

## Unit-linked annuities

### Increasing need for flexible retirement solutions

When it comes to financial retirement planning, it seems that the choice is between security and flexibility: On the one hand, lifetime annuities provide the certainty of not running out of money for the pensioner's lifetime. On the other hand, once a lifetime annuity is purchased, the annuitant is locked into the insurer's investment choice and return assumption. As the insurer has to guarantee the investment return, this is usually a rather conservative assumption, which in turn makes the annuity rate unattractive, especially in a low interest environment.

However, as seniors are increasingly prepared to take on investment risks, they decide for products such as drawdown solutions that allow for a higher investment return but leave them at risk of running out of money at a later stage. Consequently, lifetime annuity providers are at risk of losing market share due to a lack of a product sufficiently matching the needs of their customers. The concept of unit-linked annuities targets customers that would like to receive an income for life, but are happy to take on investment risks on their own.

### Product concept

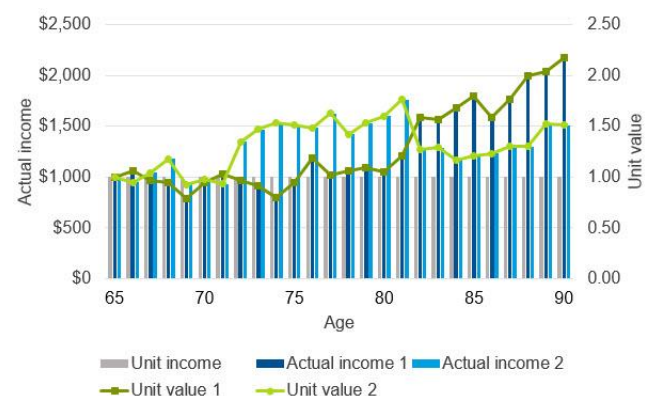
The idea behind unit-linked annuities is simple but efficient. Just as for standard lifetime annuities, a single premium is paid at retirement. However, the distinguishing feature of unit-linked annuities is that the single premium is invested by choice of the policyholder and transferred into investment units. A corresponding number of units paid out regularly for life – the unit-linked annuity – is guaranteed to the policyholder. The value of the units fluctuates with the investment performance.

The policyholder thus assumes the investment up- and downside, as the actual pay-out is dependent on the unit value. This enables the potential for significantly higher investment returns for the policyholder compared to standard lifetime annuities. At the same time, the longevity risk stays with the insurer, as the number of units paid out regularly is guaranteed for life.

This product concept also allows providers to offer investment switching in the course of the life of a policy and thus increase the flexibility of the product. Policyholders are enabled to adjust the investment profile to match their risk appetite.

Figure 1 shows a flat unit income of 1,000 units per year and two possible outcomes for the actual income based on different simulations for the unit value. At inception, this unit value is equal to 1.

**Fig. 1 Unit and actual income for two illustrative unit development scenarios**



### Purchasing power and the unit schedule

The number of units paid out regularly to the policyholder is pre-defined and can be adjusted to the policyholders' needs. In the example depicted in Figure 1, the unit income, depicted in grey bars, is constant.

The unit value at a specific point in time  $t$  is defined as  $v_t = \prod_{i=1}^t (1 + r_i)$ , where  $r_i$  is the actual investment return of the underlying assets in period  $(i - 1, i]$ .

Now, the actual income is defined as the unit income multiplied by the current unit value, thus it changes in line with the investment return. In the above examples, in

scenario 1, the unit value at age 70 is 0.78, resulting in an actual dollar income of  $0.78 \times 1,000 = 780$ . In scenario 2 at age 80, the unit value is 1.44, resulting in an actual dollar income of 1,440.

If now the actual investment return is higher than actual inflation, this would result in an annuity with increasing purchasing power, since in this scenario the annuity would increase more than inflation. By adjusting the number of units paid out over time with a constant factor, the expected purchasing power of the annuity can be adjusted:

Let us assume a starting income of  $u$  units that is adjusted regularly by a constant factor  $f$ , so the regular unit income in period  $t$  is given by  $u_t = u_{t-1} \times f = u \times f^t$ , where  $t$  starts with 0.

The actual income is given by multiplying the unit income with the unit value, which for the sake of simplicity we assume to increase with a constant investment return  $r_t = r$ . Assuming an initial unit value of 1, the actual cash income at  $t$  is thus given by  $u \times f^t \times (1+r)^t$ .

The purchasing power of the income at  $t$  is now given by the actual income discounted by inflation  $i$ , i.e.  $\text{purchasing power} = \frac{u \times f^t \times (1+r)^t}{(1+i)^t}$ .

By setting the adjustment factor  $f$  to  $(1+i)/(1+r)$ , where  $i$  is the expected inflation and  $r$  is the expected investment return, we have an annuity that is expected to have constant purchasing power:

$$\text{Expected purchasing power at } t = \frac{u \times f^t \times (1+r)^t}{(1+i)^t} = u \times \left(\frac{(1+i)}{(1+r)}\right)^t \times \frac{(1+r)^t}{(1+i)^t} = u.$$

If  $f$  is set greater than this value, the annuity is expected to have increasing purchasing power, and if  $f$  is set smaller than this value, the annuity is expected to have decreasing purchasing power.

The actual setting of the adjustment factor is based on the policyholders' preferences. As an annuity is often used for regular expenses, which are likely to decrease with increasing age, an annuity with constant or decreasing purchasing power might often make sense. At the same time, the higher the adjustment factor, the higher the starting income the provider is able to offer the policyholder.

## Reinsurance of unit-linked annuities

For the reinsurance of unit-linked annuities, the concept of a regular premium annuity treaty (RPAT), exchanging actual annuity payments with expected annuity payments, can be reutilised by just applying it to units.

The reinsurance premium is the expected annuity payments in units based on the agreed-upon mortality, and the reinsurance claim is the actual annuity payments in units. The expected and the actual annuity payments in units are offset with each other and multiplied with the unit value to get the actual settlement payment.

### Involved parties



### Mechanics



Concept of a regular premium annuity treaty (RPAT)

This reinsurance structure covers the insurer's longevity risk. Note that even though the policyholder takes the investment risk, this reinsurance structure also comes with a second order investment risk for the reinsurer:

If mortality is lower than expected and the balance of reinsurance premiums and claims is negative, this loss is amplified by (higher than expected) investment returns.

An alternative reinsurance structure, mirroring the insurer's cash flow, is a reserve release swap (RRS), where expected and actual reserve releases are exchanged. Equivalently, this swap can be implemented via exchange of the actual annuity payments and the actual change in reserve.

Just like the RPAT, this structure transfers the longevity risk to the reinsurer. In contrast to the RPAT, the reinsurance cash flow, in particular reinsurance premiums, ends as soon as the policyholder dies.

## Final thoughts

From an actuarial point of view, unit-linked annuities separate the investment risk and the longevity risk and shift the investment risk to the policyholder.

For annuitants looking for a retirement income product with a higher return potential and more flexibility, and willing to take this investment risk, the unit-linked annuity is an attractive alternative to a standard annuity.

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