Solvency Margin and Investment Risk for Pension Funds in The Netherlands

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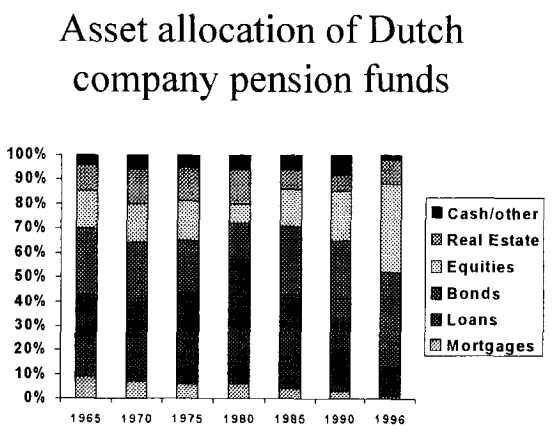
Abstract/Resume

The Dutch Insurance Supervisory Board (ISB) has issued Actuarial Principles for Pension Funds in 1997. An important element of these principles is that a pension fund should have a solvency margin for the investment risks. Actuaries en pension funds have studied this element and have developed various methods for the calculation of the solvency margin. The ISB has not prescribed an official method to be used, however some employees of the ISB have launched a specific approach. A description of the Actuarial Principles for Pension Funds in The Netherlands is given in the first part of this paper. The second part of the paper provides a brief overview of the methods used in practice to calculate the required solvency margin in respect to the investment risk. An analysis is given of the approach that has recently been brought up by some employees of the ISB. It will be shown that this method can lead to results that in our opinion are inappropriate as a general requirement for Dutch pension funds.

Keywords
Solvency margin, Investment risk, Actuarial Principles, Pension Funds

Introduction

During the last two decades the size of pension funds in The Netherlands has grown enormously. From 1970 until the end of 1993 the assets of company pension funds and industry wide pension funds together, grew from 20 billion guilders (9 billion euro) to 275 billion guilders (125 billion euro). At the end of 1996 the assets amounted to 580 billion guilders (263 billion euro). During the same period of time the strategic asset mix of most pension funds moved towards significantly more equity exposure. This shift in asset allocation is shown for company pension funds:



Source: Insurance supervisory board of The Netherlands

During the last five years a discussion has been going on about how to deal with the increased volatility of the assets. As we showed not only the strategic asset mix changed significantly, also the volatility of the financials markets went up. At the same time, influenced by international common practice, the valuation of the assets changed from conservative book values to more realistic but less stable market value. The valid question arose: how to deal with (increased) investment risks?

Furthermore you should know that the liabilities in The Netherlands are still valued at a fixed discount rate of 4% (for most pension funds). So the liabilities do neither show an explicit link with the return on investments nor with the yield on government bonds. In summary we have the situation of no volatility in the liabilities because of a fixed discount rate together with increasing volatility on the asset side.

In 1993 the Dutch Insurance Supervisory Board (further referred to as ISB) supposed to have a investment risk related solvency margin of 30% to 35% of the amount invested in equities, in case 20% or more of the total assets were invested in equities. There was a big debate about this solvency margin. Questions arose like: Is it necessary to have a specific investment related solvency margin? Is 30% to 35% of the equity exposure not to high? Should there not also be a solvency margin in relation to bond volatility? Should this margin be calculated separately for bonds and equities or jointly (total portfolio risk approach)?

After all involved stakeholders, such as trustees, actuaries, accountants, individually and by means of their respective organisations had expressed their views, the ISB announced Actuarial Principles for Pension Funds (further referred to as APP). All stakeholders again commented the draft text and almost without any change in the text, the APP were officially launched in February 1997. They came into effect immediately, however the first official solvency tests to be reported to the ISB had December 31, 1997 as measurement date. The official reporting of the solvency test should take place within nine months after the measurement date[1].

In this paper we will provide you with the meaning of the APP. We will share with you briefly the various approaches that were used in practice in order to calculate the solvency margin. Recently some officials of the ISB came up with further details about how to deal with the investment risk related solvency issue. We will share with you these new, still unofficial, thoughts within the ISB about the solvency margin. Being actuaries we did of course some quantitative analysis of the different views. Further we present some sensitivity analysis.

One of the reasons for writing this paper is that we are not convinced that we are moving in the right direction in The Netherlands. We would very much appreciate receiving comments from fellow actuaries from other countries on this important issue and the specific "Dutch treat" of it.

Actuarial Principles for Pension Funds in The Netherlands

The Dutch APP consist of five chapters. The first one is about the importance of the actuarial principles, an introduction to the topic. The fourth and fifth ones concern the certificate issued by the actuary and transitional arrangements en commencement. The most important chapters are chapters two and three. These two chapters cover two approaches in looking at a pension fund. Chapter two covers the assessment of the financial structure of a pension fund and gives guidelines with regard to the going concern (continuity) approach. Chapter three covers the minimum financial position that is required and gives guidelines for the discontinuity approach.

Going concern (continuity) approach – sound financial structure

In the second chapter of the APP the ISB gives guidelines for a sound financial structure of a pension fund. In assessing the financial structure, prudency is the keyword. The system of probabilities must not only be selected on the basis of past observations. Expected developments, external factors en planned amendments to the scheme which are expected to affect the financial position of the fund should also be taken into account. Furthermore, in assessing the financial structure, a number of other aspects should be taken into account in every case. We mention the most important aspects:

- The pension liability provision.
- Future premium income.
- The (targeted) level of future indexation.
- The (future) reinsurance policy.
- The investment policy.
- The (expected) size and composition of the financial basis on the pension fund.

Discontinuity approach – minimum solvency test

The third chapter of the APP gives guidelines for the minimum financial position, a solvency margin for investment risks and how the available assets for funding should be valued.

Calculation of the minimum financial position

The minimum financial position is equal to the present value of the vested rights. The present value must be calculated using prudent assumptions. This means that an allowance should be made for possible future negative changes in mortality, and costs. The costloading must be determined at a level at which it is possible to transfer the liabilities to an insurance company or another pension fund, or alternatively, at a level at which it is possible for the pension fund to administer the total package of liabilities independently.

With regard to the discount rate, the common 4%-rate plays a central role. The APP tell us that if the pension rules state that pension rights of pensioners and deferred pensioners will be increased under certain conditions, a 4% discount rate should be used[ii]. About 95% of the pension arrangements have some sort of conditional indexation[iii].

In case of no indexation promise at all (nominal pensions) the APP allow using a higher discount rate than 4%. Specific guidelines are given in an exhibit to the APP. These guidelines specify that reinvestments in year T are assumed to have the following rate of return, based on the U-yield[iv]:

- Fixed interest : U-yield * 0.85^T -/- 0.5%
- Equity : U-yield * 0.95^T

If these rules result in an actuarial interest rate which is less than 4%, the actuarial interest rate will be set at 4%.[v]

The discount rate in the case of fixed indexation should be 4% minus the rate of indexation[vi]. When the pension rights are increased unconditionally using an external index, for instance the consumer price index, the discount rate to be used, must also be lower than 4%.

Solvency margin for investment risk

The APP state that in general a pension fund should have a solvency margin for investment risk. The possible depreciation of all available assets must be taken into account. The solvency margin is not strict defined. The APP say that the possible depreciation should be based on historical fluctuation which may reasonably be expected to occur in the value of the available assets. Furthermore, it is stated that the financial buffer for a possible depreciation will therefore fluctuate in line with the developments on the financial markets.

It may seem odd that the ISB does not define the required solvency margin in a (more) quantitative way. The reason for it is the kind of supervision that is conducted by the ISB. It is called normative supervision, which in fact means that the supervision is applied afterwards. This is different from most other countries in Europe, where supervision is applied before.

When the APP were published, the ISB announced that it would wait and see what solutions the Dutch pension funds would come up. These solutions will be evaluated, which can lead to a more specific definition of the level of the required financial buffer.

The ISB expects a pension fund to describe a method for the calculation of the financial buffer for investment risk. That is of course easier said then done. Such a method needs to be dynamic and (in theory) needs to lead to an adequate buffer in every possible situation on the financial markets. The problem right now is, there is no good reference and the ISB does not want to quantify the required outcome in this stage, due to the normative supervision that is applied.

Solvency margin in practice

Dutch pension funds now have one year of experience in reporting the solvency margin to the ISB. It is clear that all the major actuarial firms have thoroughly studied the subject. Each of them has adopted an approach to calculate the solvency margin. All the approaches are very different in itself. The following approaches have been noticed:

- Moving average: the possible depreciation of the available assets is based on the difference of the present value of the assets and the historic average over the last x^{VII} years.
- Percentage per asset class: for each asset class a percentage is defined. The solvency margin is calculated as this percentage times the amount invested in this specific asset class.
- Downside risk measurement: Using a Markowitz type of approach using expectations for return, standard deviation and correlation, the solvency margin is calculated given a certainty of x% that the fund remains adequately funded at the end of a certain period.
- Scenario analysis: Finding the solvency margin on the basis of analysing N economic scenarios such that the fund remains adequately funded at the end or during a certain period.

Despite the various approaches, the results for 1997 were quite similar. In case of 100% fixed interest investments the solvency margin varies on average between 5% to 10% and with a 50/50 fixed interest/equity mix the results seen, varied mostly between 20% to 25%.
The issue of the solvency margin is of course relatively easy for the fixed interest assets in the portfolio. On the basis of an estimated increase of the market rate of interest and the modified duration of the bond portfolio, the required solvency margin for bonds can be calculated. Assuming a modified duration of 5 years for an average bond portfolio, a solvency margin of 5% to 10% implies an increase of the market rate of interest of 1% to 2%.
The main issue of the solvency margin for investments risks lies within the required margin for equities. After sending in the official reports of 1997 to the ISB the first comments from this supervisory authority were received. It turned out that the calculated solvency margins for pension funds with an exposure of over 40% in equities is regarded too small. In case a pension fund has invested for 50% in equities, the ISB wants to have a solvency margin of 30% to 35% of the liabilities as per December 31, 1997.

Analysis of the average result of the various approaches

For a pension fund that has invested in equities for 50%, we have done an analysis of the difference between the solvency margin required by the ISB and the results of the various approaches we have seen. We want to show the assumed depreciation of equities used in the different approaches. For our analysis we assume that the solvency margin for fixed interest investments is set to 7.5%. This means the estimated depreciation is assumed to be 7%, for 100/0.93 = 107.5.

Furthermore the average solvency margin resulting from the different approaches is set at 22.5%. From this the assumed depreciation for equities (DE) can be calculated with the equation: 100 / (0.5 * 0.93 + 0.5 * (1-DE)) = 122.5. This equation leads to an the assumed depreciation for equities equal to 30% (rounded figure).
If the same analysis and the same assumption for fixed interest investments are applied to the level required by the ISB, we find that the ISB assumes a depreciation for equities equal to 42%. This is quite a difference to the average result of the various approaches.

99.9% certainty and declined interest rates

Since it is the first year of the APP in practice, a debate has started how to deal with the investment risk solvency requirement. Some people working for the ISB launched the idea of a 99.9% probability that a pension fund will not fall below the minimum position level at any time during the next three years. The effect of the declined interest rates should also be incorporated by calculating the liabilities on the lower market rate of interest when this rate falls under 4% at any time in any scenario of the analysis. If the market rate of interest is exceeding 4% then the liabilities could be calculated on the basis of the higher interest rate allowed for pensions without indexation, as explained before.

We have done some quantitative analysis of what the effect would be of these thoughts. The assumptions used in our analysis are mentioned in the appendix. The following table shows our findings for different investment policies. We have calculated the financial buffer needed to comply with the 99.9% certainty, including and excluding the effect of a market rate of interest lower than 4%. The starting value for the market rate of interest in this analysis has been 4.1%. This was the market rate of interest by the end of 1998. The financial buffer is shown as a percentage of the present value of the liabilities calculated with a fixed discount rate of 4%.

Assetmix: bonds/equities	**Required financial buffer INCLUDING the effect of an interest rate lower than 4%**	**Required financial buffer EXCLUDING the effect of an interest rate lower than 4%**
100% / 0%	65% - 75%	25% - 35%
90% / 10%	65% - 75%	25% - 35%
80% / 20%	65% - 75%	30% - 40%
70% / 30%	70% - 80%	35% - 45%
60% / 40%	75% - 90%	40% - 55%
50% / 50%	80% - 95%	50% - 65%
40% / 60%	90% - 105%	60% - 75%
30% / 70%	100% - 120%	70% - 90%
20% / 80%	115% - 135%	85% - 105%
10% / 90%	135% - 160%	100% - 125%
0% / 100%	155% - 180%	120% - 145%

This table shows that this criterium leads to much a higher buffer than the approaches mentioned before. Even the level required by the ISB as per December 31, 1997 is much lower than the outcome of this criterium.

One of the "problems" is that two issues are combined. The first issue is the question what the size of the margin in respect to investment portfolio volatility should be. The second issue relates to the declining interest rates in The Netherlands. In our view a clear distinction between the two problems should be made. We have therefore made a similar analysis of how big the solvency margin should be using different market rates of interest as a starting point of the analysis. In the following table the results are presented for market rates of interest at the start of the analysis up to 10%. The relative differences in asset returns with the market rate of interest were kept the same. So if the market rate of interest at the start of the analysis is 1% higher, the return on equities is 1% higher accordingly.

	Required financial buffer INCLUDING the effect of an interest rate lower/higher than 4%	
Average market rate of interest	**70% bonds / 30% equities**	**50% bonds / 50% equities**
4%	70% - 80%	80% - 95%
5%	35% - 45%	45% - 55%
6%	15% - 25%	30% - 40%
7%	5% - 15%	15% - 25%
8%	(5%) - 5%	5% - 15%
9%	(20%) - (10%)	(10%) - 0%
10%	(30%) - (20%)	(20%) - (10%)

Figures between brackets are negative.

The hidden reserve in the valuation of the liabilities (discounted at 4%) when the market rate of interest is higher than 7% - 8%, is such that it is bigger than the buffer needed for the volatility of the assets. Added together it results in a negative buffer.

Macro implication of proposed criterium

If the proposed criterium would be applied, on a macro basis this would imply that Dutch pension funds, although generally regarded as very well funded, are suddenly underfunded. At present the market rate of interest is just above 4% (10 years government bonds). The total investments of pension funds in The Netherlands as at 31 December 1998 is approximately NLG 800 billion (363 billion euro), of which on average 35-40% is invested in equities. The average estimation of the total surplus of Dutch pension funds is NLG 200 billion (91 billion euro). Applying the proposed criterium would result in a total deficit of Dutch funds of NLG 200 to NLG 300 billion (91 to 136 billion euro). So the "gap", NLG 400 to NLG 500 billion (182 to 227 billion euro) is quite significant in respect of the total investments.

Concluding remarks

We would recommend a transparent presentation of solvency margins. Therefore we would propose to deal with the volatility of assets separately from the issue of low interest rates.

There is a big debate whether the discount rate should be low and fixed or dynamic representing the market rate of interest or expected return on assets. Debating this issue is not within the scope of this paper so we leave this issue to the reader. When however a fixed interest rate of 4% is used we see no need to adjust this 4% discount rate the first time the market rate of interest falls below 4%.

The solvency margin in respect to the volatility of the assets as proposed by some ISB employees is unrealistic big in case of interest rates below 6% and unrealistic low in case of interest rates higher than 6%. So the conclusion must be that this proposal is only realistic when the market rate of interest is close to 6%.

Further analysis of the methods in use under different economic circumstances is necessary. We are eager to hear how the issue of solvency in relation to investment risks is dealt with in other countries. Further we are eager to hear in Japan how our colleagues have dealt with the problems of a long period with extremely low interest rates.

APPENDIX

Liabilities

The effect of a market rate of interest different from 4% on the present value of the vested benefits is determined as follows (rounded figures)

Market rate of interest	Present value as a percentage of the present value calculated with a discount rate of 4%
10%	70%
9%	75%
8%	80%
7%	85%
6%	90%
5%	95%
4%	100%
3%	120%
2%	150%
1%	190%
0%	240%

If the market rate of interest is higher than 4%, the decrease of the present value is calculated according to the Actuarial Principles for Pension funds. In case the market rate of interest is lower than 4%, this market rate is used as the discount rate for calculation of the present value of the liabilities.

Rates of return

The economic scenarios have been generated using the following assumptions:

	Mean	Standard-deviation
Bonds	4.0	6.0
Equities	8.0	16.0
Market rate of interest	4.0	1.0

Correlationmatrix

	Bonds	Equities	Market rate of interest
Bonds	1.0	0.4	- 0.9
Equities	0.4	1.0	- 0.2
Market rate of interest	- 0.9	- 0.2	1.0

[i] The Pension and Savings Fund Act has recently been changed such that the official reporting should be from now on within the next six months after the year end.

[ii] The 4% is the maximum discount rate to be used, so it is allowed for a pension fund to calculate the present value at for instance 3.5%. Almost all pension funds use a discount rate 0f 4%

[iii] Common examples of conditional indexation are:

- following the price index when the available funds are sufficient as decided by the trustees (having heard the actuary)
- the same, but with a maximum of the excess return over 4% over the last year
- The same as the previous examples but using a wage index

[iv] The U-yield is based on the yield on a collection of government bonds selected according to specific criteria.

[v] The APP do not say anything about the situation of a market rate of interest below 4%. This seems to be an omission in the APP.

[vi] This is regardless of the fact that the 4% discount rate already includes an allowance for conditional indexation.

[vii] We have seen an example with x=3.