The Dutch Pensionfund Situation: Declining Funding Ratio's "A practical approach"

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Summary

Declined funding ratios, caused by huge negative returns on equities in the last years, brought up a new discussion to pensionfunds in general and certainly in the Netherlands. This discussion is: do the shrunken surpluses lead us necessarily to an investment strategy with a much lower risk level then it used to be? And if so, how can this be achieved? What other instruments are available for keeping the financial structure of the pensionfunds healthy?

Have ALM studies failed in warning us about the indeed very small, but obviously also realistic possibility of a stress scenario? Are ALM studies out or should we consider these tools still as useful?

Another issue is the impact of an aging population (baby boomers). This is not unexpected but has become urgently now. We are dealing with shortness on the labour market. This means that it is logical to shift up the retirement age in pension plans (or other early retirement plans). One of the possibilities of keeping pension costs on a controllable and reasonable level is to simplify the pension schemes, but this means also affecting the quality. This we will analyse.

In this paper we analyse several solutions that might be useful in solving the problems of increasing pension costs and the problems of increasing possibilities of underfunding connected with low funding ratio's caused by negative performance on investments. We also analyse the historic developments of the pension environment in the Netherlands, and the role ALM plays in that development.

1. Introduction

In this paper, we discuss the implications of fallen funding ratios and shrunken surpluses of (Dutch) pensionfunds. In section 2 of this paper we analyse in what way Asset Liability Management studies may help us in general. There may be some doubt if ALM is still useful, because especially the board of trustees feel that ALM failed in warning us about the possibility of a stress scenario. In section 3, therefore we explain the important role of ALM in the development of a pension scheme (a case study). Funding ratios have fallen dramatically. In section 4 is shown, by using a formalised pensionfund as a case, the development of the funding over the last years, and the possible implications for contributions and indexation. Besides contributions, indexation and investment policy, the pension scheme itself can be used as an instrument for steering. This is discussed in section 5. Moving on to investment strategies: in section 6 we analyse the role that alternative investments might play in diversifying and in reducing the risk of underfunding. In chapter 7, we sum up.

The ALM model that is used for the calculations for this paper is described in the appendix.

2. The purpose and use of Asset Liability Management

ALM evolved highly through the years. The accent has moved from purely optimisation of the asset-mix to optimisation of the pension finance as a whole and integral risk management. The purpose of ALM includes optimisation of return and risk on investments and offers a tool for risk management in general. Risk management covers the field of risk analysis (what to do if expectations are not met), sensitivity analyses (which factors do have the most important influence on the financial position) and stress tests (to what extend will sudden events have their impact and how strong is the power to recover). ALM gives insight into which is the most effective contribution policy. Indexation policy: the indexation of pensions might be conditional or non-conditional. However, the public regards conditional indexation as unconditional. In general, ALM can be seen as an instrument for helping to get an answer to the question what price for certainty is acceptable and what level of funding is most optimal.

One of the possible uses of ALM is constructing rules for conditional levels of indexation and conditional levels of contribution. An example of this is given hereafter:

INDEXATION	FUNDING	CONTRIBUTION
	140% and higher	contribution holiday
	135%	
	130%	Y% of coming service
wages index	**125%**	
	120%	
	115%	coming service only
consumer price index	**110%**	
consumer price index minus X%	**105%**	coming service plus backservice
no indexation at all	**100% and lower**	extra payments by the sponsor

Such a decision table might be constructed using ALM modelling, as showed below. A funding ratio in de range of 120% to 130% seems in general to be appropriate to ensure a certain guarantee of indexation against a reasonable level of contribution.

ASSET MIX

40%	equities
15%	property
45%	bonds (calculated)

INITIONAL VALUES OF INPUT

130%	funding level
0%	refund on contributions
100	starting level contribution
1000	present value liabilities
80	actuarial cost price
40	pensions

CONTRIBUTION POLICY

100%	target funding level
100%	risk funding level
0%	new level refund on contributions
0,0%	yearly increase of contributions

ECONOMIC EXPECTATIONS

5,0%	long term interest
2,0%	inflation / indexation
3,0%	riskpremium equities
2,0%	riskpremium property
0,0%	extra return on bonds
1	risk horizon in years

FIXED INPUT

4%	discount rate liabilities

DEMOGRAPHICS rate of growths on:

2,0%	actuarial cost price
2,0%	available contributions
2,0%	pensions

return (output)

6,5%	*portfolio return*
2,0%	*indexation*
4,0%	*discountrate liabilities*
0,5%	*netto real return*

FUNDING LEVEL (left hand scale) and CONTRIBUTION (right hand scale)

average probability of underfunding against the given risk-level (in 20 resp. 10 years)
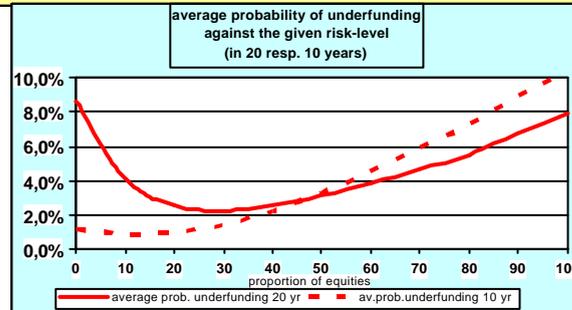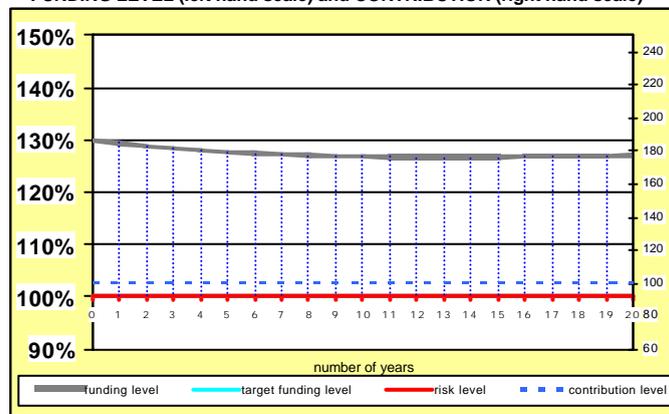
In this example, a funding level of 130% can be maintained with 40% in equities in the asset mix. The probability of underfunding is up to 40% in equities very acceptable with a level of 2%. A real interest rate of 3% is assumed (5% long-term interest minus 2% inflation).

3. The role of ALM in the development of a pension scheme (a case study)

Why is there ALM? How could we make our policies in the past without ALM?
Let us have a look to the history of PMA Pensionfund.

PMA was founded in 1957. There was no backservice, pensions were created for the years from 1957 on. The pension claims were based on fixed amounts, not related to salaries. Backservice was conditional, and was financed through extra contributions paid by the employers over a few years. So all the provisions were either conditional or unrelated to salaries and were certainly not indexed. There was a strong solidarity from employers with employees and between employees. Investment policy was mainly bonds and loans. There was no need for asset and liability management (and this was also not available, although one must say that insurance companies already introduced matching in the fifties).

After a shift from fixed provisions to a scheme based on average income, PMA changed in the early seventies to indexed average income. The yearly indexation was defined as conditional and was related to the out-performance on investments. To maintain a stable indexation the asset mix included bonds only, with a nominal valuation, which was rather common in those days. In the seventies inflation was very high. To build in a reasonable possibility of substantial level of indexation, the discount rate for the actuarial cost price and for the valuation of the liabilities was fixed on 1%, which was (and is) very low and very safe. Still no ALM was needed because the indexation of the pensions was conditional and because equities were leaved out. Most of the risks were put with the participants and not with the sponsor.
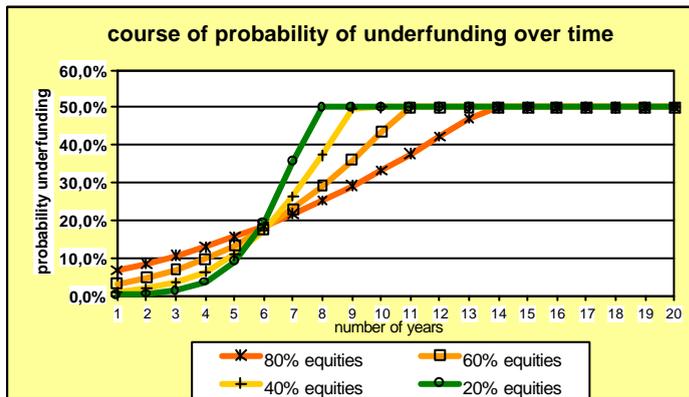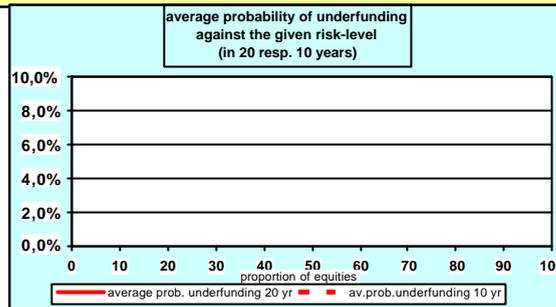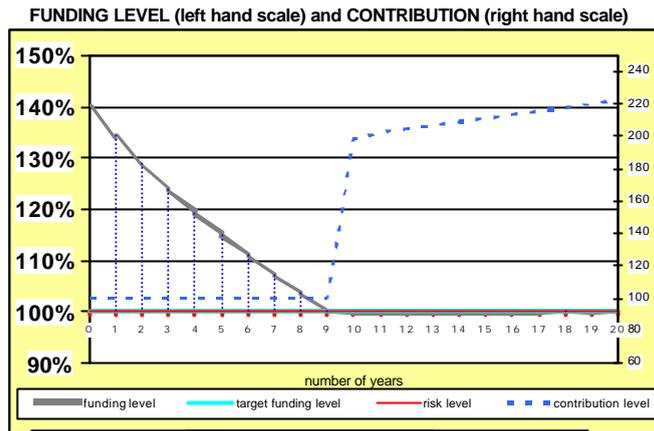
In the nineties PMA moved to a more common way of indexation: indexation related to wage inflation and not depending anymore on the (out) performance of the bond portfolio. At the same time, a shift was made to an asset mix including equities and property with valuation of the assets based on market value. The discount rate for calculation of the present value of the liabilities was raised from 1% to 3%. The risk of indexation of the pensions was transferred from the participants to the sponsor. These decisions were supported by an ALM study.

4. Implications of declining funding ratios for contributions and indexation

Looking to Dutch pensionfunds, average funding ratios declined from 150% at the end of the year 1999 to 140% in 2000, to 125% in 2001 and to an estimated 105% at the end of 2002. An illustration of the implications of this movement of funding ratios is given below, by using a formalised pensionfund.

In this case, study the funding ratio is supposed to be 140% at the end of 2000. Let us assume that contributions were reduced at that time by 40% (a refund was given). The discount rate for the liabilities is 4%. The projection of the funding in the coming 20 years and the probabilities of underfunding for various proportions of equities are as follows:

ASSET MIX
- **40%** equities
- **10%** property
- **50%** bonds (calculated)

INITIONAL VALUES OF INPUT
- **140%** funding level
- **40%** refund on contributions
- **100** starting level contribution
- **1000** present value liabilities
- **80** actuarial cost price
- **35** pensions

CONTRIBUTION POLICY
- **100%** target funding level
- **100%** risk level of funding
- **40%** new level refund on contributions
- **0,0%** yearly increase of contributions

ECONOMIC EXPECTATIONS
- **5,0%** long term interest
- **3,0%** inflation / indexation
- **3,0%** riskpremium equities
- **2,0%** riskpremium property
- **0,0%** extra return on bonds
- **1** risk horizon in years

FIXED INPUT
- **4%** discount rate liabilities

DEMOGRAPHICS rate of growths on:
- **5,0%** actuarial cost price
- **4,0%** available contributions
- **8,0%** pensions

return (output)
- *6,4%* portfolio return
- *3,0%* indexation
- *4,0%* discountrate liabilities
- *-0,6%* netto real return

FUNDING LEVEL (left hand scale) and CONTRIBUTION (right hand scale)

average probability of underfunding against the given risk-level (in 20 resp. 10 years)

course of probability of underfunding over time

Assuming 5% nominal interest rate and 3% inflation / indexation, the funding level sinks in 9 years below the level of 100%. Contributions have to rise dramatically. The probabilities of underfunding are far too high (exceeding 10%).

At the end of the year 2002, the average funding level for Dutch pensionfunds declined from 140% to 105%, which is very low. The Dutch supervisory board demands funding levels of at least 105% in the short term and around at least 120 to 125% on the somewhat longer term, depending on the proportion of real assets in the mix and depending on relative market values. Let us assume that the pensionfund in this case has arranged (recovery plan) to jack up the funding in a few years to 120% as being a strategical level of funding, fitting with a certain target asset mix. Of course, the first thing to do is to withdraw the refund on contributions, which was initional 40% in this case. Leaving further assumptions unchanged, the projection is as follows:

ASSET MIX
40%   equities
10%   property
50%   bonds (calculated)
INITIONAL VALUES OF INPUT
120%   funding level
40%   refund on contributions
100   starting level contribution
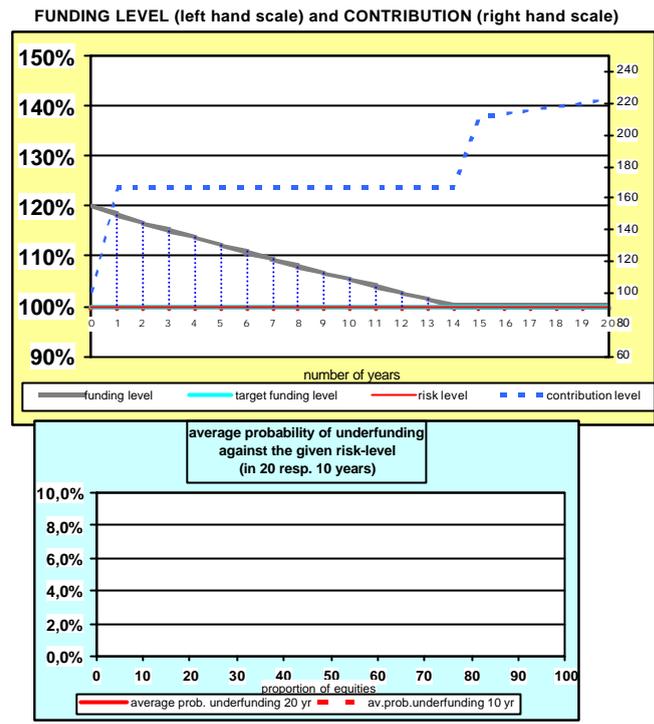1000   present value liabilities
80   actuarial cost price
35   pensions
CONTRIBUTION POLICY
100%   target funding level
100%   risk level of funding
0%   new level refund on contributions
0,0%   yearly increase of contributions
ECONOMIC EXPECTATIONS
5,0%   long term interest
3,0%   inflation / indexation
3,0%   riskpremium equities
2,0%   riskpremium property
0,0%   extra return on bonds
1   risk horizon in years
FIXED INPUT
4%   discount rate liabilities
DEMOGRAPHICS rate of growths on:
5,0%   actuarial cost price
4,0%   available contributions
8,0%   pensions
return (output)
6,4% *portfolio return*
3,0% *indexation*
4,0% *discountrate liabilities*
-0,6% *netto real return*

FUNDING LEVEL (left hand scale) and CONTRIBUTION (right hand scale)

number of years

— funding level   — target funding level   — risk level   - - - contribution level

average probability of underfunding against the given risk-level (in 20 resp. 10 years)

proportion of equities

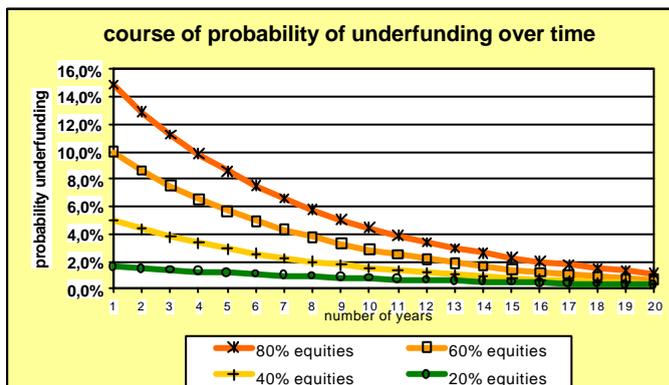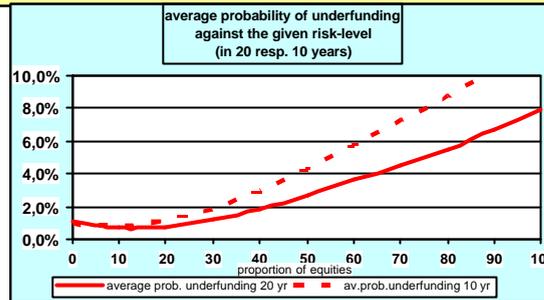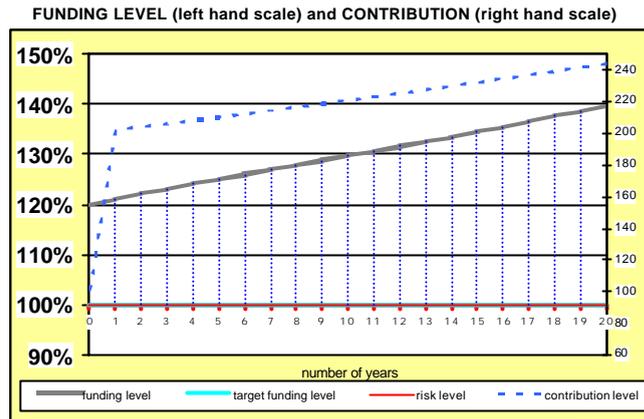— average prob. underfunding 20 yr   - - av.prob.underfunding 10 yr

It is obvious that withdrawing existing refunds on contribution and keeping the target funding level on 120% is not sufficient. The main reason for this is the negative real return on investments for the pensionfund as a whole (6,4% portfolio return minus 3% indexation and minus 4% discount rate on liabilities, makes minus 0,6%).

What this pensionfund in this case could do is:

a. to change the target for indexation of the pensions from wage inflation to price inflation. Assuming the difference is 1%, the projected indexation is 2% instead of 3%.

b. another measure is to postpone the indexation. This is to consider as an action of emergency on the very short term and is therefore not further discussed in this case study.

c. to add around 20% to the contribution, for several years, to create a extra surplus

d. as the previous picture shows, the expected growth rate for actuarial cost price is 5%. The expected growth rate of available contributions is 4%. The reason is that the future actuarial cost price is affected by the rising cost of financing the future early retirement pensions, as being a part of the pension scheme. Therefore, it seems to be necessary to raise the level of the contributions with yearly 1% (4% minus 3%) to keep up with the development of the actuarial cost price.

The results of these measures are shown in the next picture:

ASSET MIX

40%	equities
10%	property
50%	bonds (calculated)

INITIONAL VALUES OF INPUT

120%	funding level
40%	refund on contributions
100	starting level contribution
1000	present value liabilities
80	actuarial cost price
35	pensions

CONTRIBUTION POLICY

100%	target funding level
100%	risk level of funding
-20%	new level refund on contributions
1,0%	yearly increase of contributions

ECONOMIC EXPECTATIONS

5,0%	long term interest
2,0%	inflation / indexation
3,0%	riskpremium equities
2,0%	riskpremium property
0,0%	extra return on bonds
1	risk horizon in years

FIXED INPUT

4%	discount rate liabilities

DEMOGRAPHICS rate of growths on:

5,0%	actuarial cost price
4,0%	available contributions
8,0%	pensions

return (output)

6,4%	*portfolio return*
2,0%	*indexation*
4,0%	*discountrate liabilities*
0,4%	*netto real return*

FUNDING LEVEL (left hand scale) and CONTRIBUTION (right hand scale)

Legend: funding level — target funding level — risk level — contribution level

average probability of underfunding against the given risk-level (in 20 resp. 10 years)

Legend: average prob. underfunding 20 yr — av.prob.underfunding 10 yr

course of probability of underfunding over time

Legend: 80% equities — 60% equities — 40% equities — 20% equities

The level of the probability of underfunding decreases in around 7 years to below 2% (for an asset mix with 40% in equities), which is nice. In this case study a refund of 40% was allowed, which means an initional level of 0,6 contribution. Adding 20% to the contribution means a level of 1,2 contribution. The real effect is 200%, starting in year one. Therefore, the price for security is very high, the level of contribution has to double for some years. In addition to that, there is the yearly increase of the contribution with 1% to stay in line with the actuarial cost price. After 20 years, the index of the contribution is around 240%.

5. The pension scheme as an instrument for steering

One might raise the question if the present crisis on the financial markets in combination with aging population urges the pension world to break down the quality of our pension system.

The picture of the "pension cycle" might be:

the stage of building up:

- limited pension schemes for relatives
- fixed income schemes
- defined contribution schemes
- schemes of average income without the indexation component
- average salary including indexation
- final pay
- early retirement plans
- refunds on contribution

the stage of break down might be:

- final pay becomes indexed average income
- the withdrawal of refunds on contribution
- extra contributions
- lower indexation or limited indexation
- back to DC
- raising the age of retirement
- lowering the level of early retirement pensions

One must say that the process of affecting the quality of pension schemes has already started. In many cases, final pay is shifted into average income schemes for reasons of cost transparency and cost controlling (stability). Especially in the UK defined benefit schemes are closed down in favour of defined contribution. In the Netherlands, this is not yet in general the case, but is in discussion. In addition, the debate has started about raising the retirement age, in not only the Netherlands but also more in general in Europe. Although the content of the pension scheme really is an instrument for steering the financial position of the pensionfund, let us hope that the problems pensionfunds are in, will not lead to a complete demolishment of the system.

6. The asset mix as an instrument for steering

In this paper, it is illustrated that various measures could be taken to keep funding on certain levels, using contribution and indexation as instruments for steering. Besides these two instruments, one could strive to lower the risk of underfunding by changing the structure of the asset mix.

In general, Dutch pensionfunds hold an asset mix with only a few alternatives. The WM report "Performance Analytics, year 2002" shows that only in very limited cases alternative investments are included in the assets as measured by WM (at the end of 2002 only 1%). But also a category as property seems to be under represented.

The next table shows the asset mixes over the last 10 years.

asset - mix Dutch pensionfunds, in percentages of total portfolio										
	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993
bonds	49	44	48	43	50	52	55	58	57	56
equities	36	44	41	47	39	37	31	29	29	29
property	12	11	10	9	10	10	11	11	13	13
cash / alternatives	3	1	1	1	1	1	3	2	1	2

source: WM Company

If we look for a mix with a lower downside risk, one could think about an investment policy where risk is reduced and transferred from one category to another with the purpose of changing the overall risk profile and controlling and limiting the risk.
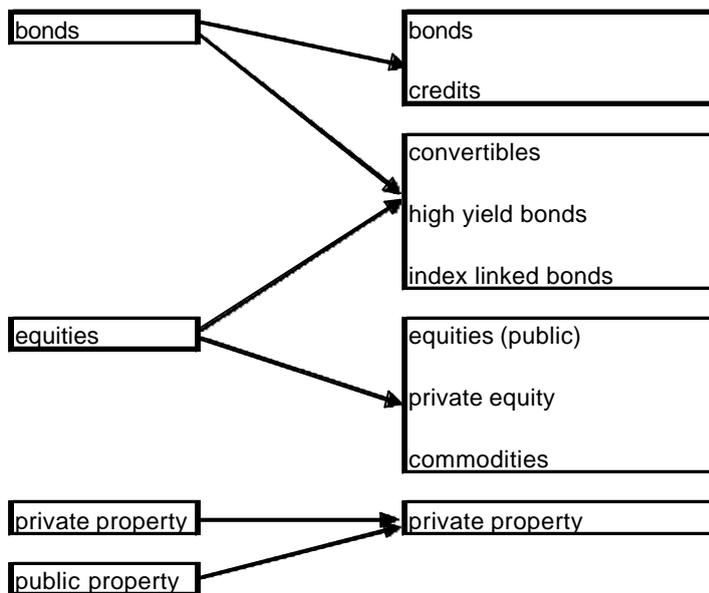
Before analysing such an alternative portfolio, let us look at the impact of lowering the portfolio risk on the pensionfund risk, in terms of probabilities of underfunding. For this purpose, a fixed asset mix is supposed with 40% equities, 50% bonds and 10% property.

economic environment

return on bonds	5%
equity risk premium	3%
property risk premium	2%
inflation - indexation	3%

valuation

real discount rate liabilities	3%

asset mix (fixed)

equities	40%
bonds	50%
private property	10%

return, variance - covariance matrix

	return	standard deviation	correlation equities	bonds	property
equities	8%	21,30%	1		
bonds	5%	7,30%	0,35	1	
property	7%	8,80%	0,10	0,10	1

average probabilities of underfunding in 10 years, for various portfolio risks and funding ratio´s
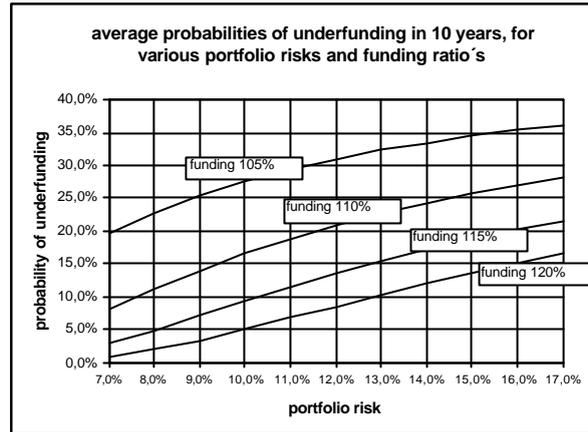
Reducing the portfolio standard deviation with two or three percent-points lowers the probability of underfunding significantly with some five percent points, depending on the initional level of funding. It is obvious that the impact of a lower risk is the most effective for a low funding ratio. Whilst it seems to be worthwhile to strive for a lower risk, the graph indicates that a level of funding of 105% to 110% in fact shows a probability of underfunding that is basically too high. This means that in this case the pensionfund has to work on a plan for recovery to bring the funding on a substantial higher level. We leave this apart for further study.

We find possibilities for lowering the risk in the following transitions:

- adding convertibles to a balanced portfolio of bonds and equities
- adding high yield bonds to a balanced portfolio of bonds and equities
- adding index linked bonds in general
- adding private equity to public equity
- adding commodities to equities
- substitute public property for private property

In the following graphs is illustrated the effect of changing existing portfolio's in alternative ones.

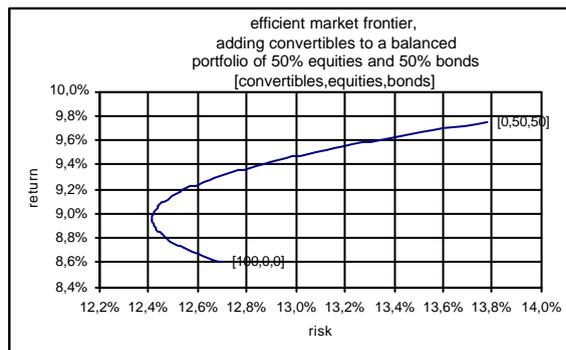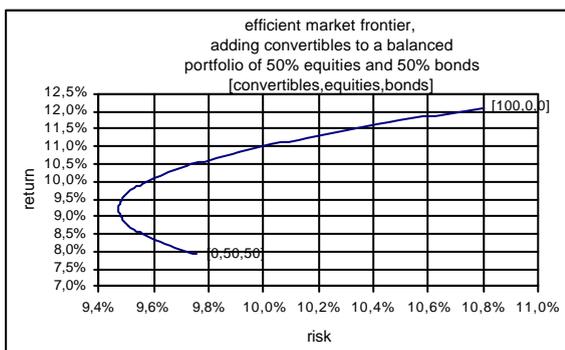**CONVERTIBLES**

European Convertible Bonds, 1995 - Febr. 2003

	return	risk	correlation convertibles	equities	bonds
convertibles	12,1%	10,8%	1		
equities	8,2%	18,4%	0,8	1	
bonds	7,6%	3,8%	-0,1	0,2	1

source: Fortis, MSCI, Merrill Lynch, JP Morgan

USA Convertible Bonds, 1973 - 2001

	return	risk	correlation convertibles	equities	bonds
convertible	8,6%	12,7%	1		
equities	13,2%	20,2%	0,8	1	
bonds	6,3%	11,2%	0,5	0,5	1

source: Fortis, Goldman Sachs

efficient market frontier, adding convertibles to a balanced portfolio of 50% equities and 50% bonds [convertibles,equities,bonds]

efficient market frontier, adding convertibles to a balanced portfolio of 50% equities and 50% bonds [convertibles,equities,bonds]

As always, the outcomes are strongly depending on the input. Markowitz optimisation processes are very sensitive for input variables especially concerning return figures. For the analyses of the convertibles, as presented above, we see what difference it makes if the period 1995 – Feb. 2003, European market, is chosen or the period 1973 – 2001 for the USA market. In the second case with a rather relative low total return on convertibles, the efficient frontier is inverse and adding convertibles lowers the risk but also lowers the return. However, in both cases the risk is reduced by adding convertibles.

The effect on the risk return figures for the combinations of high yield bonds, equities and bonds is also strongly depending on input. The graph on the left shows an inverse efficient frontier, caused by the relative low performance on high yield against 10-year Treasury bonds in the period 1985 – 2002. If we assume a spread of 3% (based on the period 1989 -2001) between these two asset classes, the risk return figure is quite more appealing.

HIGH YIELD BONDS

USA High Yield Bonds, 1985 - 2002

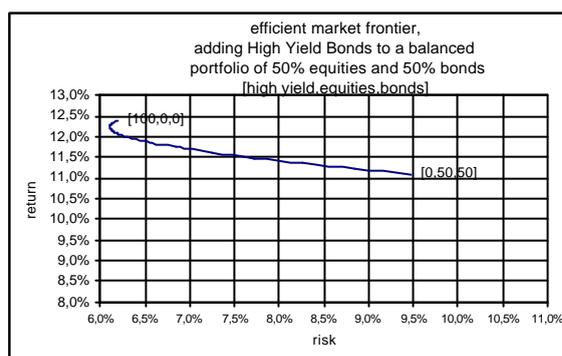|	return	risk	correlation		
			H Y Bonds	S&P 500	T-Bonds
H Y bonds	9,0%	6,2%	1		
S&P 500	12,8%	15,9%	0,5	1	
10 y-T Bonds	9,4%	7,6%	0,2	0,2	1

source: Robeco, Merrill Lynch, JP Morgan
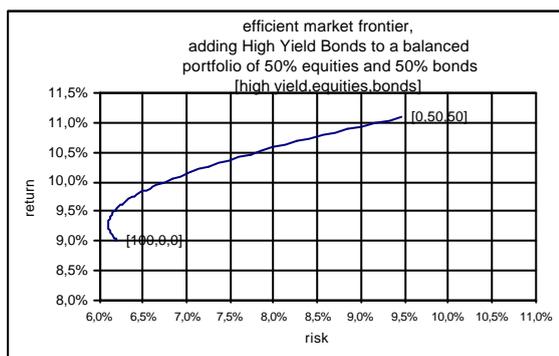
USA High Yield Bonds, 1989 - 2001, returns based on spreads

	return	risk	correlation		
			H Y Bonds	S&P 500	T-Bonds
H Y bonds	12,4%	6,2%	1		
S&P 500	12,8%	15,9%	0,5	1	
10 y-T Bon	9,4%	7,6%	0,2	0,2	1

source: Robeco, Merrill Lynch, JP Morgan

efficient market frontier, adding High Yield Bonds to a balanced portfolio of 50% equities and 50% bonds [high yield,equities,bonds]

efficient market frontier, adding High Yield Bonds to a balanced portfolio of 50% equities and 50% bonds [high yield,equities,bonds]
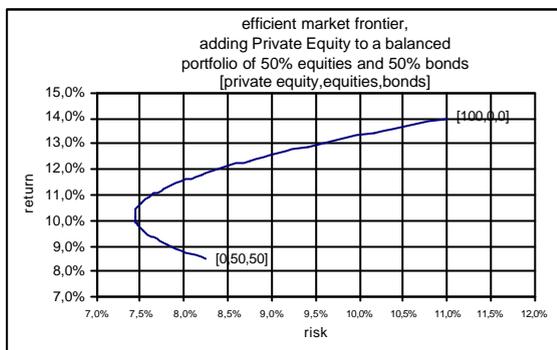
In the last two examples, figures are given for combinations of private equity, public equity and bonds and for the mix of commodities and equity as well. In both cases, the risk is reduced whilst at the same time return is added.

USA Private Equity

	return	risk	correlation		
			Private eq.	equity	bonds
Private equity	14,0%	11,0%	1		
equity	9,0%	16,0%	0,3	1	
bonds	8,0%	4,0%	0	0	1

source: Robeco, MeesPierson, Sovereign Financial Services, MSCI

efficient market frontier,
adding Private Equity to a balanced
portfolio of 50% equities and 50% bonds
[private equity,equities,bonds]

	return	risk	correlation	
			commodities	equity
commodities	11,0%	18,0%	1	
equity	9,0%	16,0%	-0,3	1

source: Robeco, Goldman Sachs, MSCI

efficient market frontier,
adding commodities to a portfolio of equities
[commodities,equities]
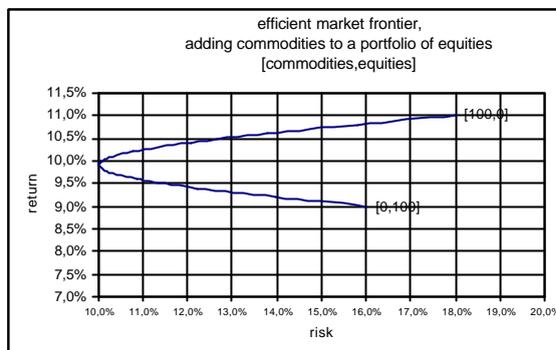
The conclusion of this last chapter is that reducing risk is possible by diversifying assets, but the overall effect is depending on the measured period. Apart from that, instruments like index-linked bonds will play an important role in the investment strategies of pensionfunds, for reasons of matching the inflation risk as the most important pensionfund risk. They role of direct property might be considered as under exposed. If this asset class is seen as a long-term investment where illiquidity is not so important, 10 to 20% in private property delivers a lot of diversification and some inflation hedge.

7. Conclusions

Asset Liability models are still very useful in developing pension schemes and in analysing pensionfund risks. In today's pensionfund world, conditional indexation of pensions and conditional contribution is more and more common. ALM helps in finding a suitable decision table. Funding ratios have fallen to dangerous low levels. ALM modelling can help finding a target funding level and can analyse which measures could be taken to define a glide path from the actual funding level to the strategical funding level. Finally, ALM is necessary to construct alternative asset-mixes, which can deliver lower probabilities of underfunding for a pensionfund.

APPENDIX

The ALM model used for this paper

ALM models are often complicated and therefore difficult to understand, not only by the board of trustees (who have to make the decisions) but also by the managers of the pensionfunds themselves. To fulfil the need of a clear model we have developed an ALM model that will deliver results in an interactive way.

The model has to produce
- ❑ clear and understandable calculations
- ❑ clear scenario analyses
- ❑ clear input and output
- ❑ real time calculations without waiting time

with the purpose to
- ❑ help the board in defining the task for the ALM specialist (internal or external)
- ❑ help the board in asking the right questions
- ❑ help the board in understanding the results of the "actual" study

There are two reasons that often make ALM models rather complicated and slow:
- ❑ stochastic approaches
- ❑ demographic / actuarial calculations

For the purposes as mentioned above, we find it sufficient to stick to the deterministic approach and to express the probabilities of underfunding by using a normal distribution of investment returns around the central projection.

Since demographic and actuarial developments are basically not related to economical environments, the actuarial calculations and demographic developments are separated from the actual ALM model. The calculation of the expected actuarial and available contributions and cash flows is done separately from the model in an earlier stage, and than transferred into the model through an interface. In the ALM-calculations, the given flow of nominal contributions and liabilities is made subject to economical and demographical variables. So the impact of inflation, wage inflation, and certain demographic developments is added afterwards. The model is strongly based on a retrospective approach instead of a prospective one.

The model is built on the following basic ideas:

BALANCE SHEET

ASSETS (A)	LIABILITIES (L)
	SURPLUS (S)
Funding ratio: A / L	

Retrospective development of the liabilities:

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$$\delta\,(L) = AC - PP + AI * (L + AC - PP) + IB * L$$

where

AC = Actuarial Cost price
PP = Pension payments
AI = Actuarial Interest (percentage)
IB = Indexation backservice (percentage)

Development of the surplus:

$$\delta\,(S) = (TIR - AI - IB) * (L + AC - PP) + TIR * S - ROC$$

where

TIR = Total Investment Return (percentage)
ROC = Reduction On Contributions = AC - CA
     where CA = contributions available

and where excess investment return is created over the liabilities and total investment return over the surplus

and where
- ❑ the actuarial cost price contents all components and costs of backservice
- ❑ pensions include costs of payment
- ❑ indexation backservice include all participants (active, deferred and pensioners)
- ❑ reduction on contributions is the difference between the required actuarial cost price and the available contributions paid by sponsor and participants

Actuarial neutral
The model is neutral on actuarial results, which means that, except for the result on interest, actuarial results on mortality, disability and administration costs, are supposed to be neutral. So actuarial assumptions does not affect the surplus in the model.

Pension scheme
The input of the cash flow of contributions and pensions is for the total of the provisions offered through the scheme. There is no need to calculate the liabilities for the separate components of the scheme, which is also a contribution to the speed of the ALM program.

Cash flow
The cash flow of actuarial contributions, available contributions and pensions paid, is on a nominal basis. The initial values of these flows are adjusted over time for inflation and (if relevant) for demographic developments.

Using the relations for liabilities and surplus, as mentioned earlier:

$$\delta (L) = AC - PP + AI * (L + AC - PP) + IB * L$$

where

AC = Actuarial Cost price
PP = Pension payments
AI = Actuarial Interest (percentage)
IB = Indexation backservice (percentage)

$$\delta (S) = (TIR - AI - IB) * (L + AC - PP) + TIR * S - ROC$$

where

TIR = Total Investment Return (percentage)
ROC = Refund On Contributions = AC - CA
        where CA = contributions available

we find (simplifying L)

$$\delta (L) = (AC - PP) + (AI + IB) * L$$
$$\delta (S) = (TIR - AI - IB) * L + TIR * S - ROC$$

the funding ratio develops in one year as follows:

$$(A / L) t+1 = [L + S + \delta (L) + \delta (S)] \ / \ [L + \delta (L)] =$$

$$[L + S + (AC - PP) + TIR * (L + S) - ROC] \ / \ [L + (AC - PP) + (AI + IB) * L]$$

so we see that the development of the funding ratio depends on
❑   the net cash flow (actuarial cost price minus pensions paid)
❑   the (excess) return on investments
❑   the refund on contributions