FI Analysis

Low for long and large annuity payments

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Summary

The prevailing low interest rate environment is challenging for pension managers who pledge a guaranteed rate of return to their beneficiaries. A well-known problem is that the present value of guaranteed benefits increases when market rates fall, which has a negative impact on the financial position of the undertakings. A lesser-known problem is that traditional methods for bonus allocation can weaken the undertakings' solvency position over time if interest rates were to remain persistently low. This is because the bonus allocations in such a scenario create annuity payments that are too large.

This analysis shows how much bonus allocations can weaken the undertakings' solvency positions in a persistent low interest rate environment. It also shows that undertakings with a high percentage of paid-up pension policies, as well as policies with instalment premiums, are most vulnerable.

Finally, the analysis shows that there are alternative models for bonus allocation that would reduce the negative solvency effects of annuity payments in a low interest rate environment.

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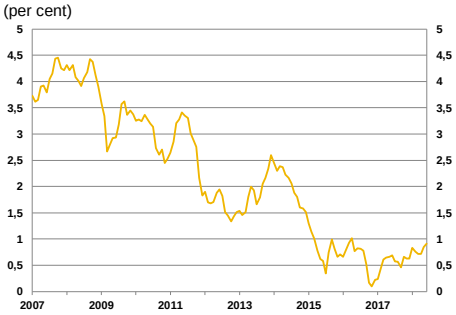
Diagram 1: Market rate for a ten-year Swedish government bond



Source: Thomson Reuters.

Background

Since the financial crisis in 2008-2009, market rates have fallen significantly and remain at historically low levels (Diagram 1). According to some economists, falling long-term interest rates reflect a view that the natural equilibrium interest rate has fallen to a permanently lower level than before (cf. Laubach and Williams, 2016). A persistent low interest rate environment causes problems for pension managers.[1] These problems differ depending on the type of pension scheme. In principle, however, low interest rates primarily affect funded pension schemes with guaranteed benefits, i.e. when the pension manager has pledged the policyholder a minimum rate of return on the paid-in pension premiums.[2]

Funded pension schemes are interest-rate sensitive since the present value of guaranteed benefits – and thus the pension manager's liabilities – increases when market rates fall. If the pension manager cannot generate a corresponding rate of return on its investments, the undertaking's financial position will deteriorate. Several pension managers have suffered from this following the decline in interest rates in recent years. This is a well-observed problem that has been documented in a number of studies, cf. Finansinspektionen (2017).

However, there is a lesser-known problem also linked to the decline in interest rates. This problem is related to how investment bonuses, in excess of the guaranteed rate of return, are normally allocated in defined-contribution pension schemes under with profits fund management.[3] These allocation principles are based on valuation standards established in an economic environment that differs significantly from today's low interest rate environment and reflect an expectation of stable market rates over time.

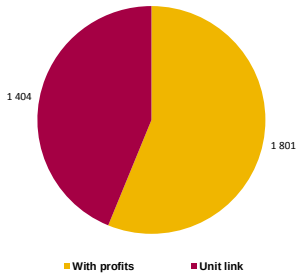
If the prevailing low rate environment were to persist, traditional bonus allocations rules may lead to annuity payments that are too large. This weakens the financial position of the undertakings and could lead to lower future pensions for younger policyholders. This FI Analysis explains why this is the case and offers examples of alternative models for bonus allocation that do not cause such effects.

1 The term *pension managers* refers to insurance undertakings, occupational pension funds and other firms that manage long-term savings in the form of pension schemes or endowment insurance.

2 The term *policyholder* refers in this analysis to the beneficiary. The beneficiary and policyholder can differ, primarily when it comes to occupational pension schemes.

3 There are a few studies on this topic. See e.g. Berdin et al. (2016), who conduct a cross-border comparison of bonus allocation.

Diagram 2: The percentage of defined-contribution schemes under with profits fund management and unit link insurance, respectively
(Managed assets, SEK billion)



Source: Annual reporting to FI, as at 31 December 2017.

Figure 1: Illustration of premium payment, determination of guaranteed value, discounting and provision

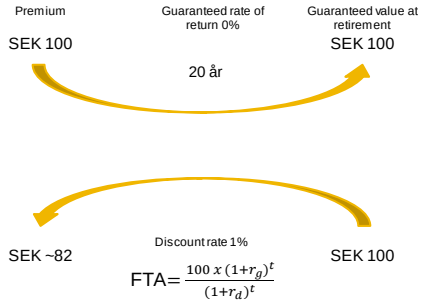
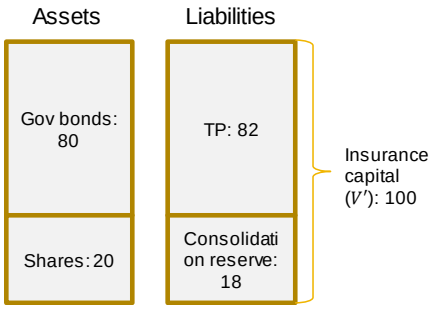


Figure 2. Schematic balance sheet for a mutual life insurance company



Risks associated with traditional bonus allocation

INVESTMENT BONUSES ACCRUE IF THE UNDERTAKING ACHIEVES A HIGHER RETURN THAN WHAT IS GUARANTEED

Defined-contribution pension schemes under with profits fund management are the most common form of pension policy in Sweden (Diagram 2). Pension policies can be signed by both individuals and employers (occupational pension benefits). In Sweden, many employees benefit from a collective occupational pension scheme. According to the agreement, the employer pays a premium every month towards an occupational pension policy, which pays out when the employee reaches the age of retirement. The premium is a percentage of the employee's salary. Occupational pension schemes are an important source of retirement income for many people.

The employee can choose whether the premiums are to be invested in a pension fund under with profits management or a unit link policy. The employee can also choose from a number of pre-selected pension managers. Upon reaching the age of retirement, the employee chooses whether to receive the pension as an annuity payment for the rest of his/her life or for a specified time period. Similar options are common in private pension schemes.

The distinguishing feature of with profits fund management is the guaranteed benefit.[4] Typically, the pension manager pledges a guaranteed rate of return on each paid-in premium. This guaranteed rate of return is often determined as a percentage of the expected return over long maturities, normally between 60–80 per cent of a long-term market rate.[5]

The undertaking reports a technical provision, i.e. a liability, for such guarantees. The value of the liability is calculated by first extrapolating every paid-in premium with the guaranteed rate of return the undertaking has pledged. This extrapolated amount constitutes the "guaranteed benefit". The extrapolated premiums are then discounted using a discount rate. For a paid-in premium of SEK 100, the calculation can be expressed in simplified terms as

$$TP = \frac{100 \cdot (1+r_g)^t}{(1+r_d)^t}$$

where TP is the technical provision for the guaranteed benefit, r_g is the guaranteed return, r_d is the discount rate and t is the time remaining to payout. Figures 1 and 2 illustrate schematically how the provision is calculated for a paid-in premium of SEK 100.

The provision for the guaranteed benefit (*TP* above) can also be defined as the *cost* of achieving the guaranteed return. In other words, this specifies the amount the pension manager must invest in interest-bearing assets – with a return of at least r_d – to be confident it will achieve the guaranteed rate of return.

4 Refer to the glossary for definitions of insurance-related terms that are used in the analysis.

5 At current interest rate levels, it is common to only guarantee a percentage of paid-in premiums. This corresponds in practice to applying a negative guaranteed rate of return.

In order to achieve the guaranteed rate of return, the pension manager retains the discretion to decide how the premiums are to be invested.[6] An undertaking with a cautious investment strategy normally invests a high percentage of the premiums in interest-bearing assets with low risk. However, because the discount rate is typically higher than the guaranteed rate of return, the technical provision is usually smaller than the policyholder's premium payment. Therefore, there is usually room for the undertaking to invest the difference in riskier assets, such as equities, which provide a higher rate of return (Figure 2).

This means that the pension manager has the ability to achieve an investment bonus in excess of the guaranteed return. The size of the future pension payout thus depends partly on the guaranteed rate of return and partly on the size of the investment bonus – in excess of the guaranteed rate – that the pension manager has achieved over time.

In Sweden, these bonuses are typically allocated to policyholders according to a specific method, called the retrospective reserve method (*retrospektivreservmetoden*). The retrospective reserve is a technical term that refers to the sum of each policyholder's paid-in premiums, adjusted by the allocated investment bonus, minus payments and withdrawals for costs associated with the policy. Investment bonuses are normally allocated using a general bonus rate.[7] This means that the undertaking's bonus is allocated proportionately according to the size of each policy's retrospective reserve and does not take into consideration whether and how the cost of achieving the guaranteed rate of return has changed.

The cost of achieving the guaranteed rate of return depends on the age of the policyholder and the time remaining until pension payout (t in the above formula). The sensitivity of the cost to changes in the market rates (that are used to discount the guaranteed benefit) also varies. Younger policyholders have a longer time remaining until annuitisation. The cost of achieving their guaranteed rate of return therefore increases more when market rates fall, compared to older policyholders. As previously mentioned, the retrospective reserve method does not take into consideration how these costs change, according to changes in the interest rates. This is partly due to the method's origins in a time when both accounting rules and the capital markets were different from what they are today.

According to older accounting rules, investment assets were to be valued at amortised cost and the lowest value principle. This means that the value of interest-bearing assets normally accrued by an annual rate corresponding to the discount rate with which they were valued at acquisition. The undertakings valued their technical provisions using a flat discount rate, which was also less sensitive to periodic fluctuations in market rates.[8] These valuation principles reflected an expectation of stable market rates over time, and the economics of individual pension policies were planned thereafter. Given such premises, the achieved return on investments works as a reasonable proxy for the investment bonus that should be allocated to individual policyholders.

In an environment where market rates fluctuate around a long-term average, such a bonus rule will not necessarily lead to any long-term

6 This form of savings thus differs from unit-linked insurance, where the policyholder determines which funds the premiums should be invested in and thus carries the investment risk.

7 Some undertakings also apply individual bonus rates.

8 Measurement of insurance commitments using market rates was introduced in Sweden in 2006. Measuring financial assets at fair value has occurred in several steps.

Figure 3. The insurance undertaking's balance sheet Year 0, before change in interest rate

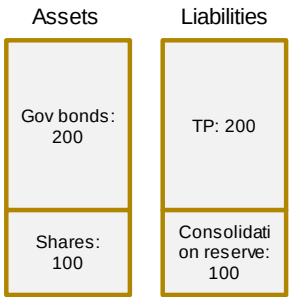


Figure 4. The insurance undertaking's balance sheet, after change in interest rate

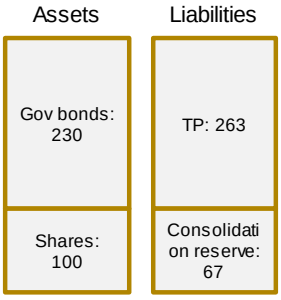
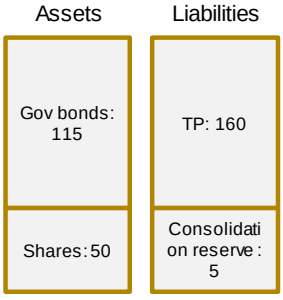


Figure 5. The insurance undertaking's balance sheet Year 1



consequences for the undertakings' financial position. This approach causes certain policies to make annuity payments that are too large when the rates temporarily fall and too low when interest rates rise. Over time, the effects cancel each other out, as long as the interest rate fluctuations are not persistent.

The bonus allocated using the retrospective reserve method can either be conditional or provisional. A conditional bonus is often specified as a fixed, agreed proportion of the undertaking's return on capital. A provisional bonus is instead determined according to more discretionary principles.[9] The undertaking can also withdraw the allocated bonus, if necessary, to cover losses. Provisional bonuses occur primarily in mutual life insurance undertakings, which is the most common association form, in the Swedish market for with profits pension schemes. The bonus capital is part of these undertakings' capital base and is normally called a consolidation reserve (Figure 2).

WHAT HAPPENS IF INTEREST RATES FALL?

The risks associated with traditional bonus allocation are best illustrated using a simplified example. Consider a life insurance undertaking with two customers. Customer A has one year left until retirement and Customer B has 20 years left until retirement. The payment at retirement is made as a lump sum, which means that the entire insurance capital is paid out at once.

At the outset (Year 0) both Customer A and Customer B have insurance capital of SEK 150. The insurance undertaking's liabilities are made up of provisions for a guaranteed benefit (TP) of SEK 100 per customer (in total SEK 200) and a consolidation reserve of SEK 100 in total. On the asset side are holdings of SEK 200 in government bonds and SEK 100 in shares (Figure 3).

We then assume that both the government bond yields and discount rates fall in parallel by 3 percentage points without any impact on the stock market. The following value changes then occur on the balance sheet (Figure 4):[10]

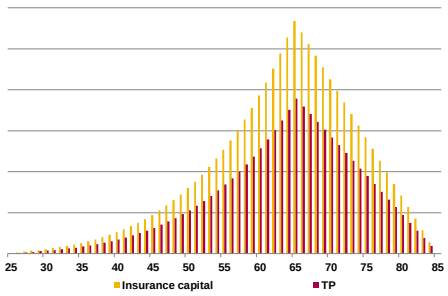
- TP for Customer A's guaranteed benefit increases to SEK 103.
- TP for Customer B's guaranteed benefit increases to SEK 160.
- The value of the government bonds increases to SEK 230.
- The value of the consolidation reserve falls by the difference between the increase in the value of the government bonds (230 – 200 = 30) and the increase in the value of the liabilities (200 – 263 = -63), i.e. SEK 33 (30 + (-63) = -33). After the changes in value, the consolidation reserve has fallen in value to SEK 67.

The increase in market value of the government bonds is allocated among the policyholders using a general bonus rate. The return of SEK 30 in total is allocated equally to Customer A and Customer B,

9 These principles are usually established in policy terms and conditions or through reference to a more general contribution principle.

10 The government bonds are assumed to have a duration of 5 years and the liabilities a duration of ~14 years. The changes in value in interest-bearing assets and liabilities are estimated by multiplying the change in interest rate with the duration. Guaranteed benefits are discounted using market rates and not a long-term equilibrium rate.

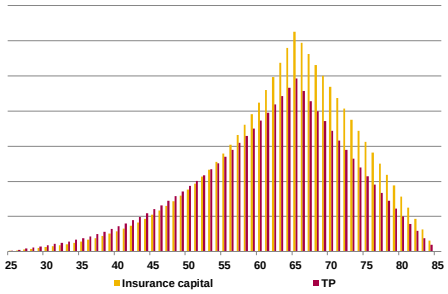
Diagram 3: Distribution of insurance capital (V) and TP of age cohorts



Source: FI.

Note: The red bars show the provision for the guaranteed benefit for each age cohort. The yellow bars show the size of the retrospective reserve. At the outset, the ratio between the retrospective reserve and the guarantee commitment is assumed to be 150 per cent for all age cohorts (Appendix 1).

Diagram 4: Distribution of retrospective reserve (V) and TP after change in interest rate



Source: FI.

Note: The change in interest rate means that the value of the guarantee commitment increases more than the value of the retrospective reserve. The ratio between the retrospective reserve and the guarantee commitment thus falls from 150 per cent to 114 per cent, but the ratio falls more for younger policyholders. For policyholders with a long time left until annuitisation (>11 years), the ratio falls to below 100%.

i.e. SEK 15 each. Customer A, who will have the entire pension capital paid out in Year 1, receives a lump sum of SEK 165 from the insurance undertaking. After the payout, the balance sheet is as follows (Figure 5):

- The value of the remaining assets is SEK 165 (330 – 230/2 – 100/2 = 165). Half of the value of the government bonds and equity shares are paid out to Customer A.
- TP for Customer B is SEK 160.
- The value of the consolidation reserve is SEK 5, which corresponds to the undertaking's remaining surplus after the payment to Customer A.

The undertaking is thus forced to finance a large part of the payment of Customer A's pension using the remaining economic surplus in the undertaking. The pension payment to Customer A therefore leads to a drastic reduction in the undertaking's consolidation reserve. The problem is magnified by the bonus allocation of SEK 15 that was paid out to Customer A despite the change in interest rates having resulted in a decrease in the undertaking's economic surplus. The problem therefore lies both in how the bonus is defined and how it is allocated.

In reality, the impact can be both more or less pronounced than in the example above. The calculation is based on, *inter alia*, an assumption that the difference in the interest rate sensitivity of assets and liabilities (measured as the duration gap between the cash flows) is 5.5 years. In reality, many traditional life insurance undertakings have larger duration gaps than this, which further enhances the impact of the changes in the interest rate.

EFFECTS ON SOLVENCY OVER TIME

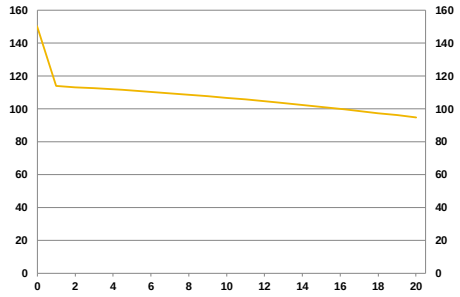
The example above illustrates the effect of a lump-sum payment. In practice, however, insurance undertakings often have long payout periods. A with-profits pension policy is usually composed of a savings policy, which is converted into an annuity upon retirement. The annuity provides a series of periodic income payments, either for a specified period or until the policyholder's demise. The effects of a persistent low interest rate environment may therefore take time to manifest themselves in the undertaking's financial position. In this section, we will thus elaborate the above calculations under an assumption that interest rates remain low for 20 years.

It is furthermore assumed that the ratio of guaranteed liabilities to insurance capital at the outset is 2/3 for all policies. This corresponds to a ratio of assets to liabilities of 150 per cent for the undertaking as a whole (Diagram 3). All interest rate changes are the same as in the previous example.[11]

As a result of the change in interest rates, the ratio between the guaranteed liability and the retrospective reserve changes. Due to the duration gap between government bonds (5 years) and guaranteed liabilities (~14 years), the market value of the assets increases by 10 per cent while the technical provisions increase by around 40 per cent. The ratio of assets to liabilities thus falls from 150 per cent to 118 per cent. The value of each policyholder's guaranteed liability changes asymmetrically, depending on the time remaining to annuitisation.

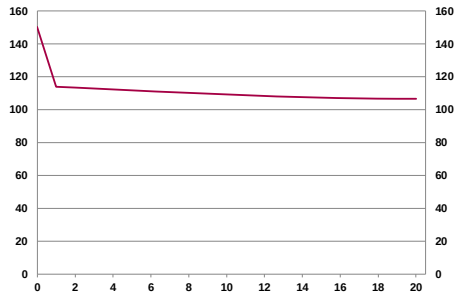
11 The calculation is based on a number of additional assumptions, which are presented in Appendix 1.

Diagram 5: Solvency over time in a run-off scenario, with a portfolio of paid-up policies
(Ratio assets/TP, per cent)



Source: FI.

Diagram 6: Solvency over time in a scenario with recurring premium payments
(Ratio assets/TP, per cent)



Source: FI.

However, the insurance capital is adjusted upward using a general bonus rate of 10 per cent for all policyholders (Diagram 4).

For policyholders with more than 11 years left before annuitisation, the guaranteed liability grows larger than the insurance capital. For policies that have already been annuitised, the value of the guaranteed liability increases much less, due to its shorter duration. This effectively implies that they are allocated a larger share of the undertaking's economic surplus. Taken as a whole, these changes serve to further weaken the financial position, as the older policyholders' insurance capital is paid out.

The contribution of bonus allocations to the undertaking's deteriorated solvency thus accrues gradually (Diagram 5) as bonuses are paid out to policyholders who have reached the age of retirement. These payments successively weaken the financial position, and the ratio between assets and TP falls below 100 per cent after 17 years. This means that the annuity payments eventually cause the undertaking to become insolvent. Remaining policyholders face the risk of not receiving the pension they were guaranteed.

Diagram 5 shows the impact of the assumed interest rate changes, *ceteris paribus*. The calculated effect is based on the undertaking not underwriting any new insurance policies or receiving any recurring premium payments on existing policies. The return on the investment portfolio is furthermore assumed to be zero. In other words, the diagram illustrates a run-off scenario for an undertaking with a portfolio of paid-up insurance policies.

The diagram also illustrates the effect of instalment premium payments. Instalment premiums mean that the insurance undertaking is not able to adjust the guaranteed rate of return on new premium payments. The effect of not being able to adjust the guaranteed rate is equivalent to the policy being paid-up. For policies with instalment premiums, the undertaking must include future premium payments (and liabilities associated therewith) in its technical provisions.[12]

SMALLER EFFECTS WITH RECURRING PREMIUM PAYMENTS

However, this example may be seen as highly stylized. In reality, there are many changes that impact the undertakings' balance sheets occurring on an ongoing basis. One important change is that the undertakings normally receive recurring premium payments on existing insurance contracts. They also typically have discretion to adjust the guaranteed rate of return on new premium payments.

Diagram 6 shows how the analysis is affected by recurring premium payments with adjusted guaranteed rates. The guaranteed rate of return is adjusted to a level at which the average solvency contribution for a premium payment is 15 per cent, i.e. the guaranteed liability amounts to 85 per cent of paid-in premiums. The analysis shows that the premium payments (with an adjusted guaranteed rate) help dampen the effect of bonus payments over time. The ratio between assets and TP falls to a low of 106 per cent at the end of the scenario horizon. In other words, the undertaking remains solvent, but the buffer for investing in risky assets has decreased. A lower share of

12 In accordance with the rules for contract boundaries set out in Article 18 of Commission Delegated Regulation (2015/35).

higher yielding assets could lead to lower pensions in the long run for remaining policyholders.

DISADVANTAGE FOR YOUNGER POLICYHOLDERS

A number of conclusions can be drawn from these analyses. First, they show that undertakings with a high percentage of paid up policies and insurance undertakings that are closed for new business are more vulnerable to the risks associated with a persistent low interest rate environment. The conclusion also applies to undertakings with a high share of instalment premium policies (with a fixed guaranteed rate).

Second, the analysis shows that undertakings with recurring premium payments are more resilient to these effects, since they can improve their solvency by lowering the guaranteed rate of return on new premiums. However, this implies that the undertaking uses the solvency contribution from new premium payments to pay out bonuses to annuitized policies. This is to the disadvantage of policyholders with a long time left to annuitisation. By extension, this could affect the size of the premium payments the undertaking receives – to the extent that younger policyholders have the option of transferring their policies to other undertakings that are not similarly burdened by contractual obligations from the past.

It should be noted that traditional bonus allocation rules only benefit policyholders close to annuitisation in scenarios where interest rates fall. If market rates instead were to permanently rise to a higher level, annuity payments would decrease for older policyholders, instead benefiting younger policyholders. The method of using a general bonus rate can therefore not be seen to have a general smoothing effect with respect to how bonuses are allocated following interest rate changes.

An alternative model for bonus allocation

The problem with using a general bonus rate is that it does not take into consideration how interest rate changes affect the economics of individual policies. Instead, it allocates the return on investments proportionally based on the size of each policyholder's insurance capital. This means that interest rate decreases benefit policyholders close to annuitisation, at the expense of the undertaking's solvency as well as younger policyholders. This section presents an alternative model for bonus allocation and the effect this model would have on annuity payments as well as the undertaking's financial position, given the same assumptions used in the earlier example. The model is one of several alternatives for allocating bonuses in a manner that gives better consideration to how the cost of guaranteed provisions differ for individual policies.[13]

Instead of allocating the return on investments proportionally, the model proceeds from the effect of interest rate changes on individual policies. Accordingly, it moves away from a collective to an individual approach in how the economics of pension policies are managed. The model also sets out a different definition of the undertaking's total

13 This alternative should not be viewed as a method that FI specifically advocates. Rather, it serves as an indication of the differences between collective and individual approaches to bonus allocation in respect of their ability to handle a transition to a persistent low interest rate environment.

Table 1: Allocation of insurance capital prior to the interest rate change

Insurance capital	Customer A	Customer B
G	100	100
Economic bonus	50	50
Total	*150*	*150*

Table 2: Allocation of insurance capital after the interest rate change

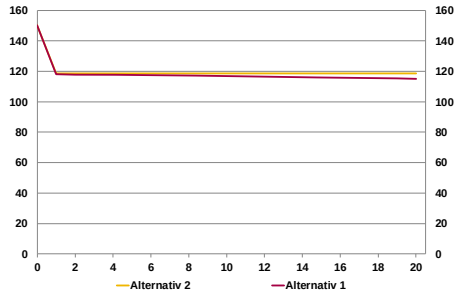
Insurance capital	Customer A	Customer B
G	103	160
Economic bonus	33.5	33.5
Total	***136.5***	***193.5***
Allocation using the retrospective reserve method	*165*	*165*
Difference	*-28.5*	*28.5*

Table 3: Allocation of insurance capital after interest rate change, expressed as a bonus rate

Allocated bonus rate	Customer A	Customer B
Retrospective reserve method	10%	10%
Alternative bonus allocation	-9%	29%

Diagram 7: Solvency over time using alternative bonus allocation

(Ratio assets/TP, per cent)



Source: FI.

Note: The diagram shows the change in the undertaking's solvency over time due to the payout of pensions. Alternative 1 shows the change that occurs if the bonus is allocated proportionally based on the size of each policy's retrospective reserve, the change in the undertaking's total surplus is translated into an effect on the individual policyholder's surplus. In the example, the consolidation reserve decreases from SEK 100 to SEK 67, i.e. by 33 per cent. This bonus rate is now multiplied by each policy's individual surplus (i.e. SEK 50 per customer). This means that both policyholders' surpluses fall by 33 per cent to SEK 33.50. This bonus is then added to the policy's guaranteed liability. For Customer A, the guaranteed liability has increased to SEK 103, and for Customer B to SEK 160. This means that Customer A's total insurance capital decreases to SEK 136.50 and Customer B's increases to SEK 193.50.

The effect is that Customer A receives a significantly smaller payout. Using traditional bonus allocation rules, Customer A received a payout of SEK 165 upon retirement. Using the alternative bonus allocation, Customer A instead receives a payout of SEK 136.50.

surplus. Instead of only taking the return on investments into consideration, the model looks at the economic surplus, which is defined as realised return on capital less the change in present value of guaranteed liabilities. For mutual undertakings, the definition can simply be expressed as the change in the value of the consolidation reserve.

To clarify the definition, we introduce the following terms:

- Investment portfolio (P): The portfolio of assets in which the undertaking has invested the clients' premium payments and accumulated return.
- Guaranteed liability (G): The present value of the individual policy's guaranteed benefit.
- Provision for guaranteed liabilities (TP): The sum of the guaranteed liability for all policyholders (G).
- Surplus (S): The difference between P and TP.[14]

At the level of the individual policyholder, we define the insurance capital as the sum of the guaranteed amount (G) and an economic surplus (S^w). Furthermore, we introduce an economic investment bonus that is based on the achieved return on investments less the change in the provision for guaranteed liabilities (i.e. $\Delta P - \Delta TP$), divided by the initial surplus (S_0). This bonus rate is applied to the policy's economic surplus at the beginning of the period (S_0^w).

AN INDIVIDUAL BONUS ALLOCATION

Let us start with the first example in this analysis, the life insurance undertaking with two customers, Customer A and Customer B. The interest rate changes are the same as in the previous example, i.e. market rates fall by 3 percentage points for all maturities. All initial effects are the same, which means that the undertaking's consolidation reserve decreases to SEK 67.

In the second step, the alternative model deviates from the example using a general bonus rate. Instead of allocating the return on investments proportionally based on the size of each policy's retrospective reserve, the change in the undertaking's total surplus is translated into an effect on the individual policyholder's surplus. In the example, the consolidation reserve decreases from SEK 100 to SEK 67, i.e. by 33 per cent. This bonus rate is now multiplied by each policy's individual surplus (i.e. SEK 50 per customer). This means that both policyholders' surpluses fall by 33 per cent to SEK 33.50. This bonus is then added to the policy's guaranteed liability. For Customer A, the guaranteed liability has increased to SEK 103, and for Customer B to SEK 160. This means that Customer A's total insurance capital decreases to SEK 136.50 and Customer B's increases to SEK 193.50.

The effect is that Customer A receives a significantly smaller payout. Using traditional bonus allocation rules, Customer A received a payout of SEK 165 upon retirement. Using the alternative bonus allocation, Customer A instead receives a payout of SEK 136.50.

14 B corresponds to the consolidation reserve in an undertaking that operates under mutual principles.

LITTLE OR NO EFFECT ON SOLVENCY WITH THE ALTERNATIVE MODEL

The payout still results in a slight decline in the undertaking's solvency. Using the alternative model, the solvency falls from 125 per cent to 121 per cent, compared to a drop to 103 per cent using traditional bonus allocation rules. This marginal decrease in solvency means that there is still some smoothing of surplus from policyholder cohorts in the savings phase to policyholders who are close to annuitisation. However, the example shows that the alternative model for bonus allocation would significantly decrease the problem of weakening solvency due to annuity payments.

There is a second alternative for how the bonus can be allocated. The example in the previous paragraph assumes that the bonus is allocated proportionally according to the size of each policy's surplus. Another alternative would be to allocate the bonus proportionally to each policy's guaranteed liability (G). With such an allocation rule, there would be no surplus smoothing between policyholder cohorts, and the undertaking's solvency would therefore not be affected by the payout (Diagram 7).

Concluding remarks

This analysis shows that traditional methods for bonus allocation can weaken the solvency of pension managers over time if the economy undergoes a transition to a persistent low interest rate environment. This is because the method of using a general investment bonus is designed for an economic environment with stable market rates over time. If interest rates remain persistently low, the undertakings' solvency is weakened by annuity payments. Undertakings with a high percentage of paid-up policies or policies with instalment premiums are more vulnerable to these effects. The analysis also shows examples of alternative models for bonus allocation that reduce the negative solvency effects of annuity payments in a low interest rate environment.

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Appendix 1. Assumptions used when calculating solvency effects over time

Characteristics of the policyholders. The age span for the policyholders is 25–84. Their starting salary is SEK 30,000 a month at the age of 25. Their salary increases by 2 per cent a year. They make a premium payment every year corresponding to 4.5 per cent of their annual salary, plus 30 per cent of the part of the salary that exceeds 7.5 basic income amounts.[15] The insurance capital is assumed to grow by 5 per cent a year.

Characteristics of the policies. The policies have a payout period of 20 years, which corresponds to the average payout period in a life insurance undertaking. Payouts begin at age 65. At the outset, the ratio between the insurance capital and the guaranteed amount is 150 per cent in all age categories (Diagram 3). This is based on the assumption that the relationship does not differ significantly between generations, which is somewhat in line with reality. While older policyholders often have a high accumulated return, their guaranteed liabilities have also typically increased sharply as a result of the long period of falling interest rates.

Assets and liabilities of insurance undertakings. One-third of the assets are invested in shares and two-thirds are invested in government bonds. Government bonds have a duration of five years. The duration of the insurance undertakings' commitments is assumed to be 14 years, which is based on assumptions about the policyholders' ages and the point in time at which payouts will begin.

Interest rate changes. Both the market rates and the discount curve fall by three percentage points. This corresponds roughly to the change in market rates that occurred between 2011 and 2015. The change in interest rate is assumed to have a full impact on the valuation of technical provisions. This means that the example does not assume a long-term equilibrium interest rate for discounting of guaranteed commitments with long maturities, like in the Solvency II regulations, for example.[16]

15 These assumption are based on typical rules for occupational pension schemes in collectively agreed employment contracts. The analysis is simplified but relevant for life insurance undertakings with provisions for both occupational pensions and private pensions. The assumption can be considered as representative for how pension savings accrue over the average lifetime of an individual.

16 Article 77 of the Solvency II Directive states that the Best estimate of technical provisions shall be calculated as the expected present value of an insurance undertaking's future cash flows, with the application of risk-free interest rates for relevant durations. Article 77a furthermore states that the applied interest rates shall converge toward an ultimate forward rate.

Appendix 2. Glossary

Discount rate The rate used to calculate the present value of a future payment.

Unit-linked insurance Life insurance in which the policyholder selects the funds in which the capital shall be invested.

Technical provisions The provisions that an insurance undertaking must set up to cover future obligations to policyholders and costs for insurance administration.

Solvency The ability to honour obligations towards policyholders.

Solvency II The solvency regulations for insurance undertakings were developed within the EU and entered into force on 1 January 2016.

Occupational pension scheme Pension benefits that are linked to employment through an agreement on pension benefits between an employer and an employee or their representatives.

With profits insurance Life insurance in which the insurance undertaking guarantees a certain minimum rate of return on savings.

Smoothed bonus approach A method for allocating bonuses for pension schemes under with profits management. This method contains an element of risk smoothing and thus is different from a return rate. The idea is that a policyholder can be protected from excessive fluctuations in market values by sharing the financial risk across various policyholder cohorts. The bonus rate is determined on an ongoing basis and is changed as needed. A typical model for determining the bonus rate is presented in Alm et.al. (2006). The model is based on the company defining in its policy a target consolidation rate, m, which is typically between 105 and 110. The company also defines a dampening factor, d, which specifies how quickly the bonus rate responds to changes in the return on capital. The bonus rate is then set as

$$r_w = \textit{Expected return on capital} + \frac{Assets/V - m}{d}$$

Conditional bonus A rule-based principle for the distribution of a bonus. Normally specified as a fixed, contractual proportion of measured capital return. A conditional bonus is part of a company's technical provisions.

Mutual insurance undertaking An insurance undertaking that is owned by its policyholders and in which all surplus is returned to the policyholders. If the undertaking incurs losses, the policyholders' bonuses are used to cover them.