# CONTRIBUTION N° 51

# DEVELOPMENT
# OF UNITED - LINKED
# LIFE INSURANCE

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**PAR / BY**

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# CONCEPTION D'UNE
# ASSURANCE - VIE LIEE A UNE
# UNITE DE COMPTE - DE
# SOLUTION DANOISE

**CONCEPTION** D'UNE ASSURANCE - VIE LIEE A UNE UNITE DE COMPTE - UNE SOLUTION DANOISE

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## RESUME

A la mi - 88, Tryg Insurance a été la première compagnie d'assurances danoise à offrir à ses clients des polices d'assurance liées à une unid de compte, c'est - à - dire relevant de la classe III de décret danois sur les activités d'assurance. Cette législation a été établie conformément à la première directive de la CEE concernant les assurances - vie (Décision du Conseil n° 79 / 267 / Cee). Auparavant, seules des polices d'assurance - vie ordinaires de la classe I étaient proposées au Danemark. La définition des classes figure dans l'Annexe de la directive du Conseil.

Dans cet article, an examine les différences entre une assurance - vie ordinaire et une assurance - vie liée à une unid de compte, en ce qui concerne la comptabilisation des actifs et les différentes formes d'affectation de réserve, et on fournit une brève description de la gamme de produits.

Dans l'introduction de l'article, nous exposons pourquoi nous avons trouvé nécessaire de proposer à nos clients une assurance - vie liée à une unité de compte, en complément de l'assurance - vie ordinaire.

On décrit ensuite la base de calcul utilisée, qui est rétrospective, ainsi que le choix du taux d'intérêt de base (0 % par un). Ce choix implique une garantie contre un gain négatif, c'est - à - dire que le client est assuré du remboursement de son dépôt à l'expiration, moins la prime de risque. Conformément à la législation en vigueur au Danemark, toute police d'assurance doit comporter un certain élément de risque, qui peut - être positif ou négatif.

Suit une brève description des actifs que les clients peuvent choisir pour placer leur épargne. Les actifs décrits sont, sauf les actions, spécifiques au Danemark.

On présente différentes comptabilisations des actifs, selon que la police d'assurance est ou non liée à une unité de cunpte. Cette différence signifie que le gain est cumulé sur des bases différentes pour les deux types d'assurance - vie.

La section finale est une description de l'affectation de réserve éventuellement nécessaire, compte tenu de l'influence du client sur les investissements et du paiement d'un taux d'intérêt garanti de 0% par un.

Une compagnie d'assurances offrant une assurance - vie liée à une unid de comptes a en général un risque d'investissement plus bas qu'une compagnie proposant une assurance - vie traditionnelle, pour la raison que le client peut obtenir un rendement négatif, à la différence du client d'une assurance - vie traditionnelle, auquel est garanti un rendement minimum.

La solution de Tryg Insurance, fondée sur l'incorporation d'une garantie contre un gain négatif à expiration ou au décès, implique un risque d'investissement plus élevé pour la compagnie, qu'une assurance - vie liée à une unid de cunpte.

On montre que, même si les clients sont autorisés à influer sur l'investissement et sont assurés de ne pas obtenir de gain négatif à expiration ou au décès, l'affectation de réserve compltmentaire n'est pas ntcessaire, car les quelques occasions de spéculation supplémentaires que pourrait offrir cette possibilité, peuvent être limitées grâce à un engagement contractuel signé entre le client et la compagnie.

## SUMMARY

In mid-1988, as the first insurance company in Denmark to do so, Tryg Insurance offered its clients unit-linked insurance policies, i.e. belonging to Class III under the Danish Insurance Activities Act (LFV). This legislation was drawn up on the basis of the EEC's first life directive (Council Directives n0 79/267/EEC). Up until this time only ordinary life insurance policies under Class I had been offered in Denmark. The definition of the individual classes appears from the Annex to the Council Directive.

This article will illustrate the differences between ordinary and investment-related life insurance in Denmark, in respect of the account entry of assets and different forms of reserve allocation, as well as a short description of the product range.

The introduction to the article illustrates why we have found it necessary to offer our clients investment-related life insurance as a supplement to ordinary life insurance.

Hereafter the calculation basis used is described, which is retrospective, as well as choice of basic interest rate (0 % per annum). This implies a guarantee against a negative yield, i.e. the client is guaranteed repayment of deposits on expiry, reduced by the risk premium. In accordance with current legislation in Denmark, every insurance policy must hold a certain risk element, which can be either positive or negative.

The following is a brief description of the assets in which clients can choose to place their savings. The assets described, with the exception of shares, are specific to Denmark.

Furthermore, different account entry of assets, depending on whether the insurance policy is unit-linked or not, is shown. This difference means that the yield is accrued on different bases for the two life insurance types.

The final section is a description of any necessary reserve allocation in connection with client influence on investments and the payment of a guaranteed interest rate of 0 % per annum.

An insurance company offering unit-linked life insurance generally has a lower investment risk than a company offering traditional life insurance. The reason is that any negative yield is met by the client, in contrast to traditional life insurance, where the client is guaranteed a minimum yield.

The Tryg Insurance solution, with the incorporation of a guarantee against a negative yield on expiry or death, implies a greater investment risk for the company than is otherwise the case for companies which write unit-linked life insurance.

This article will show that, even though clients are allowed to influence investment and are given a guarantee against negative yields on expiry or death, the allocation of further reserves is not necessary, since the few extra speculation opportunities thereby arising can be limited with the help of a legal agreement between the client and the company.

# DEVELOPMENT OF UNIT-LINKED LIFE INSURANCE (A DANISH SOLUTION)

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INTRODUCTION

This article is a description of the products offered in Denmark (DK) from 1988, legislation related to **taxation** and supervision, particularly with regard to this form of life insurance, as well as **how the** investment **risk** related to allowing clients to influence **the** placement of savings in securities has been **dealt with**

Life Insurance Activites in DK

In DK, for many years companies have had a common **calculation** basis for **premiums** and insurance payments. **This** implies that the payments related to the policy will be the same in any Danish life **insurance company. The** calculation basis is used when writing insurance covered by Class I - Ordinary **Life** Insurance - in **W** (the Danish **Insurance** Activities Act).

In DK the supervisory authorities require a life insurance policy to contain a certain insurance element For this reason, all agreements must **contain** a certain positive or negative risk *sum,* so **that an** amount which deviates from the savings **amount** is paid out **on** death or disablement.

**According** to the common calculation basis the life insurance companies guarantee the client a yield of minimum 4.5 % **per** annum. Only a few years ago this interest rate was very much on **the** safe side in relation to **the** market interest rate. Development in DK, as well as in Europe, has shown that interest levels have decreased by **almost** half during the 1980s.

On the basis of a new placement interest **rate** in **the beginning** of the 1980s of over 20 % per **annum,** and a real interest rate of over 10 % per **annum,** the Danish Government took the decision to introduce a **tax** designed to reduce the high Danish interest yields.

**The** objective of this legislation was that, on average, pension savers could achieve a real rate of interest of a maximum of 3.5 % per **annum** over and above inflation **-** while the remaining proceeds would fall to the Danish State.

**The tax** rate was fixed on the basis of extremely complicated legislation, which **will** not be described here. In recent years, where inflation has fallen considerably, **the tax** rate has been 56 %. The market interest rate has also **dropped,** and as this eventually results in lower average yields on **the** overall asset portfolio, the tax rate is expected to decrease to **between** 30 and 40 %.

As the real interest tax legislation provides tax exemption for yields on shares and special low nominal interest, index-linked bonds, these are of special interest for the savings part of life **insurance.**    .

Unit-Linked Life Insurance

Throughout **the** world, and in the USA and the UK in particular, the **1980s** have seen development towards **pension scheme** linked savings as an investment, and not merely as the allocation of reserve funds in anticipation of retirement.

In DK such schemes are already **known** from the banks, where a pension **scheme** can be established **as** a savings account, where the client may choose the investment of deposits in securities.

The deposit is made either by opening a savings account, with **an** individual safe custody account, to which each client buys and sells own securities, or by investment in **investment** pools. These pools consist of different investment **assets,** and savings can be distributed between the **different** pools.

Hitherto the insurance sector has considered savings to be dependent of a person's life, falling to the company in the event of death, against agreed payments. As described in the introduction, there must be a certain difference between payment of savings and payment in the event of death.

## Tryg Insurance - First in DK

As the first insurance company in DK to do so, Tryg Insurance has applied for authorization to conduct insurance activities within Class III, where savings can be placed in unit-linked life insurance.

This has required the development of a special calculation basis, TI 87, where savings are not dependent of a **person's** life, and where risk sums can only be positive. The common basis employed today, which is a prospective calculation basis, does contain this possibility in principle, but in TI 87 it is of crucial significance that a retrospective basis is used to guarantee investment account deposits. Characteristic for this basis is that a guaranteed net yield of $0\%$ per annum is calculated, after deduction of **costs.**

Costs and security margin are 0.75 % per annum of the savings amount at any time. The gross interest **is** therefore chosen to be 0.75 % per annum. Payment of savings is guaranteed on achievement of a specific age or in the event of prior death, regardless of the course of the insurance. In its basic form any insurance policy consists of a Fixed Term **Insurance** policy with the present value of $v^n$ calculated at $0\%$.

This insurance policy has a risk sum of $0$ and is therefore not valid as the sole policy payment according to the legislation in force in DK. It is therefore necessary to link an insurance element with a positive risk sum. This can be a Term Insurance Policy $A^1_{x:\overline{n}}$ **or** merely a premium exemption in case of disability :

$$\overline{a}^{ai}_{x:\overline{n}} = I(0,n)(v^{t}*paa(x,t)*myai_{x+t}*a_{x+t:\overline{n-t}})dt$$

where

$I(0, n)$ describes the integral from $0$ to $n$

**paa** $(x, t)$ describes the probability that an active **x-year-old** is still active at **an** age of **x+t.**

myai $_{x+t}$ describes the intensity of an **x+t-year-old** going from active to disabled state.

$a_{x+t \, . \, n-t}$ describes the life annuity to a disabled policy holder during the remaining premium period of (n-t) years.

For lump sum payments a guaranteed minimum life insurance may be linked (see Fig 1), guaranteeing survivors a minimum payment if the client dies before the date of retirement. Each year life insurance cover (Term Insurance) is bought, corresponding to the difference between the desired minimum cover and the savings at this stage. This insurance form can also be established as an annuity with a guaranteed payment period.

One can also choose a supplementary life insurance sum which is paid out in addition to the savings in the event of death before the retirement date(see Fig 2). This insurance cannot be taken out as an annuity as this is not permitted by Danish tax legislation.
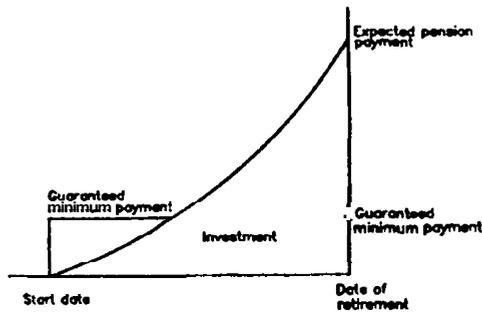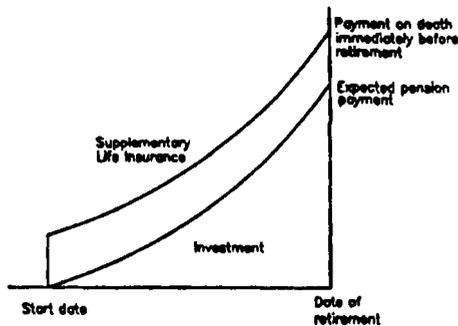
Fig 1

Fig 2

At present the product range is limited, but appears to meet the desired requirements, as the product is primarily offered to those clients who already hold insurance cover and who wish to combine the special tax rules for pension savings with influence on investment of their savings. In DK contributions to pension schemes are taxdeductible from "personal income" (gross income before allowances other than for pension contributions). The marginal tax rate is up to 68 %. Lump sums are subject to tax of 40 % at pay-out, while annuities, classified as "personal income", are also taxed up to 68%.

The fact that savings are guaranteed an interest rate of 0 % is due to the fact that pension taxation legislation in DK requires that a lump sum at maturity can be calculated. However, the guarantee against negative yields applies only on expiry or death.

As an innovation, there is no investment risk for the company on surrender, since any negative yield must be borne by the client. As a minimum, on surrender 7 % of the savings is deducted, however. For traditional life insurance in DK the client's savings are reduced by only 7 % on surrender, so that the company must bear any investment loss.

In actuarial terms, on use of a retrospective calculation basis it would have been an advantage to have been able to calculate without this interest guarantee, since this would have given an opportunity to avoid distinguishing between positive and negative yields, which depend on the client's choice of investment.

In terms of marketing, however, the guarantee does give one product advantage in that the client is ensured reimbursement of deposits reduced by risk premiums on expiry a death. Costs are paid in the form of the guaranteed gross interest of 0.75 % per annum. This implies that a client can "play the market", whithout any other risk than a 0 yield.

This guarantee, its requirements of reserve allocations and how these problems can be solved, will be described in the following. However, I would first like to give a short description of the pools in which investment can be made in DK.

Investment Pools

In DK there are currently a large number of different securities in which the Insurance Company can invest. Divided into main pools, the following investment opportunities are available in particular :

I    Bonds
II   Index-Linked Bonds
III  Shares
IV   Real property

Characteristic of these investment alternatives is that yields on Classes I and IV are subjected to the previously mentioned real interest tax, whereas the yield on the other investment categories is exempt from this tax.

Real property is not subject to day-by day evaluation and therefore represents particular problems with regard to investment pools. Tryg Insurance has therefore choosen to disregard this category.

## DESCRIPTION OF SECURITIES

Definition of a bond

A bond is standardized claim, replacing individual debt instruments. The issuer is obliged to pay fixed interest on specific dates, and also to repay the loan after a period of time agreed between the parties. This can either take place by redemption of all issued

bonds at one time or by the early redemption of bonds on each due date. Insurance companies almost exclusively purchase only bonds issued against collateral security in real property.

### Definition of an index-linked bond

An index-linked bond is a special type of bond of which the nominal interest rate is usually 2.5 % per annum. The difference between bonds and index-linked bonds is that the remaining debt of index-linked bonds is subject to continual index adjustment. Instalments are likewise index-linked. For an investor this provides a good way to safeguard against price increases, since index adjustment makes the actual yield independent of inflation trends.



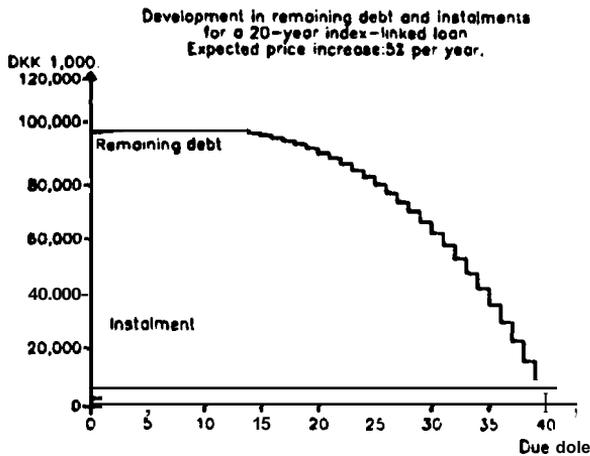Fig. 3

### Definition of shares

On purchase of a share, this does not in principle imply the right to any form of monetary payment, since an instrument of debt has not been acquired (as with a bond, giving entitlement to interest/repayment on every due date), but a share of ownership of a company. Shares are not subject to redemption like bonds and can thus only be converted to ready cash by sale.

However, annual dividend is paid, although the size of such dividend is not fixed (guaranteed). The dividend corresponds to that element of a company's operating profit which is distributed to its shareholders. Dividend will obviously fluctuate from year to year.

For investors, share dividend is normally less important than bond interest. If a price of DKK 1,000 per 100 has been paid for a share yielding 10 % in dividend, this corresponds to a yield of only 1 % on the invested capital. Yields are generated through growth in companies*earnings and consolidation(an expression of the value of the company).

The basis for a share price increase is i.a. created from own financing, i.e. that proportion of profits which is not paid as dividends, but remains in the company.

## Yield on Savings

In ordinary life insurance in DK today (Class I) bonds are valued at acquisition prices. Mathematical price adjustment of bonds takes place annually, ensuring that bands are written up to a price of DDK 100 per 100 over the remaining maturity of the bonds. This means that the book value of the bonds is not determined by a market price but by the development in the underlying liabilities. The valuation of the company's assets thus becomes a function of the liabilities, simultaneously implying that development in the company's balance sheet is extremely stable.

This principle ensures that a specific bond investment provides the same effective annual yield each year (see example below). This makes it possible to give all clients the same interest yield, regardless of when they enter the portfolio. This method of accruing interest on savings is describes as the average interest principle.

For investment-related insurance (Class III) Tryg Insurance has choosen to use a new-placement interest principle, where the yield on the previously-mentioned securities is determined on the basis of market price. This implies that for this type of business the liabilities become a function of the assets, so that the balance sheet varies a good deal from year to year. The periodical effective yield will likewise vary considerably, as shown in the following example :

## Example :
## Valuation and Yield for Traditional Bonds

Annuity loan (i.e. equal instalment payments on each due date), maturity 17 years, interest rate 7 % per annum, acquisition price DKK 80 per 100.

This corresponds to an effective yield of 10.44 % per annum.

Assuming that the market price develops as follows, at end-year prices :

> 1st year price DKK 70.00 per 100,
> 2nd year price DKK 85.00 per 100,
> 3rd year price DKK 82.27 per 100.

## Valuation with Average Interest Rate (Class I)

The assets is valued at acquisition price (80) plus mathematical price adjustment, which expresses the price adjustment towards DKK 100 per 100 which takes place year for year as maturity is approached. The price, including mathematical price adjustment, can be calculated at :

> 1st year price DKK 80.72 per 100,
> 2nd year price DKK 81.48 per 100,
> 3rd year price DKK 82.27 per 100.

The annual yield is calculated **as** the sum of :

\* direct yield, **i.e.** the interest for the year in relation to the market price for the year,

\* redemption **gain, i.e.** capital gain on redemptions in the year,

\* the year's price adjustment, **i.e.** adjustment of remaining debt at the calculated **prices.**

| Year | Direct Yield- | Redemption Gain | Mathematical Price Adjustment f a the Year | Yield |
|------|--------------|-----------------|-------------------------------------------|--------|
| 1 | 8.750 | 0.810 | 0.871 | 10.43 % |
| 2 | 8.672 | 0.857 | 0.908 | 10.44 % |
| 3 | 8.591 | 0.904 | 0.931 | 10.43 % |

With this valuation principle the yield varies only with the interest rate which can be achieved on reinvestment. The yield is therefore very stable.

Valuation with investment Pools (Class III)

Here the asset is valued in relation to market price. The annual yield is calculated **as** above, but with the difference that the actual market price is used Thus :

| Year | Direct Yield | Redemption Gain | Actual Price Adjustment for the Year | Yield |
|------|-------------|-----------------|--------------------------------------|--------|
| 1 | 8.750 | 0.810 | -12.095 | -2.54% |
| 2 | 10.000 | 1.537 | 20.660 | 32.20% |
| 3 | 8.235 | 0.702 | -3.084 | 5.85 % |

The example shows that the yield fluctuates considerably in investment pools, just as it cannot be predicted There is rapid adjustment to the market's effective interest rate.

Regardless of the principle used, the yield is credited to the client's account annually, if it is higher than the guaranteed basic interest rate.

As previously **described,** pension taxation legislation in DK requires that a lump **sum** at maturity can be calculated This requires that a basic interest rate is fixed, chosen to be **0** % per annum, although the example shows that a guaranteed interest rate of 0 % per **annum** can appear high **If an** interest rate lower than **0** % per **annum** had been chosen, this **would** probably have **been difficult** for clients to understand.

Since the company can avoid **an** accounting loss due to a negative yield by retaining the relevant assets, it has been chosen that if there is a negative yield in an investment **pool,** a client may not reduce the investment for that element of the savings which **has** been placed in the relevant investment pool.

## Example

A bond purchased at a price of DKK 80 per 100. At year-end this bond has been written up to a price of DKK 80.72 per 100 on mathematical price adjustment.

Status on purchase :

| Assets : | | Liabilities : | |
|---|---|---|---|
| Bonds | 80.00 | Savings | 80.00 |
| Total assets : | 80.00 | Total liabilities : | 80.00 |

Status at yearend according to the average principle :

| Assets : | | Liabilities : | |
|---|---|---|---|
| Bonds | 80.72 | Savings | 80.72 |
| Total assets : | 80.72 | Total liabilities : | 80.72 |

Calculated at market price the bond has fallen to a price of DKK 70 per DKK 100, which results in the following status :

Status at yearend according to the new placement principle :

| Assets : | | Liabilities : | |
|---|---|---|---|
| Bonds | 70.00 | Savings | 80.00 |
| Total assets : | 70.00 | Total liabilities : | 80.00 |

This means that if the company permitted reselection in case of negative yield, and was thereby forced to realize the loss, this would require the policyholder to pay an amount equal to the negative yield, which would result in tax problems.

In ordinary life insurance the average interest principle implies that a positive or negative "money tank" is built up, which is a reserve consisting of realized as well as unrealized capital gains or losses. If this reserve is negative, and supposing that all the company's clients cancelled their contracts, in the first instance the company, and then the clients, would suffer a loss. Ordinary life insurance is based on average considerations, and today it must be stated that in terms of known client behaviour, companies in DK have sufficient capital to cover any such loss. This if often ensured by deduction of 7 % of the client's savings as a costs and security premium as well as a fee of approx. DDK 1,000 on surrender. Furthermore, clients have no influence on the company's investment.

In an investment pool the average interest principle has been abandoned in favour of m a e individual choice of investment. The client has no influence on the composition of individual securities in a pool, but only on how the company's overall assets are divided in percentage terms between individual pools. This means that the company's stockbrokers determine what securities the individual pools consist of. For investment-related business, clients determine the size of individual pools. On the basis of this, and the 0 % guarantee, it is therefore important that the company's stockbrokers make up the price risk profile in individual pools correctly.

Negative Yield and **Treatment** Thereof

In the event of a negative yield in an investment pool, the client is unable to select an alternative investment. The reason for this limitation is that the saving element must never become less than guaranteed by the company. If reselection were permitted, **tax** authorities in DK would consider such a transaction to be **partial** surrender of the scheme (part of the savings element has lapsed) resulting in unfortunate taxation consequences.

In terms of investment many might think that in a falling market the arrangement should be realized. On the other **hand,** experience shows **that** the market fluctuates considerably. Even if **the** market is falling, it is very probable that the **price** will **rise** again. Since the company has the possibility in one investment pool of **choosing** between **investment** in securities or cash assets, it is up to the company to exploit the opportunity to hold cash in **periods** of falling prices.

If the client were able **to reselect** in the event of negative yields and still retain the full value (0 % guarantee) this would mean that the client would have to meet this deficit in addition to the agreed insurance premium, which is hardly **possible** in **tax** terms.

The loss **could** also be set off against positive yields in future years although since only the account balance, with deduction of negative yields, is invested, this would correspond to **the** company providing a free loan to **the** client to set off price drops, which makes this solution unfeasible.

What Are a Company's Possibilities of Assuming the Risk of Negative Yields ?

It is necessary to distinguish between the two situations in which the guarantee against negative **yields** is given, which are in the case of :

* a) death
* b) expiry

**Re a)**

In this situation there can both be a negative yield and the event of death. If a lump sum is involved the company must cover a possible negative yield in order to **comply** with the policy regulations.

If an annuity is involved the company can set off a possible negative yield against any possible positive yields in future years. This situation is described under re b).

On January 1 of each year the yield is distributed to the individual accounts and a risk premium is calculated for the following year's risk cover. Thereafter the guaranteed saving is written up, if growth has been positive. This means that the client's guaranteed savings $(V_g)$ are equal to the client's actual savings $(V_f)$, which is the savings which are subject to current investment. This bookkeeping entry is necessary, as a negative yield cannot be set off against a positive yield which has already been credited. If the yield is negative, $V_g$ is greater than $V_f$.

At this point it will therefore be known what **maximum** loss a company can suffer if **all policyholders** were to die on January 1. The loss can be calculated as follow :

$$\sum_i ({}^iV_g - {}^iV_f), \text{ where } i = 1,..., \# \text{ policies}$$

A risk premium can now be calculated on the basis of the cautiously determined death intensity of the basic portfolio. The formula is :

$$\sum_i (my_{x+t} * \{^iV_g - {}^iV_f\} / 12)$$

where $i = 1,..., \#$ policies
$my_{x+t}$ is the death intensity per client.

Now a model must be drawn up to project a yield sequence in order to calculate a security reserve for obligations to cover negative yields on death. Here I will instead calculate my portfolio with extreme negative yield values. Only the future can show whether these values are extreme, but the negative investment trend in e.g. the last 20 years might be considered. On the basis of this experience guidelines can be obtained.

Experience shows that a negative yield rarely occurs for more than 2 years running. The probability that the yield is negative for a longer period is therefore fixed at 0. This is naturally not statistically correct, since my argument represents a gamble. When black has not come out more than 4 times running, if this were to happen, one should not necessarily play red. However, I have selected this consideration since the yield sequence is not statistically independent. A major psychological effect is involved, by which is meant that when the price has reached a minimum at some level it begins to rise again. The reason is that many stockbrokers believe that paper has become too cheap and therefore increase demand for securities. Therefore the price rises. The reverse applies for price increases. At some point stockbrokers believe the price has become too high and want to "cash in their gains". They therefore prefer to sell and demand drops, so that prices fall. Securities trading is not based on mathematical models but on good trading flair. It has therefore not been possible to prepare a general statistical model.

My formula is as follows, where the yield per month is set to :

$$K_t = (1 + \text{sum (distribution ratio} * \text{monthly yield)})$$

calculated per policy,

where the **distribution ratio** is the percentage of the savings to be placed in the individual investment pool.. **Monthly yield** is the yield achieved per month in an individual investment pool.

$$AF = \sum_i \sum_t [my_{x+t/12}/12 * v^{t/12} * [^iV_g - {}^iV_t \ (t-1) * K_t] * I\{^iV_g > {}^iV_t \ (t-1)\}]$$

where

$i = 1, ... \#$ policies
$t = 0, ..., 23$ ($t = $ months)
$^iV_g$ is the saving per january 1
$iV_g$ (t) is the saving per January 1
$iVf$ (t) is the monthly saving to time t invested
I is the usual indicator function

AF is the reserve allocation until time $t = 0$

This formula does not allow for new additions with negative yields.

The yield is assumed to be calculated per month as the 12th root of the annual yield. The calculation date is January 1. The death intensity used in TI 87 is applied. Calculations are made on the basis of person-specific data from individual insurance policies.

## Example

On January 1 the portfolio's total $^1V_g$ : DKK 6,636,393

In all examples an interest rate of 5 % per annum is used as the discount factor. This corresponds to the assumption that inflation in Denmark is 5 % per annum on a long-term basis. The yield mentioned below assumes deduction of costs of 0.75 % per annum.

| Year/Yield | Pool I | Pool II | Pool m |
|---|---|---|---|
| 1 | -20 % | -10 % | -30 % |
| 2 | -20 % | -10 % | -30 % |

The calculation result :
Reserve allocation requirement in DKK : AF = 14000 and as a percentage of $^iV_g$ : 0.21

| Year/Yield | Pool I | Pool II | Pool III |
|---|---|---|---|
| 1 | -20 % | -10 % | -30 % |
| 2 | +5 % | +4 % | -12 % |

The calculation result :
Reserve allocation requirement in DKK : AF = 10951 and as a percentage of $^iV_g$ : 0.17

| Year/Yield | Pool I | Pool II | Pool III |
|---|---|---|---|
| 1 | +6 % | +4 % | +10 % |
| 2 | -8 % | -7 % | -17 % |

The calculation result :
Reserve allocation requirement in DKK : AF = 941 and as a percentage of $^1V_g$ : 0.01

| Year/Yield | Pool I | Pool II | Pool III |
|---|---|---|---|
| 1 | +3 % | +2 % | +4 % |
| 2 | -3 % | -2 % | -4 % |

The calculation result :
Reserve allocation requirement in DKK : AF = 288 and as a percentage of $^iV_g$ : 0.005

Here it could also be chosen to vary the yield within the year, with intervals per month, etc. However, I do not believe that this would help, since reserve allocation cannot be

based on random fluctuations. On the other hand, a company might become insolvent if too many of its decisions were based on average considerations. It can in fact be the case that, viewed over a year DKK 12, corresponding to DKK 1 per month, would be needed. If DKK 8 is required in June, and the final DKK 4 in August, it does not help to save up the amount over 12 months. The reserve allocation which should take place here should also take account of new additions as long as the company is in a growth phase. If there is a partfolio where additions and disposals vary very little, the formula shown above can be used, since here the reserve allocation was to cover the future two years' possible loss in the event of negative yield, as well as death. A newly started company should allocate this reserve differently, as the reserve at the beginning of the year is 0. The size of the reserve must therefore depend on the company's opening balance sheet, and marketing, investment and acceptance policies.

Here it can be mentioned that in the opening balance sheet, Tryg Invest's free reserves were over DKK 100 million, so that we had no initial difficulties.

## Re b)

On expiry of insurance the situation is different from in the case of death. The company knows the date of pay-out. A distinction can be made between a lump sum and an annuity. For a lump sum the situation is that savings grow towards expiry, while the reverse is the case for the annuity.

How can client speculation against the company shortly before expiry be avoided ? In principle "playing the market" is free, so that a client can be interested in taking a relatively high investment risk with the opportunity of high gains - or as the only loss to forego interest on savings in the final years.

For example the company can choose :

1) To allow clients to invest as they please and then allocate the necessary reserve,

2) To limit the client's investment opportunities prior to maturity.

## Re 1.

This possibility is self-excluding for this type of business, since the reserve which would have to be allocated would be very high and would therefore require a very large security premium.

## Re 2.

This possibility is in principle the only feasible one. A proposal for limiting might be that for a period of years prior to maturity (final pay-out) the client was unable to choose between the investment pools. One could try to calculate the number of years. During these years the company will place the savings in less risky paper with e.g. short maturities, so that any negative yield can be recouped. On the other hand, the client has no possibility of large gains during these years - there is still only a guaranteed yield of 0 %.

Another possibility might be to transfer the insurance to an insurance policy with

guaranteed interest The interest yield must be fixed with great certainty so that any negative yield can be **recouped.** This last possibility has been relinquished **until** further, **since** it would be **difficult** in marketing terms to sell an investment-type insurance policy with a guaranteed interest rate of 0 % per annum, for the first many years, which a few years before expiry is suddenly guaranteed an interest rate of **e.g.** 4.5 % per annum, which may in fact be very low. Is it then necessary to calculate traditional bonus during these years, so that the client does not feel cheated ?

We have chosen the first option, where we have calculated that it would be reasonable for clients to be denied the possibility of choosing between the **investment** pools in the last 3 years prior to maturity. **The** savings are then placed in a special pool with very little fluctuation in the price. **The** period of 3 years can be illustrated in the following examples :

Example

In the following examples a negative yield of 5 % per annum is used It is **assumed** that the special unit gives a yield of 5 % per annum, which is a cautious choice. **Furthermore,** this yield by **and** large corresponds to the yield which is used today as guaranteed for traditional life inurance, cf. the Introduction.

**Maturity** with **a Lump Sum**

Here, as previously mentioned, the savings will increase towards maturity.

| Calculation of example | | |
|---|---|---|
| Negative yield **before** maturity | 2 | 1 |
| | | Year of maturity |
| Yield **ratio** | -5 | ˙5 |
| Saving, **beginning** of year | 300000 | 300000 |
| Transferred negative yield | 0 | -17550 |
| **Pay-out** (mid-year) | 0 | 0 |
| Risk premium, beginning of year | 0 | 0 |
| Yield | -15000 | 14122 |
| Costs (0.75 % **+** 300) | -2550 | -2418 |
| Net yield (positive) | 0 | 11704 |
| **Net** yield (negative) | -17550 | 0 |
| Saving yearend | 300000 | 0 |
| Negative yield for the year | -17550 | 0 |
| Negative yield yearend | -17550 | -5846 |

**The** example shows that if the yield in the penultimate year is -5 % per annum, a yield of +5 % per annum in the final year will ensure that at maturity any negative yield which has not been credited will at most correspond to the company not receiving cover for gross costs in the final years.

## Maturity with an Annuity

Here, as previously mentioned, the savings are falling towards 0.

| Calculation of example Negative yield before maturity | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Annuity | | | Year of maturity | |
| Yield ratio | -5 | 5 | 5 | 5 |
| Saving, beginning of year | 160000 | 120000 | 80000 | 40000 |
| Transferred negative yield | 0 | -8350 | 4754 | -2706 |
| Benefit (mid-year) | -40000 | -40000 | -40000 | -40000 |
| Risk premium, beginning of year | 0 | 0 | 0 | 0 |
| Yield | -7000 | 4583 | 2762 | 865 |
| Costs (0.75 % + 300) | -1350 | -987 | -714 | -430 |
| Net yield (positive) | 0 | 3596 | 2048 | 435 |
| Net yield (negative) | -8350 | 0 | 0 | 0 |
| Saving yearend | 120000 | 80000 | 40000 | 0 |
| Negative yield for the year | -8350 | 0 | 0 | 0 |
| Negative yield year-end | -8350 | -4754 | -2706 | -2271 |

As for the example with a lump sum, it can be seen that any negative yield not credited on maturity will at most correspond to the company not receiving cover of gross costs in the last 3 years.

We could have chosen to distinguish between a lump sum and an annuity. For administrative reasons, as well as the extra security represented by the 3 years, Tryg has chosen this 3-year limitation to apply for all types of payment.

It is likely that the client thas no risk, since Tryg guarantees against loss in 2 situations, i.e. death and maturity. In other words this means that the client can invest funds otherwise, and at greater risk, than if this guarantee had not been given. On the other hand, clients themselves pay the cost, as their yield is reduced by the amount allocated to reserves. The company has the risk that the stockbrokers are not able to make favourable investments, with the risk that reserve allocation is not adequate. This may mean that the company foregoes gross profit to cover costs, as described above.

With the aforementioned considerations I believe that it is not always necessary to allocate many different forms of reserves. Often it will be enough to endeavour to limit a few speculation possibilities with the help of a legal agreement between the client and company.

In conclusion, it can be mentioned that during the **past** year only one company has established a **subsidiary** with the same object.

**It** will **be** exciting to **see whether** the **investment-oriented** product becomes **part** of the life insurance range in coming years, as has been seen in many other countries. **I** welcome this new company and hope that one outcome of this **competition** can be continuing product development, to the benefit **and** satisfaction of present **and** future clients.