

ASSET & LIABILITY MANAGEMENT FOR DUTCH
PENSION FUNDS
“POLICY AND DECISIONS”

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PREFACE

VBA Portfolio Management Commission

The Portfolio Management Commission was set up at the end of 1988 on the initiative of several members of the Dutch Society of Financial Analysts (VBA). The Commission's objectives were formulated as follows: to gather, analyse, discuss and present theoretical and practical aspects of portfolio management in a changing world. The Commission has about twenty-five members. They come from banks, insurance companies, consultancy practices (including actuarial), pension funds and universities. The expertise of the individual members is fully brought to bear in the selection of study topics, which are then pursued in further detail by small working groups. The results are published in reports and announced at presentations.

At the end of 1990 an “Asset & Liability Management” working group was set up within the Portfolio Management Commission.

The group has now (end-1992) presented its findings in a detailed report in Dutch. This is a translation of an abridged version.

1. INTRODUCTION

Although pension funds do spread their investments to control risk, they seldom have an overview of overall pension-fund risk. It is therefore advisable for all pension funds to apply Asset & Liability Management techniques, even if this remains limited to simple scenario analysis.

Before turning to Asset & Liability Management itself, we summarise the Dutch institutional investment scene.

Dutch institutional investors

Characteristic of the supply side of the Dutch capital market is the dominant position of the institutional investors. This is because of the extensive system of social security and pension provisions in the Netherlands. The main old-age provision in the public sector is the AOW (Old Age Pensions Act) programme, which is financed by a pay-as-you-go system. However, most private pension provisions, including those for civil servants, are financed by a capital funding system. As pension schemes in the Netherlands are rather generous, it is not surprising that pension funds are relatively large. More than 75% of personal savings are contractual. The funds of Dutch institutional investors equal almost 124% of Gross Domestic Product, which is very high compared to other OECD countries.

Funds of the institutional investors as a percentage of GDP:

The Netherlands	124
Switzerland	122
United Kingdom	104
Japan	56
United States	45
Germany	28
France	21

What is striking is the tendency of Dutch institutional investors to invest mainly in Dutch guilder paper. Surveys in recent years have revealed growing interest on the part of institutional investors in share investments. The weighting of equities in the portfolio has therefore increased although it is still modest.

Percentage distribution of investments (Dutch pension funds):

	1965	1975	1985	1992
Equities	8	11	11	23
Bonds/Loans	77	72	74	62
Property	14	14	13	11
Cash	1	3	2	4

One fund in particular, the ABP (General Public Service Pension Fund), manages nearly 30% of total Dutch institutional investors' assets (including insurance companies). In international perspective the Dutch pension funds are among the largest investors outside the US.

Portfolios of pension funds in international perspective (assets in US\$ bn as of end-1991):

N°	Fund	Country	Assets
1	Kampo	Japan	428.0
2	ABP	Netherlands	99.4
3	Allmanna Pensionfonden	Sweden	83.0
4	Central Provident Fund	Singapore	25.4
6	PGGM	Netherlands	23.8
13	Philips Pensioenfond	Netherlands	11.8
20	Shell Pensioenfond	Netherlands	8.2
25	Metaalnijverheid	Netherlands	7.6

Source:Euromoney, August 1992.

2. ASSET & LIABILITY MANAGEMENT (ALM)

Objective

The objective of ALM in the pension fund context is to define a strategic investment portfolio that will continue to safeguard the insurance function in the long term as well as generate sufficient returns to minimise pension costs and ensure a desired level of contribution stability.

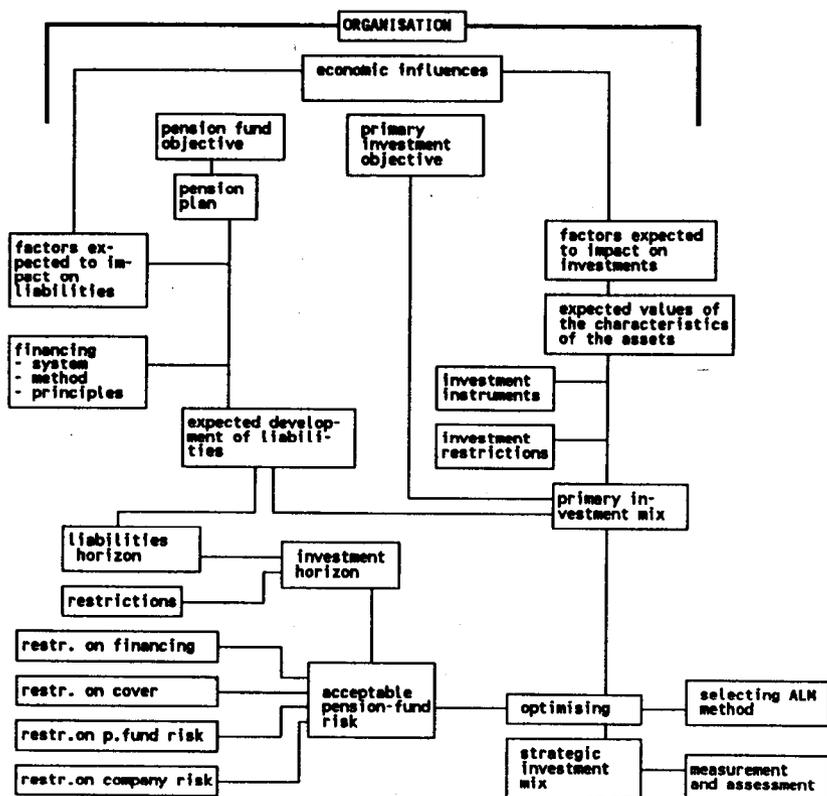
3. THE STATUS OF ALM WITHIN THE ORGANISATION OF A PENSION FUND

The structure of a pension fund is comparable with the structure of a company. Common to both are the three levels identified by business administration theory: operational, tactical and strategic.

Pension funds have two principal functions – insurance and investment. Within the organisation these functions will be accommodated in different units, each divided into the three levels specified above: at the operational level we find administration. At the tactical level: portfolio management and cash-flow forecasting for investment purposes. The

third level is the strategic investment and insurance level, integrated to form an ALM level. It is, therefore, at this third level that the two main functions of the pension fund have to be brought together.

4. THE ALM PROCESS



1. The pension fund's objective (insuring pensions) is formalised in the pension plan.
2. Economic factors will lead to an expectation of the pension costs and the size of the liabilities, taking into account the financial system, -method and -principles, and expected demographic trends.
3. The economic factors referred to above will also have a certain impact on the characteristics of the assets (regarding return, risk and correlation).
4. The expected values of the characteristics of the assets coupled with

available investment instruments, allowing for restrictions in place, lead to a primary investment mix that meets the primary investment objective, i.e. performance of the insurance function.

5. A liabilities horizon is arrived at on the basis of the composition and structure of the liabilities.
6. The investment horizon to be applied is determined taken into account the one-year-period of the financial year, the evaluation period, and the liabilities horizon.
7. Evaluation of restrictions on financing and cover is necessary because these restrictions may increase pension costs instability. The requirements imposed by pension fund and company (as the premium payer) concerning the stability of costs should also be assessed. These evaluations, along with the investment horizon, may lead to an acceptable risk for the pension fund in terms of horizon, return and risk level.
8. Based on the ALM method selected and allowing for the above requirements, the primary investment mix can be optimised to arrive at the strategic investment portfolio and therefore achieve the investment objective derived from this.
9. Evaluation of the results obtained. There should also be continuous monitoring of whether initial assumptions are being met.

5. LIABILITIES

Capital funding

The capital funding method should be applied to the financing of pension provisions that are promised under the Dutch Act on Pensions and Savings Funds.

Capital funding is based on a balance between, first, the present value of expected, future pension allowances and, second, the sum of the existing provision for pension liabilities and the value of premiums to be expected.

Actuarial interest rate

This is the interest rate on investments that is applied for calculating the present value of the liabilities within the capital funding system. The choice of interest rate depends on various factors, most importantly the type of liability entered: nominal, index-linked or prosperity-linked. In the Netherlands, the actuarial rate used is generally a real rate of interest

(i.e. nominal interest less inflation). Another possibility is to split both factors and assume a market rate of interest plus an assumption for inflation. The choice of interest rate also depends on the investment returns that can be achieved.

As a rule, if the liabilities are of a nominal nature the actuarial rate of interest may be a function of the effective nominal returns, whereas in the case of prosperity-linked liabilities the actuarial rate is based on a real rate of interest.

In the Netherlands, the actuarial rate of interest is usually set at 4%. However, in the opinion of some people 4% is too high. For index-linked pension obligations 1% would not be unreasonable and, for prosperity-linked cover, even 0%.

ALM can clarify the implications of the actuarial rate of interest selected.

Calculating forecasts for liabilities

The following steps can be differentiated:

1. Determination of actuarial rules and probability systems regarding internal demographic movements.
2. Determination what semi-internal (endogenous) factors will influence the size of the pension liabilities in the future, such as growth in the number of participants, distribution of new entrants across age categories and incidental rises in salary (promotion).
3. Determination what external (exogenous) factors will influence the size of the pension liabilities in the future, such as general salary increases, rises in state pension payments (AOW) and indexation of rights of inactive beneficiaries (prosperity-linked, index-linked, a combination or otherwise).
4. Obviously, both when forecasting liabilities and returns on investment, the same economic factors apply.

6. ASSETS

Inflowing cash - the premium payments - must be invested in order to earn interest. If the nominal character of the pension fund's liabilities were the sole criterion then investment in a deposit environment would be the simplest choice and, very probably, returns would also be sufficient. However, since most pensions in the Netherlands are based

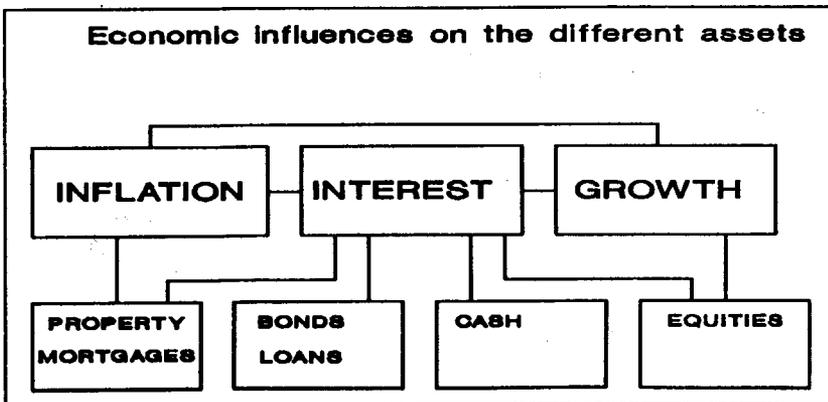
on a final pay scheme besides being index-/prosperity-linked, the required return on investment is generally higher than returns yielded by deposits.

The incoming funds must therefore be invested to ensure the highest possible return. Attached to every investment is a returns expectation, which may be overshoot or undershot. This constitutes the investment risk. The higher the expectation, the higher the risk. It is between these two polarities of expected risk and return that the portfolio manager needs to strike an optimum balance.

Minimising and stabilising the premium are, in principle, conflicting objectives - the one is at the expense of the other. High returns on investment minimise the premium and are almost always accompanied by a high investment risk. High investment risk creates an unstable investment result from period to period, which runs contrary to a stable premiums policy.

Besides the wishes and requirements of a pension fund, the portfolio manager also has to take account of the requirements of Dutch legislation. All Article 14 of the Act on Pension and Savings Funds stipulates is this: "Investment of the available funds of a pension fund or savings fund must be on a sound basis". ALM techniques can clarify whether this requirement is being met.

Returns on investment are strongly influenced by economic trends. The most important, measurable economic parameters are inflation, interest rates and growth. Every investment instrument is influenced to a greater or lesser degree by the development of these parameters, and this must be taken into account when ALM techniques are applied.



Asset characteristics

Based on a long-term horizon, the following values might be applied in using ALM calculations:

	Expected return	Expected risk (σ)
Int. equities	13	20
Dutch long bonds	8.5	7
Loans (nominal)	7.75	1.5
Property (indirect)	10	12
Cash (Dfl)	7	2

The correlation matrix might be as follows:

	Equities	Bonds	Loans	Property	Cash
Equities	100	33	40	50	-35
Bonds		100	20	25	-10
Loans			100	0	10
Property				100	-50
Cash					100

The reported figures (annualised) are assessed on the basis of historical observation and practical experience but are subject to fluctuations over time. Loans are based on nominal valuation in the balance sheet. Risk figures can be arrived at by calculating the square root of n (for investments held and assessed for n years).

Efforts to achieve high returns

Active portfolio management aimed at maximising returns is essential for a pension fund. This is evident from the statistic - frequently quoted in the press - that an additional 1% in portfolio return in one year can be equivalent to 1/4 to 1/3 of annual premium income.

Efforts to keep (pension-fund) risk low

The risk can be reduced by ensuring a good spread across investment instruments, countries, currencies, sectors, debtors, durations, etc. Judicious use of option and futures strategies may supply a high degree of flexibility.

Book value

Given that risk is defined as the standard deviation of expected return and that returns consist partly of changes in market prices, it will be evident that the book value of the various investment instruments is highly important. Equities are valued at market price, with the result that over time there will be many changes in value. Bonds and loans are usually valued nominally, with the result that changes in value - which do of course occur - are not accounted for. This is permitted in view of the long-term character of the liabilities and because there is usually no necessity to sell the bonds and loans before the repayment date.

The balance sheet valuation has an influence on the risk expected for investment instruments. In the Netherlands, the standard deviation for the period 1966-1990 was about 7% on long-term bonds (based on market prices) and about 1.5% on private loans (nominal valuation).

Markowitz optimisation

Once expected returns, expected risk and expected correlations are known or assumed, the "efficient frontier" can be calculated using the Markowitz optimisation technique.

The table below reproduces the efficient frontier using ten optimum portfolios:

Without restrictions / horizon: 1 year

N°	Return	Sdev	Shares	Bonds	Loans	Property	Cash
1	7.53	1.15	0.00	0.00	53.14	4.46	42.41
2	8.48	3.24	8.46	6.27	74.75	10.52	0.00
3	9.10	5.34	17.74	10.01	57.12	15.14	0.00
4	9.70	7.43	26.73	13.63	40.03	19.61	0.00
5	10.29	9.53	35.63	17.22	23.11	24.04	0.00
6	10.88	11.62	44.49	20.80	6.27	28.45	0.00
7	11.46	13.72	55.48	13.31	0.00	31.21	0.00
8	12.02	15.81	67.47	0.00	0.00	32.53	0.00
9	12.54	17.91	84.52	0.00	0.00	15.48	0.00
10	13.00	20.00	100.00	0.00	0.00	0.00	0.00

Investment restrictions

In practice, efforts to achieve high returns while keeping risk low are limited by investment restrictions. Frequently, these restrictions have been introduced or imposed for different reasons over time. Examples

are ceilings on equity holdings, foreign investments and private loans, a minimum holding of high-dividend ("high-return") stock, etc.

Generally speaking, restrictions cost money. The Markowitz efficient frontier table below sheds light on this. The same values are applied to returns, risk and correlations as for the calculation above except that certain restrictions have been added: equities, maximum 40%, property, maximum 25%, equities plus property, maximum 50%, cash, maximum 10%.

With restrictions / horizon 1 year

N°	Return	Sdev	Shares	Bonds	Loans	Property	Cash
1	7.73	1.36	0.00	0.00	87.77	2.23	10.00
2	8.20	2.36	4.23	4.56	82.79	8.41	0.00
3	8.51	3.36	9.01	6.49	73.71	10.79	0.00
4	8.81	4.37	13.50	8.30	65.18	13.03	0.00
5	9.11	5.37	17.88	10.06	56.86	15.20	0.00
6	9.39	6.37	22.20	11.81	48.64	17.35	0.00
7	9.68	7.38	26.49	13.54	40.49	19.49	0.00
8	9.96	8.38	31.71	18.26	31.74	18.29	0.00
9	10.22	8.38	38.07	27.39	22.61	11.93	0.00
10	10.45	10.39	40.00	50.00	0.00	10.00	0.00

Comparison of the two tables lead to the following conclusions:

- * where restrictions are in place, the lowest feasible risk is at a higher level (1.36 versus 1.15);
- * where restrictions are in place, the highest feasible return is at a lower level (10.45 versus 13.00);
- * where restrictions are in place and the risk is the same, the feasible return is generally at a lower level.

ALM may identify the impact of restrictions.

7. DEGREE OF COVER

Concepts central to a pension fund's objectives are:

Solvency: it must be possible to meet liabilities at all times.

Profitability: The required contribution (pension costs) should be as low as possible.

Stability: The required contribution should show a low variation.

Liquidity: The cash inflow should be larger than or equal to cash outflow.

In practice, a choice has to be made between the different objectives. The basic assumption is the idea that a pension fund should be approached more as if it were a company.

A company produces at as low a price as possible. In pension fund terms, this means that the first two objectives referred to above - solvency and profitability - form the basis of its activity. A pension fund's product is its guaranteed promise to pay out pension benefits. This product, therefore, is to be "produced" at as low a price as possible.

Moreover, it is indisputable that a stable premium pattern is also of great importance. This stability will depend not only on - highly changeable - financial results but also on the type of financial system. By choosing a financial system that equalises short-term fluctuations in the financial result, a pension fund is initially able to concentrate on the first two objectives when implementing an ALM policy. The key parameters will, therefore, be solvency (the level of risk to be accepted) and profitability (the desired return on investment). Solvency in the long term should be safeguarded since this is the very basis of the pension fund's existence. The risk of insolvency should, therefore, be minimised.

Degree of cover as a measure of solvency

A number of ratios are used to determine solvency. Actuaries generally use the degree of cover, which is the quotient of total assets and liabilities.

The criterion is whether the level of cover has a ratio of one or higher. Various approaches are possible, the strictest being to demand that cover always equals or exceeds one. In that event, short-term fluctuations that could depress the ratio below one are rigorously avoided. Given the long-term nature of the liabilities, with cover needed to be sufficient for a period of twenty to thirty years, a long-term approach is more appropriate. The ratio may, therefore, be allowed to dip below one in the interim.

However, this is on condition that the policy pursued is well defined and acceptable. Also important here is the financial strength of the underlying company, since this must guarantee any shortfalls.

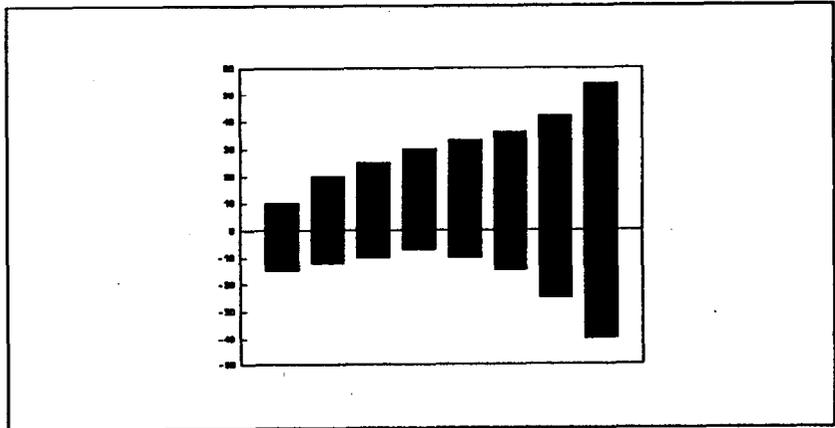
The policy is to concentrate on the acceptability of the cover ratio falling below one. Given a degree of cover calculated on the basis of valuation principles regarded as realistic, and on the assumption of a primary investment mix that is yet to be optimised, it is possible to calculate the minimum return required for the ratio not to go below one

in the long term. However, in an uncertain world we have to accept at least a small risk of a lower-than-expected return with the ratio falling below one after all. It is this risk that indicates the degree of reliability desired.

Ex ante cover

By calculating the assets and liabilities in advance a pension fund can determine the cover to be expected given different investment mixes - both before and after portfolio optimisation. Total pension fund risk as defined in this report must be allowed for.

Below, we provide an illustration of possible positions to be covered. The ideal positioning is the cover with the highest expected minimum and the highest expected value.



The investment mix represented by the fourth bar from left is the portfolio that would be preferred on the basis of the above criterion. If a lower minimum cover were acceptable, the choice would be for the portfolio shown by a bar to the right of this. The portfolio positioned fifth from left would be preferred to the portfolio at third from left - minimum cover is the same but the former's expected level is higher. As pointed out above, however, this concerns selection in the first instance. In the second instance the portfolios would have to be assessed according to other criteria, such as the liquidity or stability of premium movements if a financial system with inbuilt stability was not chosen.

Profitability assessment

On the basis of the information in the above paragraph, a step can be taken towards assessing profitability. Indirectly, this will already have been done if the expected degree of cover has also been selected as a measure of profitability. By assuming a fixed degree of cover, say 100% or 110%, the pension fund is able to calculate the premium discount that can be granted on the basis of outcomes for cover with various portfolio structures. The amount in excess of what is determined in advance as the cover required is then translated into a premium discount. Obviously a negative amount is also possible, in which case an additional premium will be required.

The premium required in light of the fixed degree of cover and fixed investment mix decided on is the basic consideration. The investment mix may be the one in place at the time or the mix aimed at. The calculated premium reduction or addition indicates what saving on or increase in pension costs will occur if a particular mix is selected.

8. HORIZON AND PENSION FUND RISK

The pension fund is a long-term investor. The objective of ALM is to generate an investment strategy for the position to be taken in the long term.

Both tactical and strategic investment policies can take account of economic cycles and other long-term patterns. A further consideration in this context is that the pension fund, as a rule, is not forced to sell investments in the short term (at least not unexpectedly). There is no need to sell in a trough. There's time to ride out the storm.

The long-term character reduces the risk. The investment horizon can have a favourable effect on the risk profile. The standard deviation increases in line with the investment horizon, but not to the same extent as the cumulative expected return. So the return/risk ratio becomes more favourable.

With a horizon of one year the ratio is

$$\frac{\text{return}}{\sigma}$$

With n years this is

$$\frac{\text{return} \times n}{\sigma \times \sqrt{n}}$$

This assumes an independence of the distribution of the returns for successive observations.

Calculated back on an annual basis the return works out at r . The risk is

$$\frac{\sigma \times \sqrt{n}}{n} = \frac{\sigma}{\sqrt{n}}.$$

To illustrate the relation between horizon, risk and correlation some results of Wilkie's stochastic model are given for the Dutch market.

In this model a direct link is made between the effect of inflation on the liabilities and investments. Numerous studies indicate that inflation is the principal risk factor for pension funds. In the model the inflation is generated automatically and forms the basis for the results of the other economic parameters and investment variables.

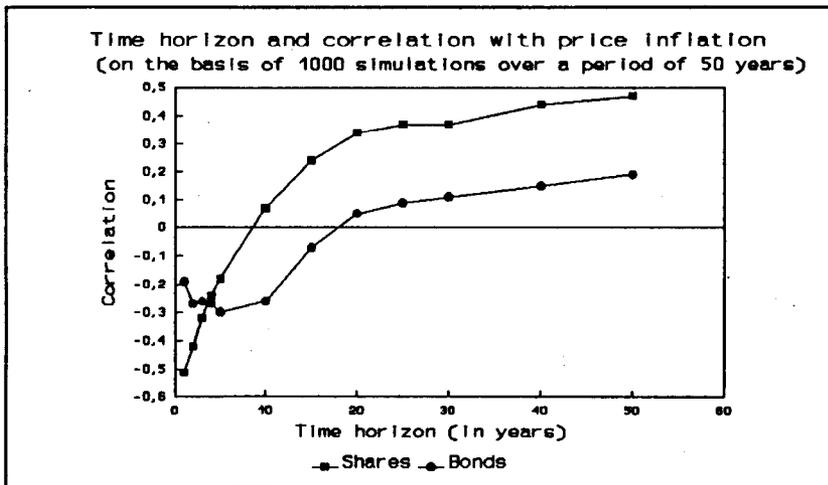
The parameters for the given model are estimated on the basis of data over the period 1952 to 1992. Subsequently one thousand simulations were performed over a period of fifty years. Here we have only given the results for equities and bonds. Note that all figures given in the table are expectations.

Horizon	Equities Return	Equities Risk	Bonds Return	Bonds Risk
1 year	12.54	21.98	8.48	10.61
2 years	11.54	13.93	8.50	6.88
3 years	11.61	10.16	8.38	5.17
4 years	10.98	8.10	8.34	4.21
5 years	10.78	6.94	8.37	3.49
10 years	10.72	4.03	8.33	1.85
15 years	10.69	3.12	8.25	1.32
20 years	10.70	2.73	8.30	1.20
30 years	10.64	2.52	8.36	1.18
40 years	10.61	2.29	8.37	1.19
50 years	10.59	2.06	8.36	1.15

These figures lead to the conclusion that Wilkie's model predicts a lower risk than a risk assessment that assumes normally distributed returns (sigma divided by the square root of the horizon). This assumption therefore seems to generate risks which tend to be on the safe side. The most important conclusion, however, is that the risk decreases exponentially with a longer investment horizon.

The table shows that the risk profiles of equities and bonds differ greatly with a short investment horizon. When the investment horizon is one year, equities are in absolute terms much riskier than bonds. Though the relative difference only decreases slowly, the absolute difference narrows rapidly with a longer investment horizon. The expected return on equities, however, still contains a risk premium of 2.3 percentage points in relation to bonds. So with a longer investment horizon, equities remain relatively speaking more attractive than bonds.

The correlation between return on investment and price inflation also varies depending on the selected investment horizon. The graph below shows this dynamic relationship.



Measured in the short term shares display an extremely negative correlation with price inflation. In the longer term, however, the correlation becomes positive. In addition, shares also show a stronger correlation with inflation than bonds.

Relationship liabilities horizon - investment horizon

The liabilities horizon is the starting point for the investment horizon. This liabilities horizon can be seen as the average expected duration of the liabilities weighted according to the present value of these liabilities.

The average pension fund shows a liabilities horizon of 10 to 20 years as calculated above. It is not realistic, however, to assume that in

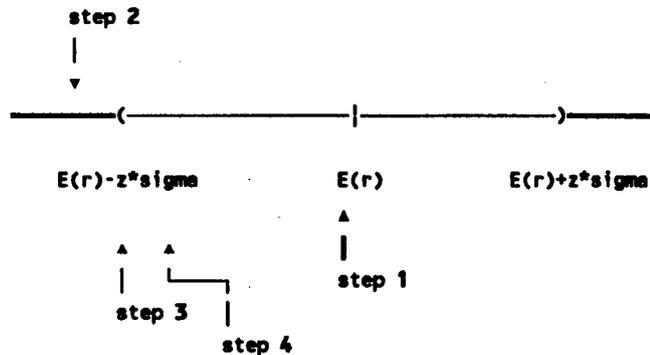
applying the optimisation procedure the standard deviations based on one-year observations can simply be replaced by degrees of risk with such a long horizon.

In practice reporting takes place on the basis of financial years. It seems unnecessary however to base the standard deviation on one year only. The investment horizon can be set at a value between one and the liabilities horizon. A good starting point is to conform to a period used (internally) by a pension fund, say 3-5 years, as could be used for measuring and judging investment performance.

Pension fund risk

On the basis of the investment horizon the standard deviation for the respective investment categories is reduced from values belonging to one year to values corresponding with the longer horizon.

By following the steps below we can determine what risk can still be regarded as acceptable to the pension fund:



step 1

The expected primary return $E(r)$ follows from the primary investment mix (the still unoptimised portfolio).

step 2

A shortfall in respect of the expected return $E(r)$ may arise if the exogenous pension costs are set against this return on investment. This shortfall must be made up from additional premiums or from the pension fund's own resources. So it is necessary to find out what shortfall the

premium payers (company, industry) or pension fund still find acceptable. The following factors play a role in this: size of shortfall against size of premium and e.g. size of wage costs. The premium payers may express the payable shortfall in terms of funds tied up in wage costs.

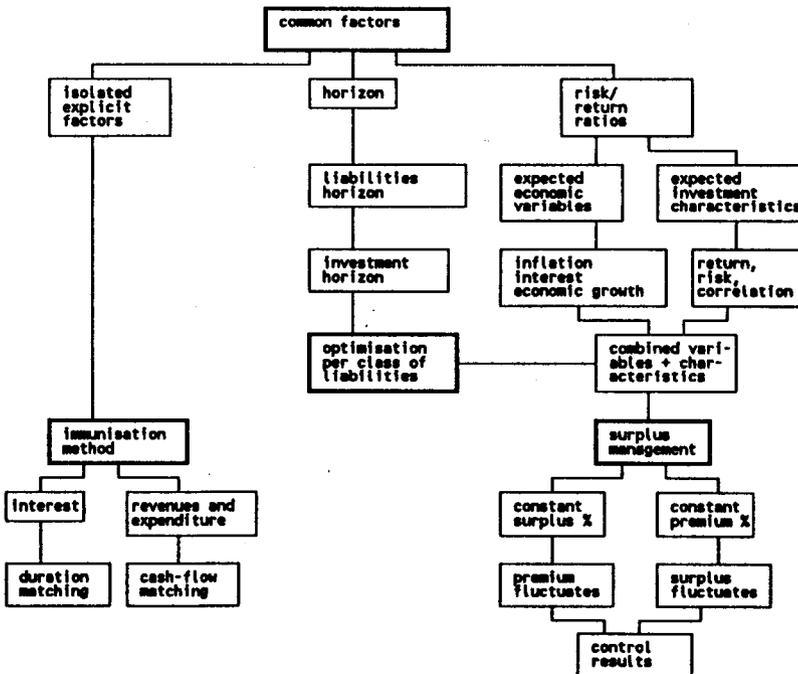
step 3

Find out what probabilities can be attached to these shortfalls. In other words, establish an acceptable reliability interval around the pension fund's net expected return. The z-value is assigned.

step 4

Derive the sigma from the resulting reliability interval. This is the value of the standard deviation which can serve as input for the acceptable risk at portfolio level.

9. ALM METHODS



The ALM problem can be approached using several different methods.

Duration matching

With this method the average duration of the investments is adjusted to the duration of the liabilities. The duration concept is aimed at eliminating the interest rate risk.

This duration matching is not so useful for pension funds, partly because the liabilities generally have much longer durations than the investments, except in the case of old participants or short-term liabilities. In addition, duration can only be applied to nominal liabilities financed by fixed-interest securities. In fact the pension fund has to deal with real liabilities which are also covered by equities. The objective is to arrive at integral risk analysis.

Cash-flow matching

The starting point here is that no cash shortfalls may occur in any period. For each period the sum of the proceeds then received (coupons and redemptions) must be at least equal to the sum of the then matured liabilities. This method is of no use with reallabilities and may lead to forced, inefficient investment decisions.

Surplus management

The relative size of the free reserves (the accumulated surplus) is the measure for the maximum risk to be incurred. In other words, the higher the reserves, the more that can be allocated to equity investments. This reasoning is often followed. It should be noted that even in the absence of free reserves there should be room for risk-bearing investments. For it is quite conceivable that investment losses can be absorbed either by increasing contributions or by temporarily accepting less than 100% cover.

The accumulated surplus can be taken as the starting point for the calculations. As a measure of the risk, the surplus is then a guiding factor. New surpluses can be used either to increase the existing surplus or reduce the contributions.

Basically most ALM methods boil down to (a form of) surplus control.

Optimisation per class of liabilities

The fund is divided into classes (cohorts or generations), with each class being assigned a portfolio that is compatible with the expected

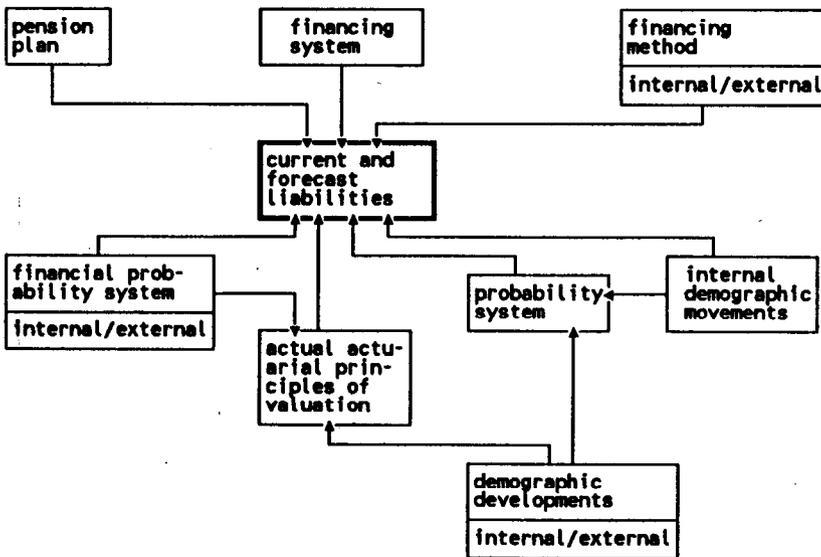
duration of the class. This method offers useful additional insights and can support other methods, for instance by approximating to the horizon of liabilities or investments. However, if used too much in isolation, this method ignores the long-termism of the pension fund and the ever changing circumstances in which it operates. The method is appropriate for funds that are winding down.

10. ALM DECISION-MARKING PATH

Operational aspects

An inventory must be made of the data which are needed in the first instance to make the required calculations. This concerns the valuation of the current situation and the calculation of forecasts.

The liabilities



The liabilities originate in the pension plan and pension system.

The financing system and the financing method indicate how the liabilities are valued and how the costs are distributed over time.

Observations and expectations regarding internal demographic developments result in retirement and entry probabilities. Values can also

be assigned to the other factors of change given within the internal demographic movements. The valuations of the probabilities lead to the probability system.

The required provision for pension liabilities is set aside on the basis of actuarial principles of valuation. These need not necessarily correspond with the expectations. For instance the normal actuarial interest rate of 4% is not realistic. It is a matter of policy whether the ALM forecast is based on common principles or realistic principles.

There is a financial probability system. Internal factors are the incidental salary developments and the collective labour agreement policy. External factors are price compensation, prosperity (economic growth) and the development of basic provisions (state pension, etc). These factors play a role in calculating forecasts. If required they can be included in the actuarial principles of valuation.

The investments

The current assets of the fund consist of the current composition, valued according to either the current principles of valuation or alternatives (everything according to market price). This choice is a policy matter. Make an inventory of the restrictions and basic conditions.

The surplus

The surplus consists of the difference between the fund's assets and the provision for pension liabilities.

Naturally, operating results generate a surplus. Whether this surplus remains with the fund or goes back to the company depends on the financial agreement between the pension fund and company. Another possible source of surpluses (or shortfalls) is the applied premium system (external financing). Especially an aggregate normal premium can generate a surplus on premium.

Policy aspects

This refers to the selection of methods and techniques and the assignment of values to the expectations for the economic parameters and investment characteristics.

Method

Establish at what stage the pension fund will be in the next 10 to 15 years. This could be:

- a. growth stage
- b. stationary situation
- c. winding-down (closed) fund.

Closed fund

With closed funds, no further premiums are paid and there are only sleepers and pensioners. In such cases, it is only natural to restrict oneself to methods which centre on maintenance of at least 100% cover. These methods are cash-flow matching, duration-matching and division into classes.

Step-by-step plan with growing or stationary fund

The aim is to control the surplus.

1. Establish what the existing or future policy aims are for solvency, profitability, stability, liquidity, investment horizon and stretchability of premium payers. This determines the acceptable risk profile of the pension fund.
2. Calculate the forecasts given a reasonable basic scenario with non-extreme economic variables.
3. Given the current, primary, unoptimised investment mix, assess the degree of cover, stability and cash flow.
4. With extremely unfavourable findings give priority to actuarial adjustments
5. Devote attention to the accounting principles used for valuing the investments and liabilities. Make sure that the accounting principles for valuing the assets/liabilities are consistent.
6. Analyse the results of the simulations with the various scenarios and optimise the strategic investment mix.
7. Always check the points mentioned in 3.
8. Assess the influence of restrictions and basic conditions and make adjustments where necessary.

11. ALM-TECHNIQUE

Input of the ALM model

Enter into the model expectations for economic parameters (inflation, interest rates and economic growth) and investment characteristics (return, risk and correlation).

- a. according to your own expectations
- b. according to a stochastic process by:
 1. simulation of economic sub-periods or
 2. simulation of inflation and investment variables.

Future economic situations concern in principle successive blocks of economic sub-periods. The technique of stochastic simulation is particularly suitable for this purpose.

A stochastic process generates the sub-periods through repeated computer simulations, thus providing a picture of the probability distribution for the results generated by several investment mixes.

If your own expectations are assumed, the natural thing will be to aim for a single end situation and assess the consequences of this development for several investment mixes.

In making a selection from the possibilities, the fact that the second method requires more complicated software may play a role, while more insight is also required into the correlation between economic parameters and investment characteristics.

Output of the model

The economic environment and the future development of the pension fund are simulated.

To this end, forecasts are calculated for the various economic scenarios with accompanying values for the investment characteristics. Subsequently the sensitivities for the scenarios, given different investment mixes can be analysed. This concerns year-on-year calculations: balance sheet position at end of year t is starting position $t + 1$.

Calculations

The application of Markowitz optimisation given the forecast investment horizon.

The sigma for the acceptable pension fund risk is input for the sigma at investment portfolio level. Given this risk it is possible to seek the optimal portfolio composition which gives the highest return. The starting point, incidentally, is the idea that the sigma value for the pension fund risk is so high that optimisation is worthwhile.

12. CONCLUSIONS AND RECOMMENDATIONS

Asset & Liability Management: YES! ALM is not merely a matching technique. The added value of an Asset & Liability approach in a strategic pension policy is derived, in particular, from:

1. The insight obtained into the correlations between macro-economic developments and capital market developments.
2. The insight obtained into the mutual relations between future developments of investments and liabilities.
3. The insight obtained into the consequences of an investment strategy for the development of the surplus and the premiums policy; this is a more relevant decision-making criterion for a pension fund than a straightforward weighing up of investment returns and risks.
4. The insight obtained into possible results and correlations in respect of the development of the surplus, inflation sensitivity, the movement of future liabilities; uncertainties in these factors call for a "more businesslike" investment policy (at the expense of premium stability) or for structurally higher contributions assuming an unchanged investment policy.

The portfolio manager and the actuary give concrete substance to Asset & Liability Management. The appointment of a special ALM manager is worth considering. Support from an ALM consultant is an alternative.

To achieve efficient and effective ALM, the organisation must be geared accordingly. Often the required (management) information is not available because: it is fragmented within the pension fund, automated access is difficult or impossible, the administrative set-up does not invite the necessary ALM input, the actuary and portfolio manager only have irregular contacts and so on.

ALM must be supported within the organisation, it requires a strategic vision and a clear, well-formulated objective. At administrative level it is necessary to rethink e.g. the selected financing method, the expected development of employment at the company and/or in the industry, the

stretchability of the premium payers and, in connection with this, the required premium policy, the method of valuation of the investment instruments on the balance sheet, the investment horizon to be considered, the (un)desired investment restrictions, the investment instruments to be used (derivatives?, indexed loans?), investment methods and investment models, the costs/benefits in order to arrive at an effective ALM approach, etc.

If ALM is seriously taken in hand, a host of new problems present themselves: which tools and models are to be used, how and what must be measured, how to assess calculations and results, what sensitivity analyses must be made, should ALM be tackled in its totality or initially (and cautiously) in sub-areas: a comprehensive forecasting model or a separate forecasting model for the development of the future liabilities and separate investment (analysis) models, stochastic processes or simple scenario analyses, etc.

Beware of all sorts of statistical pitfalls. Historical figures can be used as a first indication, but always remember that the future often holds (unpleasant) surprises. A term like "standard deviation" is based on a so-called normal probability distribution, e.g. possible calculated returns may be distributed evenly around the average expected return. If this is not the case, then the full probability distribution must be calculated and included in the arithmetical models. Take care not to compare like with unlike. Standardise any figures that are not directly comparable.

Always evaluate the ex ante results of calculated forecasts: the degree of cover at the end of the forecasting period, the cumulative premium surpluses, the standard deviation from the degree of cover, etc. In short, select the relevant information from the many results/figures in order to draw conclusions.

The calculated forecasts eventually lead to a strategic investment mix. This strategic asset allocation can be the benchmark for the dynamic - day-to-day, week-to-week, month-to-month - investment policy.

In general, a pension fund has long-term liabilities and therefore a long investment horizon. In practice however there are also short-term considerations such as the financial year (one-year-period) and the performance assessment period (one to three years); this means that a shorter investment horizon must also be taken into account.

The board of the pension fund is recommended to devote explicit attention to the required actuarial interest rate to be applied. This actuarial interest rate should in our view depend on the nature of the

liabilities undertaken (nominal, index-linked or prosperity-linked) and the (conservatively estimated) expected return on investment.

Recommendations for further research

1. The sensitivity of equities to inflation, interest rates and economic growth.
2. The effect of the adopted balance sheet valuation for the investments on the expected risk of these investments.
3. The effect of the selected actuarial interest rate.
4. The effect of adopted (investment) restrictions.
5. The investment horizon to be used in relation to the expected risk of the investment instruments.
6. Evaluation of commercial (investment) models in relation to ALM.
7. Trace and analyse economic subperiods in correlation with the determination of the expected return on and risk of the investment instruments.

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