
67	24,461	20,518	25,305	20,265	24,486	20,654
68	25,395	20,901	26,276	20,509	25,247	21,091
69	26,356	21,319	27,276	20,787	26,032	21,553
70	27,343	21,745	28,303	21,103	26,839	22,042
71	28,355	22,180	29,357	21,441	27,670	22,559
72	29,428	22,623	30,475	21,801	28,527	23,105
73	30,545	23,076	31,639	22,202	29,409	23,682
74	31,692	23,537	32,836	22,629	30,317	24,294
75	32,870	24,008	34,065	23,081	31,251	24,941
76	34,078	24,488	35,327	23,543	32,212	25,631
77	35,367	24,978	36,674	24,014	33,202	26,346
78	36,693	25,478	38,060	24,494	34,221	27,087
79	38,057	25,987	39,486	24,984	35,269	27,855
80	39,459	26,507	40,954	25,484	36,347	28,653

Graph 6.7 Relative difference pension payments with current nominal contract



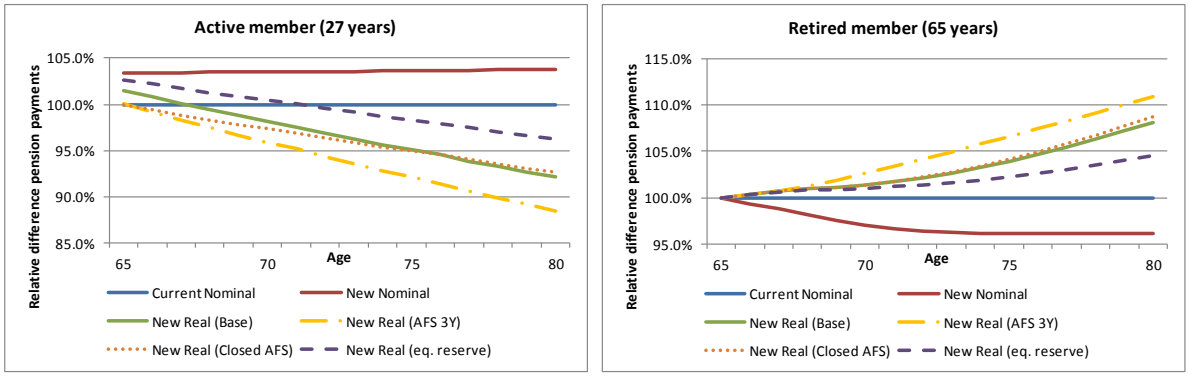
Graph 6.8 Relative difference pension payments with new real contract base analysis



In simulation 1 and 2 an AFS processing period of three years instead of ten led to a profit for the active member and a loss for the pensioner. However, in this simulation we see the contrary happen. The ‘closed’ AFS will benefit the pensioner. The active member will start at retirement age with a lower pension payment. Eventually the expected pension payment exceeds the expected pension payment in the base analysis. The formation of an equalization reserve will lead to lower expected pension payment for the retiree and to higher expected pension payments for the active member.

In the graph below the relative differences in pension payments with respect to the current nominal contract are shown. The formation of an equalization reserve will reduce the differences between the active and the retired member. A closed AFS or a processing period of three years will only increase the differences between the active and retired member.

Graph 6.9 Relative difference pension payments with current nominal contract



6.4 Results simulation 4

Simulation 4 is a simulation of a extreme bad scenario the coming year of -30% asset return. How the different contracts deal with the deficit is shown in the table below.

Because of the extreme bad scenario of -30% the funding ratio drops way below the 100% and causes a situation of underfunding. The funding ratio will not be restored in time and therefore the pension rights will be reduced in the current and new nominal contract. From that point on slowly the pensions will be compensated again for price inflation.

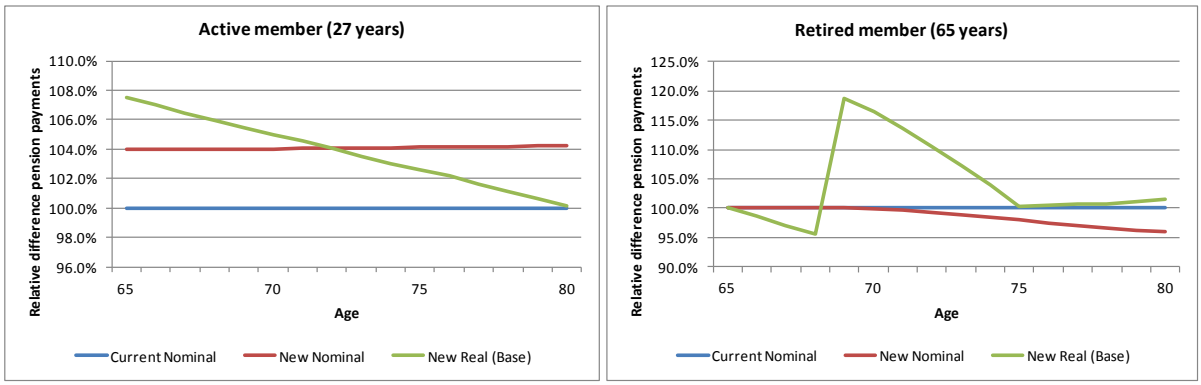
Transition to the new nominal contract is favorable to the active member and unfavorable to the retired member. The ability to compensate the pension rights is lower in the new nominal contract. Therefore more buffers will build up for future generations and hence the current active member profits.

The new real contract results in a slightly better pension payment scheme for the retired member. The active member will gain as well although the increase in pension payments in the nominal contracts is higher.

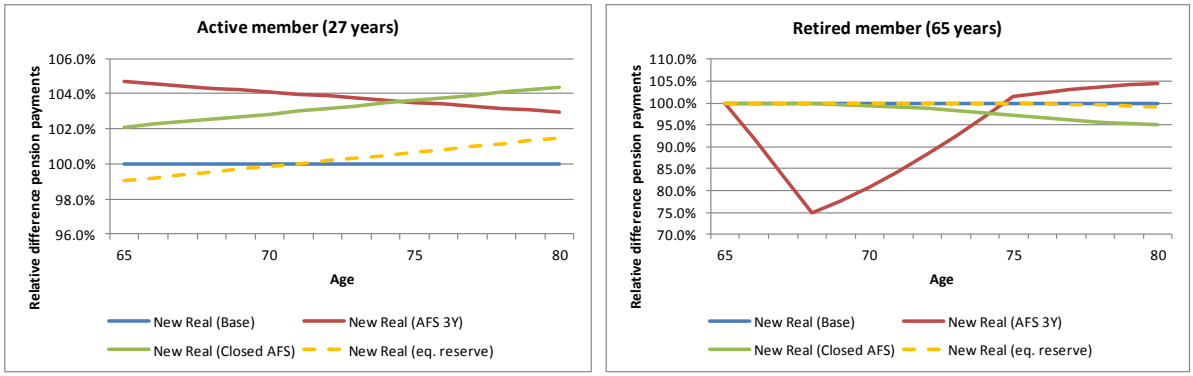
Table 6.4

	Current Nominal		New Nominal		New Real (Base)	
	Active (27)	Retired (65)	Active (27)	Retired (65)	Active (27)	Retired (65)
PV payments (A)	35,424	150,296	36,899	147,448	35,898	157,979
PV premiums (B)	18,961		18,961		20,331	
Factor (A/B)	186.82%		194.60%		176.57%	
Age						
65	18,265	19,850	18,989	19,850	19,634	19,850
66	18,901	19,850	19,652	19,850	20,224	19,568
67	19,571	19,850	20,350	19,850	20,832	19,274
68	20,259	19,850	21,067	19,850	21,458	18,970
69	20,963	15,702	21,803	15,702	22,102	18,653
70	21,685	15,744	22,556	15,727	22,765	18,327
71	22,423	15,849	23,328	15,790	23,447	17,997
72	23,209	15,997	24,150	15,879	24,149	17,668
73	24,026	16,168	25,004	15,993	24,873	17,344
74	24,864	16,383	25,881	16,134	25,618	17,019
75	25,723	16,645	26,782	16,315	26,385	16,700
76	26,603	16,934	27,704	16,510	27,175	17,009
77	27,545	17,250	28,693	16,735	27,988	17,354
78	28,514	17,595	29,710	16,989	28,825	17,733
79	29,510	17,947	30,756	17,261	29,687	18,147
80	30,533	18,306	31,831	17,565	30,574	18,593

Graph 6.10 Relative difference pension payments with current nominal contract



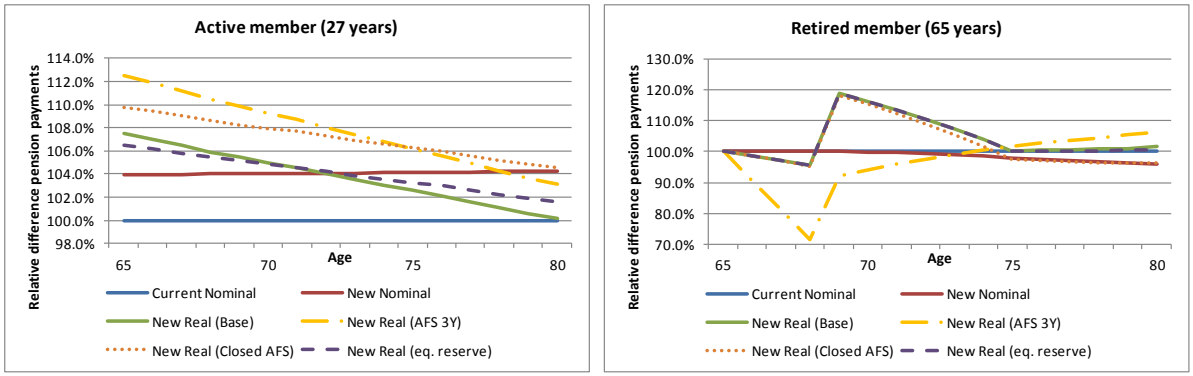
Graph 6.11 Relative difference pension payments with new real contract base analysis



A negative financial shock the first year will have its effect if the AFS processing period is three years instead of ten. The pensioner must take a few high negative indexations for granted. The pension payment on the other hand will increase with a higher speed than in the base analysis and on the long

term the pension payment will be higher than the pension payment in the base analysis. The active member will gain in the situation of a AFS processing period of three years. The 'closed' AFS will benefit the active member but will hurt the retired member. The formation of an equalization reserve will have not much effect on the future expected pension payments.

Graph 6.12 Relative difference pension payments with current nominal contract



Finally the relative differences in pension payments with respect to the current nominal contract are shown in the table above. We can see that in this particular simulation of a worse case scenario all alternatives will profit the active member. The retiree has no choice than to deal with the negative result the first year. However, the pension payments will eventually be higher than in the current nominal contract.

6.5 Results simulation 5

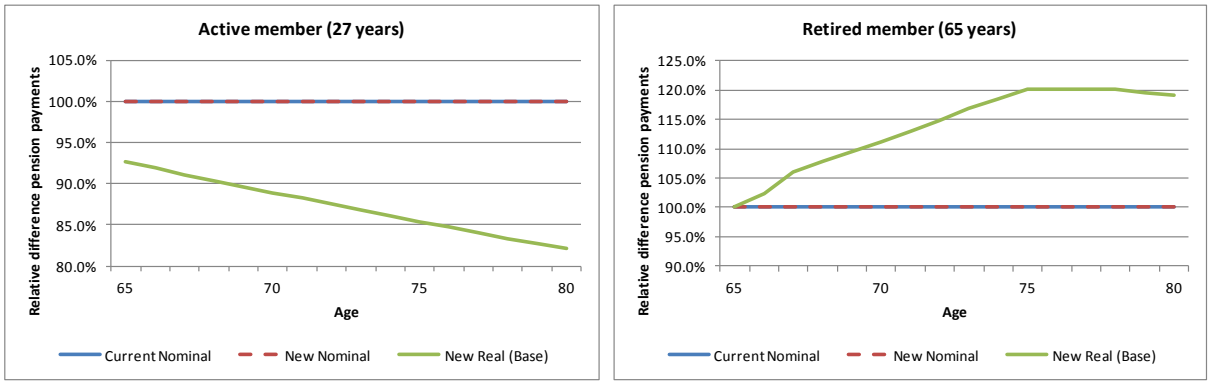
Finally we will analyze the situation of an extreme good scenario the first year. The results are shown in the tables below.

Table 6.5

	Current Nominal		New Nominal		New Real (Base)	
	Active (27)	Retired (65)	Active (27)	Retired (65)	Active (27)	Retired (65)
PV payments (A)	56,093	224,699	56,093	224,699	47,095	254,443
PV premiums (B)	18,961		18,961		20,331	
Factor (A/B)	295.83%		295.83%		231.64%	
Age						
65	27,334	19,850	27,334	19,850	25,318	19,850
66	28,434	20,247	28,434	20,247	26,120	20,722
67	29,593	20,415	29,593	20,415	26,949	21,642
68	30,790	20,962	30,790	20,962	27,804	22,610
69	32,026	21,593	32,026	21,593	28,685	23,633
70	33,299	22,232	33,299	22,232	29,592	24,711
71	34,608	22,881	34,608	22,881	30,527	25,844
72	35,996	23,539	35,996	23,539	31,490	27,033
73	37,444	24,205	37,444	24,205	32,482	28,277
74	38,935	24,987	38,935	24,987	33,504	29,585
75	40,469	25,781	40,469	25,781	34,556	30,958
76	42,046	26,590	42,046	26,590	35,637	31,932
77	43,725	27,413	43,725	27,413	36,750	32,924
78	45,455	28,249	45,455	28,249	37,896	33,935
79	47,237	29,231	47,237	29,231	39,074	34,970
80	49,071	30,234	49,071	30,234	40,286	36,030

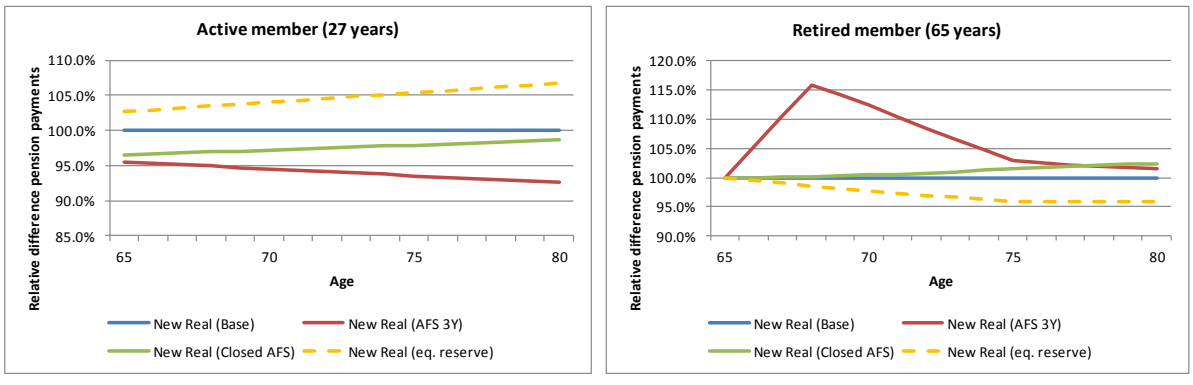
In this simulation there are no differences between the current and new nominal contract. The reason for this is the fact the financial shock the first year will boost the funding ratio up to a level of just above the 145%. This is exactly the level at which is corrected in case the funding ratio becomes higher than 145%. The funding ratio will therefore not become any lower than 145% and results therefore in exactly the same indexations in the current and new nominal contract.

Graph 6.13 Relative difference pension payments with current nominal contract



Transition to the new real contract does have effect. The retired member will profit directly from the positive financial shock. Only a buffer of 1% has to remain instead of 145% in the nominal contracts so the indexations in the new real contract are much higher than the indexations in the nominal contracts. The active member will benefit as well but the high indexations will be applied on a low amount of accrued pension rights. The time the pension rights will get to a serious amount, the financial shock of the first year is already processed completely. The latter indexations are lower than the indexations in the nominal contract and hence lower expected future pension payments for the active member. This is also the reason why an AFS processing period of three years instead of ten years will hurt the active member even more whereas the retired member will just benefit more.

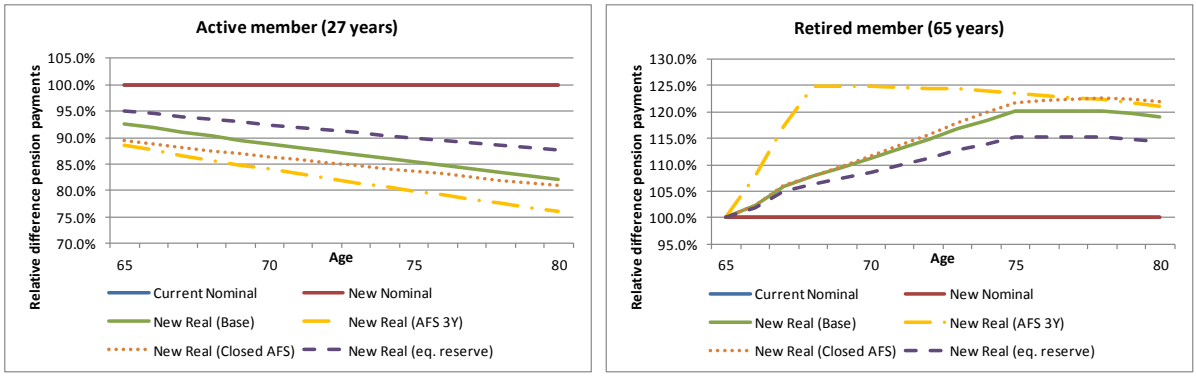
Graph 6.14 Relative difference pension payments with new real contract base analysis



A ‘closed’ AFS system will lead to more profit for the retired member and some loss for the active member. An equalization reserve will lead to a delay in indexations since the equalization reserve must yet be formed out of positive results. The delay will benefit the active member and hurt the pensioner.

The relative differences in pension payments of the various contracts are shown in the graph below. As in simulation 3 a positive result will benefit the retired member and hurt the active member. Only the formation of an equalization reserve makes the differences between the active and the retired member smaller.

Graph 6.15 Relative difference pension payments with current nominal contract



7 Collectivity versus individuality

7.1 Introduction

The Dutch pension system is characterized by solidarity. This solidarity expresses itself in intergenerational risk sharing and can smooth financial shocks over many generations. This property of intergenerational risk sharing is believed to result in a more smooth and more auto-correlated indexation of the pension rights and is therefore considered to be a very desirable feature.

In the Dutch pension system we have two extremes with respect to the intergeneration risk sharing. On the one hand we have individual defined contribution pension plans. These plans show poor investment decisions[25] and are relatively more costly than collective plans. On the other hand we have the collective defined benefit pension plans which has the highest level of risk sharing between generations over time. However, these plans are becoming more and more unsustainable. In this chapter we will analyze the effect of intergeneration risk sharing. Does it really leads to a more smooth indexation?

Since risks in the new real contract are explicitly transformed to the members of the pension fund the question rises if the new real contract has a place in the Dutch pension system to begin with. An individual defined contribution pension plan namely seems to result in the same expected pension payments and is simpler and easier than the new real contract. But if the new real system with intergenerational risk sharing really leads to a more smooth indexation of pension rights this could lead to a better solution than individual investment strategies according to a life cycle. We will analyze these effects in this chapter as well.

7.2 Collectivity versus individuality

To see if collectivity results in a more smooth indexation of pension rights we will investigate the same 'average' Dutch company pension fund as in chapter 5 and 6. The assumptions are equal to the base analysis in paragraph 5.2. In the collective analysis all the risks/results will be processed in the pension fund as a whole whereas in the ring fence analysis all the risks/results will be processed within the realm of the model point itself. Again, we will look at the pension results and the actual future expected pension payments of a current 27 year old active member and a current 65 year old pensioner.

We note that the pension results in the individual analysis are not that reliable anymore. The reason for this is the effect of the pension payment on the funding ratio. This effects increases significantly

[25] See for example the analysis of internet investors: "The Performance and Persistence of Individual Investors: Rational Agents or Tulip Maniacs?" by Rob Bauer, Mathijs Cosemans, Piet M.A. Eichholtz, University of Maastricht – Limburg Institute of Financial Economics (LIFE)

with decreasing liabilities[26]. The pension results in the individual analysis will result in a huge widening of the spread of pension results, particularly on the upside. For this reason we don't take the pension result of the complete retired period and the whole period in consideration.

7.2.1 Collective analysis – Current nominal, new nominal and new real contract

For the results of the collective analysis we refer to the tables of the base analysis in paragraph 5.2.

7.2.2 Individual analysis – Current nominal contract

The tables below show the absolute differences of the individual analysis in the current nominal contract with respect to the collective analysis in the current nominal contract. The results do show an extreme widening of the spread of the pension results. We don't want to give the pension result too much weight in the individual analysis for we are more interested in the effects on the pension payments.

Table 7.1

Active member (27 years) - Absolute differences with collective current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	8.2%	0.0%	5.0%	0.0%	7.9%	0.0%
Deferred period	8.2%	0.0%	5.0%	0.0%	7.9%	0.0%
Retired period		0.0%		0.0%		0.0%
Retired period first 15Y	-5.9%	0.0%	-5.2%	0.0%	-5.1%	0.0%
Total period		0.0%		0.0%		0.0%
First 5Y	-2.0%	0.0%	21.0%	0.0%	83.2%	0.0%
First 10Y	4.0%	0.0%	27.9%	0.0%	83.9%	0.0%
Firtst 15Y	7.9%	0.0%	28.8%	0.0%	76.5%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	178		-2,810		-8,190	
PV premiums (B)	-		-		-	
Factor (A/B)	2.0%		-15.2%		-42.7%	

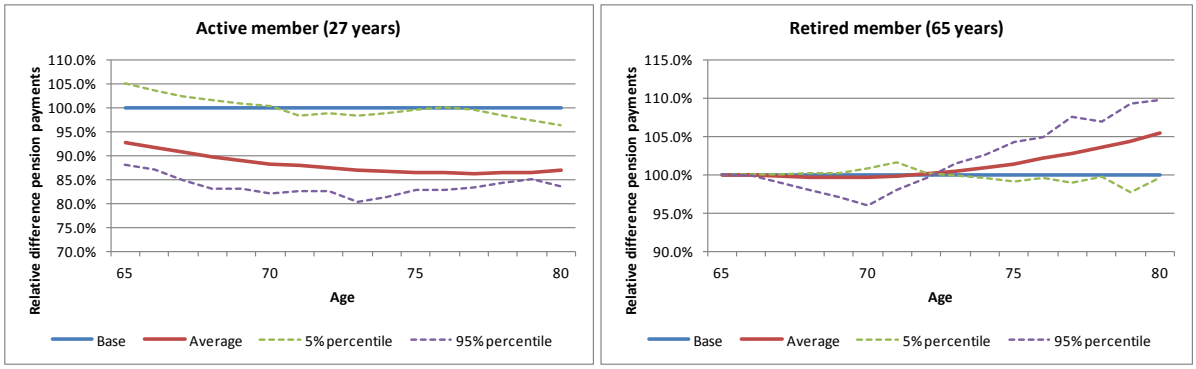
Table 7.2

Retired member (65 years) - Absolute differences with collective current nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period		0.0%		0.0%		0.0%
Retired period first 15Y	-0.6%	0.0%	5.5%	0.0%	16.1%	0.0%
Total period		0.0%		0.0%		0.0%
First 5Y	0.6%	0.0%	-0.3%	0.0%	-2.6%	0.0%
First 10Y	-0.5%	0.0%	1.4%	0.0%	3.3%	0.0%
Firtst 15Y	-0.6%	0.0%	5.5%	0.0%	16.1%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	2,822		24,820		54,020	

[26] Consider for example the situation of a model point with 150 pension assets and 100 liabilities. Hence, the funding ratio is 150%. Now a pension payment of 50 has to be paid out. This results in a funding ratio of 200% (i.e. 100 / 50) with a corresponding extreme high indexation. In the situation the model point has a funding ratio of lower than 100% the opposite occurs. Consider for example the situation of a model point with 100 pension assets and 150 liabilities resulting in a funding ratio of 67%. A pension payment of 50 results in a funding ratio of 50%. Since the pension assets cannot become lower than zero the effects on the downside are less extreme than the effects on the upside. Such a high pension payments with respect to the height of the liabilities occurs when the member approaches the age of the end of the mortality table. A collective pension plan with new entrees doesn't have this 'problem'.

The expected future pension payments in the individual analysis show an overall decrease for the active member with respect to the collective analysis. The spread in pension payments has however become smaller. For the retired member the spread has increased as expected. The average pension payment has increased and so did the pension payments in the 95% percentile. The increase in the 95% percentile is much bigger than the decrease in pension payments at the 5% percentile which is minor.

Graph 7.1 Relative difference pension payments with collective current nominal contract



7.2.3 Individual analysis – New nominal contract

The effects of an individual analysis compared to a collective analysis are in the new nominal contract quite the same as in the current nominal contract: for the active member a decrease in expected future pension payments with a smaller spread and for the retiree an increase of the pension payments with a widening of the spread.

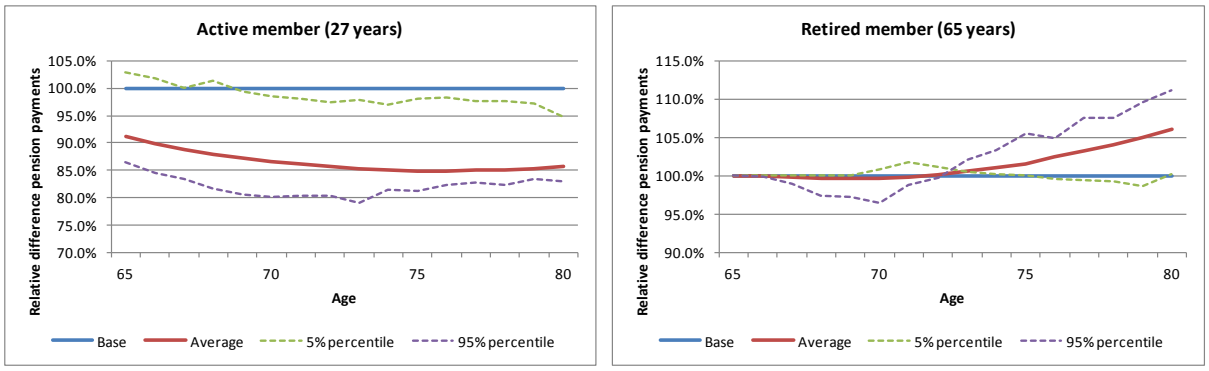
Table 7.3

Active member (27 years) - Absolute differences with collective new nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	5.8%	0.0%	3.1%	0.0%	3.3%	0.0%
Deferred period	5.8%	0.0%	3.1%	0.0%	3.3%	0.0%
Retired period		0.0%		0.0%		0.0%
Retired period first 15Y	-5.6%	0.0%	-4.9%	0.0%	-6.3%	0.0%
Total period		0.0%		0.0%		0.0%
First 5Y	-1.9%	0.0%	21.5%	0.0%	84.0%	0.0%
First 10Y	3.4%	0.0%	28.3%	0.0%	84.4%	0.0%
Firtst 15Y	7.6%	0.0%	29.1%	0.0%	76.8%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	39		-3,199		-9,073	
PV premiums (B)	-		-		-	
Factor (A/B)	0.5%		-17.4%		-45.7%	

Table 7.4

Retired member (65 years) - Absolute differences with collective new nominal contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period		0.0%		0.0%		0.0%
Retired period first 15Y	-0.5%	0.0%	6.1%	0.0%	16.7%	0.0%
Total period		0.0%		0.0%		0.0%
First 5Y	0.6%	0.0%	-0.3%	0.0%	-2.0%	0.0%
First 10Y	-0.8%	0.0%	1.6%	0.0%	4.2%	0.0%
Firtst 15Y	-0.5%	0.0%	6.1%	0.0%	16.7%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	3,645		26,708		55,884	

Graph 7.2 Relative difference pension payments with collective new nominal contract



7.2.4 Individual analysis – New real contract

The effects are in the new real contract no different as well. Again we see a smaller spread for the active member, especially the upside has dropped. On average the pension payment will decrease for the active member while the pension payment of the retired member will increase.

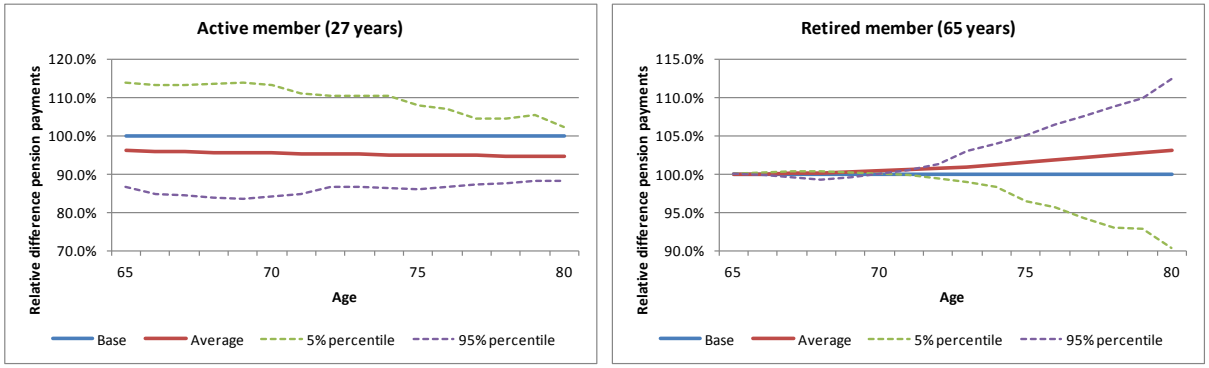
Table 7.5

Active member (27 years) - Absolute differences with collective new real contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	9.7%	0.0%	-5.6%	0.0%	-36.2%	0.0%
Deferred period	9.7%	0.0%	-5.6%	0.0%	-36.2%	0.0%
Retired period		0.0%		0.0%		0.0%
Retired period first 15Y	-4.1%	0.0%	-0.7%	0.0%	4.4%	0.0%
Total period		0.0%		0.0%		0.0%
First 5Y	-0.5%	0.0%	1.7%	0.0%	10.0%	0.0%
First 10Y	4.3%	0.0%	1.8%	0.0%	0.3%	0.0%
Firtst 15Y	7.4%	0.0%	1.5%	0.0%	-5.8%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	1,245		-1,380		-6,766	
PV premiums (B)	-		-		-	
Factor (A/B)	7.4%		-7.1%		-37.2%	

Table 7.6

Retired member (65 years) - Absolute differences with collective new real contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period		0.0%		0.0%		0.0%
Retired period first 15Y	-6.6%	0.0%	3.3%	0.0%	17.3%	0.0%
Total period		0.0%		0.0%		0.0%
First 5Y	0.0%	0.0%	0.4%	0.0%	0.4%	0.0%
First 10Y	-2.7%	0.0%	1.6%	0.0%	6.2%	0.0%
Firtst 15Y	-6.6%	0.0%	3.3%	0.0%	17.3%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	-9,657		7,685		36,720	

Graph 7.3 Relative difference pension payments with collective new real contract



7.3 Individual life cycle versus new real contract

In the previous paragraph we analyzed the effects of collectivity versus individuality with respect to risk sharing. The assumption of a constant 40% stock exposure in an individual pension plan is however not realistic. According to the duty of care risks must be decreased when a member approaches the retirement age. This investment strategy is called a life cycle. In practice from more than one life cycle can be chosen: a defensive up to an aggressive life cycle. The more aggressive the life cycle the more investment risks are taken, especially at a younger age of the member.

When we take a look at the active period of a member we see that in a life cycle more risks are taken when he is young and lesser risks when he grows older. We assume taking risk leads to a higher expected return. This does not work out very well since the pension assets accrued at a young age are very low. When the assets grow to a serious amount the risks are decreased. In short, the risks will not benefited much. The life cycle also decreases the ability to restore a bad scenario in younger years. Depending on the timing of the bad scenario one generation will lose more than the other.

The reduction of risk is not necessary in the new real contract. Intuitively the new real contract much therefore lead to higher pension payments than the individual pension plans.

We have investigated the differences between a collective new real contract based on 40% stock exposure and 50% interest risk hedge and an individual contract based on a life cycle. The life cycle is shown in the table below.

Table 7.7

Age	Stock exposure	Interest risk hedge	Age	Stock exposure	Interest risk hedge
< 40	65%	50%	55	30%	50%
40	65%	50%	56	30%	54%
41	65%	50%	57	30%	58%
42	65%	50%	58	30%	62%
43	65%	50%	59	20%	66%
44	60%	50%	60	10%	70%
45	50%	50%	61	10%	74%
46	50%	50%	62	10%	78%
47	50%	50%	63	10%	82%
48	50%	50%	64	10%	86%
49	50%	50%	65	10%	90%
50	45%	50%	66	10%	90%
51	45%	50%	67	10%	90%
52	45%	50%	68	10%	90%
53	45%	50%	69	10%	90%
54	45%	50%	≥70	10%	90%

Although the characteristics of an individual life cycle contract are not exactly the same as the new real contract we analyzed the effects of the life cycle based on a new real contract. See for the results of the base analysis paragraph 5.2.3. In the tables below the results in the new real contract are shown in case of a life cycle investment strategy. As in the base analysis an AFS processing period of ten years is assumed. As in the previous chapter we note that the pension results are not very reliable in an individual contract.

Table 7.8

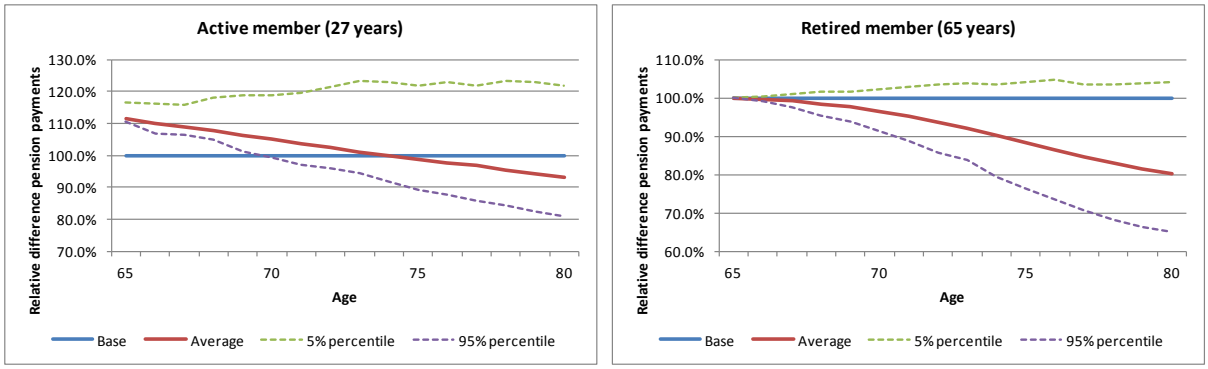
Active member (27 years) - Absolute differences with collective new real contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	11.7%	0.0%	28.1%	0.0%	69.3%	0.0%
Deferred period	11.7%	0.0%	28.1%	0.0%	69.3%	0.0%
Retired period		0.0%		0.0%		0.0%
Retired period first 15Y	9.0%	0.0%	-14.3%	0.0%	-45.3%	0.0%
Total period		0.0%		0.0%		0.0%
First 5Y	-2.2%	0.0%	4.4%	0.0%	17.6%	0.0%
First 10Y	1.0%	0.0%	11.2%	0.0%	25.7%	0.0%
Firtst 15Y	5.3%	0.0%	20.4%	0.0%	50.3%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	2,033		-131		-4,212	
PV premiums (B)	-		-		-	
Factor (A/B)	11.1%		-0.6%		-16.8%	

Table 7.9

Retired member (65 years) - Absolute differences with collective new real contract						
Pension results	5% percentile	No indexation	Average	No indexation	95% percentile	No indexation
Active period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deferred period	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retired period		0.0%		0.0%		0.0%
Retired period first 15Y	0.8%	0.0%	-19.9%	0.0%	-50.2%	0.0%
Total period		0.0%		0.0%		0.0%
First 5Y	2.5%	0.0%	-3.5%	0.0%	-10.8%	0.0%
First 10Y	2.0%	0.0%	-11.7%	0.0%	-30.3%	0.0%
Firtst 15Y	0.8%	0.0%	-19.9%	0.0%	-50.2%	0.0%
Other	5% percentile		Average		95% percentile	
PV payments (A)	1,533		-33,324		-79,333	

In the graph below the future expected pension payments are shown relative to the pension payments in the base analysis (collective new real contract). Compared to the base analysis we see a clear downsizing of the upper percentile! This means a great deal of the upside potential has disappeared. This holds for the active member and for the retired member. The pension payments in the 5% percentile are however higher. On average the pension payments will decrease for the active member and the retired member as well.

Graph 7.4 Relative difference pension payments with collective new real contract



The life cycle above results in less risks during the whole period which leads to a significant narrowing of het spread of the pension payments. Especially the upside has decreased much. Overall, the higher average pension payments and the significantly higher upside potential is in favor of the collective new real contract.

8 Summary

8.1 The new pension deal

The recent years has put the current financial assessment framework for pension funds under a lot of pressure and a need for a new framework was inevitable. Based on the recommendations of two committees a new pension deal has been proposed. Two types of contracts can be chosen in the new pension deal, a nominal contract or a real contract. The new nominal contract is basically the same as the current nominal contract with the exception of the ability to adjust the pension rights with inflation. This ability to compensate the pension rights is more difficult in the new nominal contract. The new real contract handles surpluses and deficits quite different than the nominal contracts. In the new real contract surpluses and deficits will be processed within a period of maximum ten years. Since the various contracts deal differently with surpluses and deficits the new pension deal will lead to some generational effects.

The Dutch Central Planning Office (CPB) has analyzed the effects of the new pension deal. CPB used risk neutral valuation techniques to analyze the value transfer for the different age groups. Although the analysis done by CPB is extremely helpful, it does not give us (enough) insight in the timing, the height and the variability of the pension payments.

There are different criteria to compare the different contracts. For example, from the view point of the pension fund one could compare the development of the funding ratio. From the view point of the participants one can investigate the value transfer and/or the differences in probability of a pension reduction. This research has focussed on probably the most important criteria: the actual expected pension payments of the members. Together with the analysis done by CPB this research forms a framework for pension fund boards to analyze the effects of the new pension deal.

8.2 The effects of the new pension deal

In chapter 5 the results of the stochastic analysis are discussed. Every analysis, stochastic as well as deterministic, shows that transition to the new nominal contract will lead to negative effects for old members and positive effects for young members. This can be explained by the fact more buffers will be formed since on the short term less indexation is given. This benefits the future participants. An additional effect of transition to the new nominal contract is the smaller spread in pension results and pension payments.

Transition to the new real contract results in general to major losses for young members and small wins for old members. Only in the situation of a extreme bad scenario does transition to the new real contract benefit young members. As in the new nominal contract the spread in pension results and pension payments will decrease. Especially the downside will be much higher in the new real contract.

The reason for this is the difference in processing time. The nominal contract has a recovery period of three years whereas the new real contract will process results in ten years time.

We also analyzed the effects of transition to the new contracts in the situation of a lower funding ratio. Although the results are generally much lower than the base analysis no major differences in the transitions of contracts could be seen with respect to the base analysis. The other alternative analysis (an average premium instead of an actuarial premium with a solvency premium; and a stock exposure of 50% instead of 40%) didn't result in other effects at transition as well. Therefore we conclude the transitions are not very sensitive to the different assumptions investigated.

The new real contract has different features which can be set. In chapter 5 we saw that these features do have much impact on the results. First, we analyzed an AFS processing period of three years instead of ten years. This led to a huge widening of spread of the expected pension payments for old members. On average the future expected pension payments were a bit higher for young and old members as well. Based on the deterministic analysis we can conclude that lowering the AFS processing period from ten to three years will benefit young members in case of negative scenarios and hurt them in case of positive scenarios. The opposite is true for old members.

Second, we analyzed the effects of the 'closed' AFS system. The future expected pension payments for young and old members didn't change that much. However, the spread in payments increased, especially for old members. The effects of a 'closed' AFS instead of an 'open' AFS are similar to the effects of changing of the AFS processing period from ten to three years, although the effects are smaller.

Finally, we took a look at the formation of an equalization reserve. The formation of an equalization reserve will lead to a smaller spread in pension results on the short term although the effects in this analysis are small. The pension payments show a slight improvement with respect to the base run for the new real contract for young members and a downturn for old members. Only the formation of an equalization reserve can decrease the differences between the active and retired member.

From the analysis we can conclude that transition to the new nominal contract is favorable to young members and unfavorable to old members. All analysis shows a loss for old members. Almost every analysis shows profits for the young member, except for the deterministic analysis of a constant annual return of 1%. Transition to the new real contract will cause some real damage to the young members except for the deterministic scenario of a extreme negative financial shock. Old members will profit if transition takes place to the new real contract. The effects of transition to the new real contract are (much) greater than the effects of transition to the new nominal contract.

Based on the analysis done in this research no clear choice can be made without hurting one of the generations in question. Especially the analysis of a positive financial shock (deterministic simulation 5) will lead to extreme negative (for young members) and positive effects (for old members).

8.3 Collectivity versus individuality

Collective pension plans are believed to smooth results over time. Individual pension plans do not have the element of intergenerational risk sharing and should therefore result in more extreme outcomes. In chapter 7 we've analyzed the effects of a collective pension plan versus an individual pension plan. The results do not show fully the results we expect. In all the three contracts (current nominal, new nominal and new real) the spread in pension payments increased for old members but decreased for young members in the individual pension plan. Especially the upside dropped much for young members.

8.4 New real contract versus life cycle

One can ask if the new real contract has a place in the Dutch pension system to begin with. Transferring all the risks to the members of the pension plan like the new real contract does seems to result in the same outcome of a individual contract. The analysis done in this research could not bring evidence collective contracts must be preferred above individual contracts inasmuch they should lead to a more smooth result (see previous paragraph).

However, that specific analysis was done assuming a constant asset allocation. In practice individual contracts will invest according to a life cycle. A life cycle is characterized by the fact less investment risk is taken when the member approaches its retirement age. This element in a life cycle does not benefit the member for the full 100%. Much risk is taken in the younger years of the participant when the accrued pension assets are few. The time the pension assets grow to a material size the risks are reduced. The new real contract does not need to reduce the risk of the members and should therefore intuitively lead to better outcomes.

From the analysis in chapter 7 of the comparison of an individual contract based on a life cycle and the collective contract in the base analysis we can conclude the new real contract does indeed result in better outcomes. In this research on other life cycles were analyzed. It is therefore possible this result does not hold for every life cycle.

8.5 Final remarks

The analysis done in this research are based on various and specific assumptions. Especially the assumptions regarding the economic scenarios and the demography of the pension fund can and will have its effects on the outcomes. Hence, an important alternative for further investigation is the analysis of the effects of the new pension deal on different types of pension funds (young, middle and old).

Finally, it should be clear that the analysis done in this research doesn't have to be representative to any existing pension fund. Every pension fund should be analyzed separately.

9 References

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Regeling Parameters Pensioenfondsen

Demography of Dutch pension funds:
http://www.statistics.dnb.nl/financieele-instellingen/pensioenfondsen/toezichtgegevens-pensioenfondsen/index.jsp# (table 8.6 and 8.7)

Estimated funding ratio Dutch pension funds:
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“QIS 5 Risk-free interest rates – Extrapolation method”, https://eiopa.europa.eu/fileadmin/tx_dam/files/consultations/QIS/QIS5/ceiops-paper-extrapolation-risk-free-rates_en-20100802.pdf (the Smith-Wilson method)

10 Appendix A – The Ultimate Forward Rate

In September 2012 the Dutch Central Bank (DNB) introduced the Ultimate Forward Rate (UFR) methodology for pension funds in imitation of the solvency II guidelines for insurance companies[27]. This methodology suggests that, based on a historical values of 2.0% inflation and 2.2% real interest rate, on the long term the nominal interest rate should be equal to 4.2%. The nominal interest rate term structure (i.e. the zero swap spot curve) will therefore be adjusted to meet this condition. To be more specific, the adjustments are made on the so called forward interest rates. Forward rates depicts future expected zero spot interest rates for a given maturity.

If the nominal zero interest rate for maturity t is equal to R_t than the n-year forward rate at time t is formulated by $R_{t,n}^{Fwd} = ((1 + R_{t+n})^{t+n}/(1 + R_t)^t)^{1/n} - 1$). For example, consider an annual interest rate of 3.0% for maturity 30 years. For maturity 31 years we assume the annual interest rate to be equal to 3.1%. The 1 year forward rate at time 30 is in this case equal to 6.1% (i.e. 1.031^31 / 1.03^30 – 1).

The UFR method adjusts the 1 years forward rates on basis of which a new nominal zero spot curve is created. The adjustments of the 1 years forward rates start at term 20 years. From this term and upwards the 1 years forward rate is based on a linear interpolation of the forward rate from the term structure and the UFR of 4.2%. The adjusted forward rate is formulated as follows:

$$R_{t,n}^{Fwd\ adjusted} = (1 - weight_t) \times R_{t,n}^{Fwd\ term\ structure} + weight_t \times UFR$$

The $weight_t$ are based on a calculation method developed by Smith-Wilson[28]. From term 60 years and over the $weight_t$ are considered to be equal to 1. This means from that point on the nominal zero spot curve will be based on a forward rate of 4.2%. However, this does not mean the nominal interest rates are actually at this level! See the example below in Table 10.1. In column A the nominal zero swap spot curve is presented as per June 30, 2013. The 1 years forward rates are shown in column B and in column C the weights according to the Smith-Wilson method. The adjusted 1 years forward rates are found in column D. Finally the adjusted nominal zero spot rates are shown in column E. As you can see the adjusted nominal interest rate at term 60 is equal to 3.446% and is not even close to 4.2%.

This method partly overrules the market data concerning the zero swap rates from term 20 years and over. The reason for this is that the law giver considers the long term swap rates to be too illiquid (i.e. too less trading to determine a good and solid market price). Up to term 20 years the zero swap rates are completely based on market data.

[27] For more information about the UFR methodology see: "UFR Methodiek voor de berekening van de rentetermijnstructuur" , http://www.toezicht.dnb.nl/5/18/50-226790.jsp

[28] The Smith-Wilson method is described by EIOPA in the paper 'QIS 5 Risk-free interest rates – Extrapolation method', https://eiopa.europa.eu/fileadmin/tx_dam/files/consultations/QIS/QIS5/ceiops-paper-extrapolation-risk-free-rates_en-20100802.pdf

Table 10.1

	A	B	C	D	E
Term	Zero swap rates	Forward rates	Weights	Forward rates adjusted	Zero swap rates incl. UFR
1	0,419%	0,419%	0,000	0,419%	0,419%
2	0,605%	0,790%	0,000	0,790%	0,605%
3	0,792%	1,168%	0,000	1,168%	0,792%
4	1,018%	1,700%	0,000	1,700%	1,018%
5	1,238%	2,119%	0,000	2,119%	1,238%
6	1,440%	2,461%	0,000	2,461%	1,440%
7	1,619%	2,700%	0,000	2,700%	1,619%
8	1,780%	2,914%	0,000	2,914%	1,780%
9	1,928%	3,120%	0,000	3,120%	1,928%
10	2,062%	3,272%	0,000	3,272%	2,062%
11	2,179%	3,358%	0,000	3,358%	2,179%
12	2,277%	3,358%	0,000	3,358%	2,277%
13	2,355%	3,302%	0,000	3,302%	2,355%
14	2,422%	3,301%	0,000	3,301%	2,422%
15	2,481%	3,301%	0,000	3,301%	2,481%
16	2,509%	2,926%	0,000	2,926%	2,509%
17	2,533%	2,926%	0,000	2,926%	2,533%
18	2,555%	2,926%	0,000	2,926%	2,555%
19	2,574%	2,926%	0,000	2,926%	2,574%
20	2,592%	2,926%	0,000	2,926%	2,592%
21	2,593%	2,614%	0,086	2,751%	2,600%
22	2,594%	2,614%	0,186	2,909%	2,614%
23	2,595%	2,614%	0,274	3,049%	2,633%
24	2,596%	2,614%	0,351	3,171%	2,655%
25	2,596%	2,614%	0,420	3,280%	2,680%
26	2,592%	2,475%	0,481	3,305%	2,704%
27	2,587%	2,475%	0,536	3,400%	2,729%
28	2,583%	2,475%	0,584	3,482%	2,756%
29	2,580%	2,475%	0,628	3,558%	2,784%
30	2,576%	2,475%	0,666	3,624%	2,812%
31	2,581%	2,713%	0,701	3,755%	2,842%
32	2,585%	2,713%	0,732	3,802%	2,872%
33	2,589%	2,713%	0,760	3,843%	2,901%
34	2,592%	2,713%	0,785	3,880%	2,930%
35	2,596%	2,713%	0,808	3,915%	2,958%
36	2,599%	2,713%	0,828	3,944%	2,985%
37	2,602%	2,713%	0,846	3,971%	3,012%
38	2,605%	2,713%	0,863	3,996%	3,037%
39	2,608%	2,713%	0,878	4,019%	3,062%
40	2,610%	2,713%	0,891	4,038%	3,087%
41	2,628%	3,334%	0,903	4,116%	3,112%
42	2,645%	3,334%	0,914	4,126%	3,136%
43	2,661%	3,334%	0,923	4,133%	3,159%
44	2,676%	3,334%	0,932	4,141%	3,181%
45	2,691%	3,334%	0,940	4,148%	3,202%
46	2,705%	3,334%	0,947	4,154%	3,223%
47	2,718%	3,334%	0,954	4,160%	3,243%
48	2,731%	3,334%	0,960	4,165%	3,262%
49	2,743%	3,334%	0,965	4,170%	3,280%
50	2,755%	3,334%	0,970	4,174%	3,298%
51	2,766%	3,334%	0,974	4,177%	3,315%
52	2,777%	3,334%	0,978	4,181%	3,332%
53	2,788%	3,334%	0,982	4,184%	3,348%
54	2,798%	3,334%	0,985	4,187%	3,364%
55	2,807%	3,334%	0,988	4,190%	3,378%
56	2,817%	3,334%	0,990	4,191%	3,393%
57	2,826%	3,334%	0,993	4,194%	3,407%
58	2,835%	3,334%	0,995	4,196%	3,420%
59	2,843%	3,334%	0,997	4,197%	3,434%
60	2,851%	3,334%	0,998	4,198%	3,446%

11 Appendix B – The AFS mechanism

The major new element in the new real contract is the so called Adjustment mechanism Financial Shocks (AFS). This mechanism causes returns not to be processed right away, but to spread them over a specific processing period. The allowed processing period is three years up to ten years. The pension fund is free to choose a processing period but once the processing period is chosen it is fixed.

But first we have to answer two questions regarding the AFS:

1. How will financial shocks be processed?; and
2. will adjustments do or will adjustments do not effect new accrued pension rights?

In this appendix we will address the above questions. According to the consultation paper the AFS must lead to a real funding ratio of 101%. However, for illustration purposes the examples this appendix adjust to a real funding ratio level of 100%. We'll end this appendix with some final remarks regarding the AFS.

11.1 Processing financial shocks

11.1.1 The 'rooftop tile' method

The mechanism analyzed in this research is as follows. Consider a pension fund with a funding ratio of 100% (on a real basis) and starts in the new real contract. We'll set the processing period at 5 years and consider a number of shocks to be processed by the AFS. In this example no premiums are paid and the liabilities only changes due to adjustments done by the AFS. The processing of the shocks in this example is shown in Table 11.1.

Table 11.1

	Beginning of year			End of year			
Year	Liabilities	Assets	Funding ratio	Result	Liabilities	Assets	Funding ratio
1	1,000	1,000	100,0%	-200	1,000	800	80.0%
2	960	800	83,3%	100	960	900	93.8%
3	940	900	95,7%	50	940	950	101.1%
4	930	950	102,2%	-50	930	900	96.8%
5	910	900	98,9%	100	910	1,000	109.9%

	AFS: Write off over processing period					End of year
Year	T=t+0	T=t+1	T=t+2	T=t+3	T=t+4	AFS indexation
1	-40	-40	-40	-40	-40	-4.0%
2	-20	-20	-20	-20	20	-2.1%
3	-10	-10	-10	30	10	-1.1%
4	-20	-20	20	0	-10	-2.2%
5	0	40	20	10	20	0.0%

At the end of year one the pension fund has a loss / deficit of 200. One fifth part (i.e. -40) will be processed each year the coming five years, starting immediately. This corresponds with an indexation

of -4.0% at year end. At the end of the second year the pension fund has realized a profit / surplus of +100. This surplus will also be processed within five years, each year one fifth part. At the end of year two the pension fund must therefore process -20 (i.e. 1/5 of -200 and 1/5 of +100) and equals an indexation of -2.1%. At the end of the third year the pension fund will process -10 as negative indexation of -1.1% of the pension rights (i.e. 1/5 of +50, 1/5 of +100 and 1/5 of -200). After five years the loss / deficit of the first year is completely processed.

This interpretation of the AFS is also called the “rooftop tile” method. The AFS will cause the compensations to be dampened.

11.1.2 The ‘1/N’ method

The other interpretation of the AFS is shown in **Fout! Verwijzingsbron niet gevonden.** below. In this research it is called the ‘1/N’ method (N is commonly used to denote the processing period of the AFS).

Table 11.2

	Beginning of year			End of year			
Year	Liabilities	Assets	Funding ratio	Result	Liabilities	Assets	Funding ratio
1	1,000	1,000	100.0%	-200	1,000	800	80.0%
2	960	800	83.3%	100	960	900	93.8%
3	948	900	94.9%	50	948	950	100.2%
4	948	950	100.2%	-50	948	900	94.9%
5	939	900	95.9%	100	939	1,000	106.5%

	AFS		EOY
Year	Write off	Remainder	AFS indexation
1	-40	-160	-4.0%
2	-12	-48	-1.3%
3	0.40	1.60	0.0%
4	-9.68	-38.72	-1.0%
5	12.26	49.02	1.3%

The loss / deficit at end of year one will be processed for one fifth part, i.e. -40 and is equal to an indexation of -4.0%. Therefore, -160 remains to be processed. This -160 will be aggregated with the surplus the next year which is in this example equal to +100. Hence, a total deficit of -60 remains at the end of the second year which again will be processed for one fifth part, i.e. -12 (-1.3% indexation). Minus 48 remains to be processed and will on its turn be aggregated with the result in year three which is assumed to be +50. At the end of the third year 0.40 will therefore be processed (0.0% indexation), i.e. one fifth part of 2.

The results in this method will never leave the system completely. Every year one fifth part will be processed so there always remains a part of the result to be processed still. This is not according to the proposed new financial assessment framework which states shocks must be processed within a period of maximal ten years.

11.2 The AFS and accrual of new pension rights

As mentioned in paragraph 4.2.3 an 'open' AFS will lead to an undesirable effect in case a member wants to transfer its pension rights when changing jobs. To counter attack this problem a 'closed' AFS is suggested. To illustrate the 'open' and 'closed' AFS we will expand the example in Table 11.1 with premium contributions[29]. The examples of the 'open' and 'closed' AFS are not intended to be compared with the example in Table 11.1. The same financial shocks are assumed and since the basis of the AFS is different (without and with pension accrual) comparison is difficult.

11.2.1 The 'open' AFS

In the 'open' AFS new accrued pension rights will be sharing in the risks of the past. In other words, all the adjustments in the AFS yet to be adjusted, will also be processed on the new accrued rights.

Table 11.3

	BOY before premium			Premium		BOY after premium			EOY
Year	Liabilities	Assets	Funding ratio	Pension right	Premium	Liabilities	Assets	Funding ratio	Result
1	1,000	1,000	100.0%	10	100	1,100	1,100	100.0%	-200
2	1,060	900	84.9%	10	100	1,160	1,000	86.2%	100
3	1,140	1,100	96.5%	10	100	1,240	1,200	96.8%	50
4	1,230	1,250	101.6%	10	100	1,330	1,350	101.5%	-50
5	1,310	1,300	99.2%	10	100	1,410	1,400	99.3%	100

	EOY			AFS: Write off over processing period					EOY
Year	Liabilities	Assets	Funding ratio	T=t+0	T=t+1	T=t+2	T=t+3	T=t+4	AFS indexation
1	1,100	900	81.8%	-40	-40	-40	-40	-40	-3.6%
2	1,160	1,100	94.8%	-20	-20	-20	-20	20	-1.7%
3	1,240	1,250	100.8%	-10	-10	-10	30	10	-0.8%
4	1,330	1,300	97.7%	-20	-20	20	0	-10	-1.5%
5	1,410	1,500	106.4%	0	40	20	10	20	0.0%

In the example in Table 11.3 we assume an annual pension accrual of 10 with a corresponding premium of 100. At the end of year one -40 has to be processed. In this example the adjustment will lead to an indexation of -3.6%. At the end of the second year -20 will be processed and is equal to an indexation of -1.7%. The pension accrual in the beginning of year two will also be adjusted with -1.7% indexation and shares therefore in the result of year one.

11.2.2 The 'closed' AFS

The 'closed' AFS is characterized by the fact new accrued pension rights don't share in recent results concerning 'old' pension rights. This means a separate AFS mechanism must be applied every time new pension rights are accrued. Such an interpretation of the 'closed' AFS is undesirable. However, a 'closed' AFS can be formed without a separate mechanism for each time pension rights are accrued. See Table 11.4 for an example of such a 'closed' AFS.

[29] The transfer of pension rights can be considered as a premium contribution. So the effects for new premiums hold for value transfers as well.

The main focus of this method is to keep just one AFS mechanism in place. This means that for every new accrual of pension rights we'll have to create an 'fictive' AFS history equal to that of the 'old' pension rights as if it was participating in the AFS all along. To create this 'fictive' AFS history we will adjust the pension accrual. Ultimately, when the processing period is over, the 'fictive' AFS history will be processed completely and the adjusted pension accrual is adjusted to the level it should have been in the first place.

Table 11.4

	BOY before premium			Premium			
Year	Liabilities	Assets	Funding ratio	Pension right	Pension right adj.	Premium Liabs	Premium Assets
1	1.000	1.000	100.0%	10.00	10.00	100.00	100.00
2	1.060	900	84.9%	10.00	11.78	117.78	100.00
3	1.154	1.118	96.8%	10.00	10.33	103.26	100.00
4	1.243	1.271	102.2%	10.00	9.78	97.82	100.00
5	1.317	1.319	100.1%	10.00	9.99	99.88	100.00

	BOY after premium			EOY	
Year	Liabilities	Assets	Funding ratio	Result	Result premium
1	1,100	1,100	100.0%	-200	0.00
2	1,178	1,000	84.9%	100	-17.78
3	1,257	1,218	96.8%	50	-3.26
4	1,341	1,371	102.2%	-50	2.18
5	1,417	1,419	100.1%	100	0.12

	EOY			AFS: Write off over processing period					EOY
Year	Liabilities	Assets	Funding ratio	T=t+0	T=t+1	T=t+2	T=t+3	T=t+4	AFS indexation
1	1,100	900	81.8%	-40.00	-40.00	-40.00	-40.00	-40.00	-3.6%
2	1,178	1,118	94.9%	-23.56	-23.56	-23.56	-23.56	16.44	-2.0%
3	1,257	1,271	101.1%	-14.21	-14.21	-14.21	25.79	9.35	-1.1%
4	1,341	1,319	98.3%	-23.77	-23.77	16.23	-0.22	-9.56	-1.8%
5	1,417	1,519	107.2%	-3.75	36.25	19.81	10.46	20.02	-0.3%

This example is equal to the example of the 'open' AFS in Table 11.3 with exception of the 'closed' versus 'open' method. Again, we assume an annual pension accrual of 10 with a corresponding premium of 100. At the end of year one 1/5 of the result has to be processed which leads to an indexation of -3.6%. So far nothing different with the 'open' AFS.

In the 'open' AFS 10 would be accrued at the beginning of year two. However, in the 'closed' AFS we will adjust the accrual of 10 by the funding ratio at the end of year one without changing the premium of 100. We'll divide the 10 by 81.8% and accrue 11.78 instead of 10. The difference of 1.78 can be considered as a fictive pension right. Hence, the liabilities will grow with 118 whereas the assets will grow with the actual premium of 100. This leads to a result of -17.78 which will be processed in the AFS at the end of the year as if it was a normal result. After five years this -17.78 is completely processed and results in a pension right of 10.

This example shows it is possible to have a 'closed' AFS with just one AFS mechanism instead of multiple.

The example also shows the 'closed' AFS method will lead to more extreme AFS indexations than the 'open' AFS method. This can be explained by the following formulas. First, consider the AFS indexation at time t in the 'open' AFS system:

$$'Open' AFS\ Indexation_t = \frac{AFS\ adjustment_t}{Liabilities_t + Premium_t}$$

Next, we consider the situation in which the AFS adjustment is *negative*. The AFS indexation at time t in the 'closed' AFS will therefore be equal to:

$$'Closed' AFS\ Indexation_t = \frac{-AFS\ adjustment_t - \frac{1}{N-1} \times A_t}{Liabilities_t + Premium_t + A_t}$$

Whereby A_t is equal to the 'premium result' at time t caused by the adjustment of the accrued new pension right and *N* is equal to the AFS processing period. As you can see in the formula, in the case of coming negative AFS adjustments, the 'closed' AFS method will always lead to more negative AFS indexations. The limit of the 'closed' AFS indexation (if *A* will be infinitely high) is equal to -1/(N-1).

Finally, we consider the situation in which the AFS adjustment is *positive*. The AFS indexation at time t in the 'closed' AFS is in this situation equal to:

$$'Closed' AFS\ Indexation_t = \frac{AFS\ adjustment_t + \frac{1}{N-1} \times A_t}{Liabilities_t + Premium_t - A_t}$$

In this case the 'closed' AFS method will always lead in higher AFS indexations. The limit of the 'closed' AFS indexation is when A_t equals to $Premium_t$. It depends on the height of the 'normal' AFS adjustment and the value of the liabilities at time t what the limit of the AFS indexation will be.

11.3 Final remarks on the AFS

In the examples in this chapter we assumed the population of the pension fund to be fixed and not ageing. Hence, processing an equal amount over the AFS period leads to a steady (adjustment) indexation. In reality however, the population of a pension fund is not fixed and probably will age. This especially will be true for very small pension funds. For very big pension funds the assumption of a steady state population can hold. The value of the liabilities change if the population of the fund changes and if the liabilities change, adjusting same amounts will lead to different indexations.

To illustrate the effects of ageing consider the following example. Consider two pension funds A and B. Pension fund A and B are equal except for the fact the population of pension fund A does not age and the population of pension fund B does. We focus on a result to be processed by the AFS of 500 over a period of ten years (i.e. 50 per year). Furthermore, we assume the average age at commencement to be 50 and the total accrued pension right to be 1,000 euro with no new accrual of pension rights. Finally, we assume the mortality rate based on GBM 2005-2010 and an interest rate of 3% fixed. See Table 11.5 for the results of this example.

Table 11.5

Pension fund A						
Year	Age	Act. Factor	Pension right	Liabilities	AFS write off	AFS indexation
1	50	7.730	1,000	7,730	50	0.65%
2	50	7.730	1,000	7,730	50	0.65%
3	50	7.730	1,000	7,730	50	0.65%
4	50	7.730	1,000	7,730	50	0.65%
5	50	7.730	1,000	7,730	50	0.65%
6	50	7.730	1,000	7,730	50	0.65%
7	50	7.730	1,000	7,730	50	0.65%
8	50	7.730	1,000	7,730	50	0.65%
9	50	7.730	1,000	7,730	50	0.65%
10	50	7.730	1,000	7,730	50	0.65%

Pension fund B						
Year	Age	Act. Factor	Pension right	Liabilities	AFS write off	AFS indexation
1	50	7.730	1,000	7,730	50	0.65%
2	51	7.987	1,000	7,987	50	0.63%
3	52	8.254	1,000	8,254	50	0.61%
4	53	8.534	1,000	8,534	50	0.59%
5	54	8.827	1,000	8,827	50	0.57%
6	55	9.134	1,001	9,143	50	0.55%
7	56	9.456	1,002	9,475	50	0.53%
8	57	9.794	1,003	9,824	50	0.51%
9	58	10.151	1,004	10,192	50	0.49%
10	59	10.528	1,005	10,581	50	0.47%

The AFS will lead to a constant indexation of 0.65% in pension fund A and a decreasing indexation for pension fund B, starting with 0.65% at the end of year one and 0.47% at the end of year ten. The AFS will therefore lead to different indexations for different pension funds since the populations will not develop the same.

The results will be more extreme if we take the accrual of new pension rights into account. The accrual of new pension rights will also develop over time according to the demography of the pension fund, the number of new entrees in the pension plan and possible other causes.

12 Appendix C – Demography and constructing model points

The Dutch Central Bank (DNB) monitors all the Dutch pension funds not only concerning their solvency ratio but also concerning the demography. DNB publishes aggregate data with respect to the demography of pension funds on its website[30]. We will use this data to construct the demography of the "average" Dutch pension fund.

12.1 Data of Dutch Central Bank

In order to get an approximation of the "average" pension fund the data with respect to all Dutch company pension funds is selected. We will use the total number of participants split to age and split to the following states: active members; deferred members and retired members (table 8.7 on the website).

Table 12.1

	Total number of participants all Dutch company pension funds		
Age	Active	Deferred	Retired
< 20	2,140	536	5,360
20 – 25	37,084	37,100	1,856
25 – 30	61,590	83,411	364
30 – 35	73,081	130,791	216
35 – 40	83,419	151,217	731
40 – 45	102,137	170,822	2,055
45 – 50	99,524	164,826	4,172
50 – 55	90,465	144,162	6,962
55 – 60	73,056	113,956	12,029
60 – 65	46,952	79,879	52,671
65 – 70	618	3,122	115,876
70 – 75	2	1,544	95,527
75 – 80	-	184	75,830
80 – 85	1	63	61,005
85 – 90	-	17	36,409
90 – 95	-	3	13,155
> 95	-	1	2,662

Note: a member will be counted as many times he has accrued pension rights at different pension funds. There is no data available to correct for this phenomenon.

Table 12.1 as shown above can be considered as the demography of the "total" Dutch pension fund. Some further steps must be taken to use these numbers in the ALM model as the "average" Dutch pension fund.

The ALM model values the premiums and liabilities with an overall retirement age. The retirement age in the analysis is set at 65 years. This means that every member is considered to retire at age 65. The

[30] http://www.statistics.dnb.nl/financieele-instellingen/pensioenfondsen/toezichtgegevens-pensioenfondsen/index.jsp#. The most recent data is used, i.e. as per 2011. It is assumed no major changes in the demography of Dutch pension funds has occurred since 2011.

number of active and deferred members older than 65 years old will therefore be grouped with the number of active respectively deferred members of age cohort 60-65.

The next step is to split the number of retired members into two groups, i.e. old age pension and widow pension. We use another data table published by DNB to make an approximation of the split: the total number of participants split to the following states: active members; deferred members; retired members old age pension and retired members widow pension (table 8.6 on the website). In this data no split is made to age cohort. The (aggregated) data of this table is shown in Table 12.2.

Table 12.2

State	Number	%
Active	697,252	30.9%
Deferred	1,069,355	47.4%
Old age pension	326,518	14.5%
Widow pension	138,496	6.1%
Disability pension	19,074	0.8%
Orphans pension	7,038	0.3%

Note: a member will be counted as many times he has accrued pension rights at different pension funds. There is no data available to correct for this phenomenon. The total number of participants is different than the total number in table 11.1. There is no clear explanation for this.

We'll assume that all retired members with an old age pension are older than 60 years old[31]. We also assume that all members with an orphans pension are younger than 25 years old and that all members with a disability pension are younger than 60 years old. Furthermore, we assume the disability pension members are distributed along the age cohorts according to the total retired members. The above mentioned assumptions will lead to the following distribution of the retired members with widow pension younger than 60 years old.

Table 12.3

Age	Retired members: - widow pension - disability pension - orphans pension	==>	Age	Retired members: - widow pension - disability pension	==>	Age	Retired members: - widow pension
< 20	5,360		< 20	0		< 20	0
20 – 25	1,856		20 – 25	178		20 – 25	51
25 – 30	364		25 – 30	364		25 – 30	104
30 – 35	216	==>	30 – 35	216	==>	30 – 35	62
35 – 40	731		35 – 40	731		35 – 40	209
40 – 45	2,055		40 – 45	2,055		40 – 45	587
45 – 50	4,172		45 – 50	4,172		45 – 50	1,192
50 – 55	6,962	==>	50 – 55	6,962	==>	50 – 55	1,990
55 – 60	12,029		55 – 60	12,029		55 – 60	3,438

[31] The reason no 65 years is chosen is the fact the number of retirees in table 11.1 in cohort 60-65 is significantly higher than of cohort 55-60. This is caused by retirement ages of lower than 65 years old and temporary old age pensions. It is therefore not realistic to assume all the retirees in cohort 60-65 are all widow pensioners. The assumption made makes the split in old age pension and widow pension more fair for cohort 60-65. After the split is made, the retirees with old age pension of cohort 60-65 will be aggregated with cohort 65-70 in order to meet the requirement of the ALM model.

In the first step we subtract the number of orphans in age cohort <20 till the number is zero. The remaining number of orphans (1,678) are subtracted from cohort 20-25. In the second step we subtract the members with a disability pension.

From the total of 138,496 members with a widow pension 7,633 members are accounted for in the age cohorts up to 60 years old. The age cohorts of 60 years and older will be split to old age pension and widow pension according to the ratio 326,518 / (326,518 + 138,496 -/- 7,633) to old age pension and ratio (138,496 -/- 7,633) / (326,518 + 138,496 -/- 7,633) to widow pension (see Table 12.3).

Since the retirement age in the ALM model is set at age 65 years old, the number of retired members with an old age pension in age cohort 60-65 will be grouped with age cohort 65-70 (see also note 23).

In order to construct the numbers of the "average" Dutch pension fund the numbers in Table 12.1 up to Table 12.3 must be divided by the total amount of pension funds which is according to the data of DNB be equal to 246 as per ultimo 2011[32].

The above steps leads to the numbers in Table 12.4.

Table 12.4

	Adjusted number of participants all Dutch company pension funds			
Age (years)	Active	Deferred	Retired old age pension	Retired widow pension
< 20	8,70	2,18	-	-
20 – 25	150,75	150,81	-	0,21
25 – 30	250,37	339,07	-	0,42
30 – 35	297,08	531,67	-	0,25
35 – 40	339,10	614,70	-	0,85
40 – 45	415,19	694,40	-	2,39
45 – 50	404,57	670,02	-	4,85
50 – 55	367,74	586,02	-	8,09
55 – 60	296,98	463,24	-	13,98
60 – 65	190,86	324,71	152,85	61,26
65 – 70	2,51	12,69	336,27	134,77
70 – 75	0,01	6,28	277,22	111,10
75 – 80	-	0,75	220,06	88,20
80 – 85	0,00	0,26	177,04	70,95
85 – 90	-	0,07	105,66	42,35
90 – 95	-	0,01	38,18	15,30
> 95	-	0,00	7,73	3,10

[32] Since the data in Table 12.1and Table 12.2 are per 2011 we use the number of company pension funds also as per 2011. Source: see note 30, table 8.8 on the website.

12.2 Model points

For the projection of future expected premiums and pension payments we also need assumptions about the salary and accrued pensions. Hereto we assume every member to follow the same career path. The following conditions determine the salary and the accrued pensions for each model point:

- Starting pension plan at age 20;
- Retirement age: 65;
- Salary at age 20: 20,000;
- Franchise at age 20: 12,000;
- Accrual percentage: 2,0% per year for old age pension;
- Widow pension (latent) is equal to 70% of old age pension;
- Widow pension (entered) is equal the amount as if the member would have accrued widow pension rights till the date of retirement;
- Wage inflation: 3%;
- Price inflation: 0,5%[33].

The fictive career path is shown in Table 12.5.

According to all the assumptions mentioned above a widow pension of 9,845 must be paid out to the survivor when a 40 year old active member dies. The 9,845 is calculated as the accrued widow pension (latent) (3,699) plus the time to retirement age (24) multiplied by the accrual (366) multiplied by 70%. However, when a 41 year old active member dies 10,090 has to be paid out as a widow pension instead of 9,845. So the height of the widow pension is dependent on the timing of death of the active member. Since the table shows only the widow pension (entered) in the case the active member just died, the pension rights are decreased with 40% in order to correct for the fact the time of death could have taken place back in time with corresponding lower accrued pension rights.

A similar correction of a 40% decrease is applied to the pension rights of deferred members. In state “deferred” the height of the pension rights is dependent on the time the active member switched jobs.

The complete set of model points used for the analysis with the ALM model is shown in Table 12.6. The age of the model point is average age of the age cohort rounded down. For some model points a different formula is chosen. These are the model points from aggregated age cohorts. For example, age cohort 60-65 was aggregated by age cohort 65-70 for old age pension. The age for model point 19 was therefore chosen at 65 years old instead of 67.

[33] According to the DNB data the average value of liabilities per Q1 2013 is just over 9 hundred million euro (source: see note 30, table 8.8 on the website). We lowered the indexation from 2.0% to 0.5% in order the value of the liabilities of the model points to become circa 9 hundred million euro.

Table 12.5

Age	Wage inflation	Price inflation	Salary	Franchise	Pension Base	Accruel	Accrued Old age pension	Accrued Widow pension (latent)	Widow pension (entered)
20	3.0%	0.5%	20,000	12,000	8,000	160	160	112	5,040
21	3.0%	0.5%	20,600	12,240	8,360	167	327	229	5,262
22	3.0%	0.5%	21,218	12,485	8,733	175	502	351	5,486
23	3.0%	0.5%	21,855	12,734	9,120	182	684	479	5,714
24	3.0%	0.5%	22,510	12,989	9,521	190	875	612	5,944
25	3.0%	0.5%	23,185	13,249	9,937	199	1.074	751	6,177
26	3.0%	0.5%	23,881	13,514	10,367	207	1.281	897	6,412
27	3.0%	0.5%	24,597	13,784	10,813	216	1.497	1,048	6,649
28	3.0%	0.5%	25,335	14,060	11,275	226	1.723	1,206	6,889
29	3.0%	0.5%	26,095	14,341	11,754	235	1.958	1,371	7,130
30	3.0%	0.5%	26,878	14,628	12,250	245	2.203	1,542	7,373
31	3.0%	0.5%	27,685	14,920	12,764	255	2.459	1,721	7,618
32	3.0%	0.5%	28,515	15,219	13,296	266	2.725	1,907	7,864
33	3.0%	0.5%	29,371	15,523	13,847	277	3.002	2,101	8,111
34	3.0%	0.5%	30,252	15,834	14,418	288	3.290	2,303	8,359
35	3.0%	0.5%	31,159	16,150	15,009	300	3.591	2,513	8,607
36	3.0%	0.5%	32,094	16,473	15,621	312	3.903	2,732	8,855
37	3.0%	0.5%	33,057	16,803	16,254	325	4.228	2,960	9,104
38	3.0%	0.5%	34,049	17,139	16,910	338	4.567	3,197	9,352
39	3.0%	0.5%	35,070	17,482	17,588	352	4.919	3,443	9,599
40	3.0%	0.5%	36,122	17,831	18,291	366	5.285	3,699	9,845
41	3.0%	0.5%	37,206	18,188	19,018	380	5.665	3,966	10,090
42	3.0%	0.5%	38,322	18,552	19,770	395	6.061	4,243	10,332
43	3.0%	0.5%	39,472	18,923	20,549	411	6.472	4,531	10,572
44	3.0%	0.5%	40,656	19,301	21,355	427	6.900	4,830	10,809
45	3.0%	0.5%	41,876	19,687	22,188	444	7.344	5,141	11,043
46	3.0%	0.5%	43,132	20,081	23,051	461	7.805	5,464	11,273
47	3.0%	0.5%	44,426	20,483	23,943	479	8.285	5,799	11,498
48	3.0%	0.5%	45,759	20,892	24,866	497	8.782	6,148	11,718
49	3.0%	0.5%	47,131	21,310	25,821	516	9.299	6,509	11,932
50	3.0%	0.5%	48,545	21,736	26,809	536	9.836	6,885	12,140
51	3.0%	0.5%	50,002	22,171	27,831	557	10.393	7,275	12,340
52	3.0%	0.5%	51,502	22,614	28,887	578	10.971	7,680	12,533
53	3.0%	0.5%	53,047	23,067	29,980	600	11.571	8,100	12,717
54	3.0%	0.5%	54,638	23,528	31,110	622	12.194	8,536	12,891
55	3.0%	0.5%	56,277	23,999	32,279	646	12.840	8,988	13,055
56	3.0%	0.5%	57,966	24,479	33,487	670	13.511	9,457	13,208
57	3.0%	0.5%	59,705	24,968	34,736	695	14.206	9,944	13,348
58	3.0%	0.5%	61,496	25,468	36,028	721	14.927	10,449	13,476
59	3.0%	0.5%	63,341	25,977	37,364	747	15.675	10,973	13,588
60	3.0%	0.5%	65,241	26,496	38,744	775	16.451	11,516	13,685
61	3.0%	0.5%	67,198	27,026	40,172	803	17.255	12,079	13,766
62	3.0%	0.5%	69,214	27,567	41,647	833	18.089	12,662	13,828
63	3.0%	0.5%	71,290	28,118	43,172	863	18.953	13,267	13,872
64	3.0%	0.5%	73,429	28,681	44,748	895	19.849	13,895	13,895
65	3.0%	0.5%	75,632	29,254	46,378	-	19.850	13,895	13,895
66	3.0%	0.5%	77,901	29,839	48,062	-	19.851	13,896	13,896
67	3.0%	0.5%	80,238	30,436	49,802	-	19.852	13,897	13,897
68	3.0%	0.5%	82,645	31,045	51,600	-	19.853	13,897	13,897
69	3.0%	0.5%	85,124	31,666	53,459	-	19.854	13,898	13,898
70	3.0%	0.5%	87,678	32,299	55,379	-	19.855	13,899	13,899

Table 12.6

Model point	Gender	Age	State	Number	Salary	Accrued Old age pension	Accrued Widow pension
1	Male	20	Active	159.45	20,000	160	112
2	Male	27	Active	250.37	24,597	1.497	1.048
3	Male	32	Active	297.08	28,515	2.725	1.907
4	Male	37	Active	339.10	33,057	4.228	2.960
5	Male	42	Active	415.19	38,322	6.061	4.243
6	Male	47	Active	404.57	44,426	8.285	5.799
7	Male	52	Active	367.74	51,502	10.971	7.680
8	Male	57	Active	296.98	59,705	14.206	9.944
9	Male	62	Active	193.39	69,214	18.089	12.662
10	Male	20	Deferred	152.99	-	96	67
11	Male	27	Deferred	339.07	-	898	629
12	Male	32	Deferred	531.67	-	1.635	1.144
13	Male	37	Deferred	614.70	-	2.537	1.776
14	Male	42	Deferred	694.40	-	3.637	2.546
15	Male	47	Deferred	670.02	-	4.971	3.480
16	Male	52	Deferred	586.02	-	6.583	4.608
17	Male	57	Deferred	463.24	-	8.524	5.967
18	Male	62	Deferred	344.77	-	10.853	7.597
19	Male	65	Old age pension	489.12	-	19.850	13.895
20	Male	72	Old age pension	277.22	-	19.857	13.900
21	Male	77	Old age pension	220.06	-	19.862	13.904
22	Male	82	Old age pension	177.04	-	19.867	13.907
23	Male	87	Old age pension	105.66	-	19.872	13.911
24	Male	92	Old age pension	38.18	-	19.877	13.914
25	Male	97	Old age pension	7.73	-	19.882	13.918
26	Female	22	Widow pension	0.21	-	3.292	-
27	Female	27	Widow pension	0.42	-	3.990	-
28	Female	32	Widow pension	0.25	-	4.718	-
29	Female	37	Widow pension	0.85	-	5.462	-
30	Female	42	Widow pension	2.39	-	6.199	-
31	Female	47	Widow pension	4.85	-	6.899	-
32	Female	52	Widow pension	8.09	-	7.520	-
33	Female	57	Widow pension	13.98	-	8.009	-
34	Female	62	Widow pension	61.26	-	8.297	-
35	Female	67	Widow pension	134.77	-	8.338	-
36	Female	72	Widow pension	111.10	-	8.340	-
37	Female	77	Widow pension	88.20	-	8.342	-
38	Female	82	Widow pension	70.95	-	8.344	-
39	Female	87	Widow pension	42.35	-	8.346	-
40	Female	92	Widow pension	15.30	-	8.348	-
41	Female	97	Widow pension	3.10	-	8.351	-

13 Appendix D – Characteristics economic scenarios