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A COMPARISON OF RISK-SHARING APPROACHES IN HYBRID OCCUPATIONAL PENSION SCHEMES

Abstract

Objective: Hybrid pension schemes provide a mixture of features of DB and DC schemes. They allow for the risk to be shared between employer and member. The aim of this article is to present the risk sharing between employer and member within selected forms of hybrid pension schemes – cash balance and self-annuitizing schemes – and in a proposed type of hybrid scheme.
Research Design & Methods: The variability of contributions required to provide a fixed level of benefit is chosen as a measure of risk within the schemes. Investment and longevity risk is introduced via changes in the investment rate of return and life table probabilities used to price annuities. The variability of member and employer contributions required in each scheme is compared.
Findings: In cash balance and self-annuitizing schemes risk sharing is achieved by allocating a given type of risk (investment or longevity risk) to either the employer or the member. In the proposed scheme, risk is shared irrespective of its type. This allows for better financial planning for the two parties involved by setting a limit on the employer's contributions and requiring an adjustment to the member's contributions only in certain instances.
Implications/Recommendations: A hybrid scheme which allows for risk to be shared irrespective of its type should be considered. Additional safeguards, such as setting an upper limit for contributions, should be employed.
Contribution: Further development of hybrid pension schemes and a comparison of the proposed solution with existing ones.

Keywords: occupational pension schemes, risk sharing, hybrid schemes, contributions.
JEL Classification: G22, J26.

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1. Introduction

The aim of occupational pension schemes is to allow members (employees of a sponsoring employer) to provide extra income for retirement. The actual cost of benefit provision is unknown (it is only known after all the benefits have been paid out or bought out through an insurance company), so there is a risk that the funds accumulated for the payment of retirement benefits could be inadequate. While there are several types of risk affecting retirement benefit provision (Blake 2006, p. 174; Turner 2014, pp. 5–6; Cooper 2005, pp. 6–7), this article focuses on two types of risk which have a big impact on the funding of a pension scheme: investment risk and longevity risk.

Investment risk is the risk that the rate of return which the scheme earns on its investments is higher or lower than expected. Longevity risk is the risk that a member's future life in retirement (which determines how long the benefits will be paid for) will be shorter or longer than assumed. As a result, the funds accumulated for the payment of retirement benefits may be lower or higher than required.

Defined contribution (DC) and defined benefit (DB) schemes are the two main forms of occupational pension scheme (Pugh & Yermo 2008, p. 6). In a DC scheme, the benefit amount is unknown and depends on contributions paid and the rate of the scheme's investment returns. The member bears the investment and longevity risk, although they can protect themselves against the latter by purchasing a life annuity from an insurance company. In a DB scheme, the benefit amount is set in advance and the employer has the responsibility to fund the scheme in such a way that the promised benefits can be paid. As such, it is the employer who bears the risk in this scheme. DB schemes have recently been in decline, with some employers choosing to close their DB schemes in favour of a DC scheme in order to decrease the level of risk to which they are exposed (Petelczyc 2016, p. 62). This, however, leads to members bearing all the risk, despite often not having adequate means or knowledge to manage and protect themselves against that risk (Clark & Monk 2006, pp. 43–44; Davis 2013, p. 685; Sweeting 2007, p. 2).

Hybrid pension schemes are schemes that are neither fully DB or DC, but are a mixture of both. They allow for the risk to be shared between the employer and the member.

Occupational pension schemes are common in countries such as Switzerland and the Netherlands, where participation in these schemes is compulsory (nationwide or for certain industries or professions), with the participation rate reaching almost 90% (European Commission 2017, p. 7).

In countries where participation is voluntary, the participation rate is usually lower, for example around 55% in the US (Bureau of Labor Statistics 2018). In Poland, only 2.6% of employees participated in an occupational pension plan in 2018 (KNF 2019). However, this figure can change after the introduction of new employee capital plans with automatic enrolment.

The aim of this article is, firstly, to illustrate risk sharing within selected forms of hybrid pension schemes, and then to illustrate it in a scheme which takes a different approach to risk sharing between employer and member. To this end, the variability of the employer's and member's contribution needed to achieve a target level of benefit is investigated. The effectiveness of occupational pension schemes could be increased in this way.

2. Risk Measures in Pension Schemes

Risk in a pension scheme can be measured in several ways. From the member's point of view, an important measure is the variability in benefit amount which can be received from the scheme (Blommestein *et al.* 2009, Cooper 2005, Davis 2013, Davis & Madland 2013). In a DB scheme, the member is guaranteed to receive a pension equal to a proportion of their salary, hence there is no variability of benefit amount. By contrast, in a DC scheme, the benefit amount is not known until retirement, as it depends on the amount of contributions paid, the rate of investment returns which the scheme has earned net of costs, and annuity conversion rates.

Another measure used to illustrate risk in pension schemes is the variability of the funding level, i.e. the ratio of the scheme's assets to its liabilities (Blommestein *et al.* 2009). This measure applies to DB schemes and schemes with some benefit guarantee. Depending on the financial performance of its assets, such a scheme may be under- or over funded. By contrast, a DC scheme is always fully funded. This is an important measure for the employer, as any changes in the funding level will need to be rectified, typically via an increase in the employer's contributions. From the member's point of view, this measure shows the security of benefits, as a very low funding level may indicate financial difficulty and the possibility of benefits not being paid.

The third measure, and the one that will be used in this article, is the variability of contributions needed to provide a fixed level of benefit (see also Gierusz 2019). The contributions of employer and member will be considered separately in order to illustrate risk sharing within a scheme. In a DB scheme, a member's contributions are fixed, whereas the employer's

contributions are adjusted to ensure that funding remains at the required level. In a DC scheme, the situation is the opposite: the employer's contributions are fixed and the member's contributions may need to be adjusted in order to provide the required level of benefit. In a hybrid scheme, either the employer's or the member's contributions can change depending on who bears the given type of risk.

3. Hybrid Schemes Considered

For the purpose of this article, two forms of hybrid scheme have been chosen due to their risk-sharing characteristics: the cash balance scheme and the self-annuitising scheme.

In a cash balance scheme, a member's account is credited every year with a certain fixed percentage of their salary (a so-called salary or pay credit). Every year, the amount accumulated within the account is increased by a fixed interest rate guaranteed by the employer (interest credit). At the point of retirement, the member is entitled to the amount accumulated within the account, which can be used to purchase a life annuity from an insurance company (Mackenzie 2010, pp. 4–5; Szczepański & Brzęczek 2016, p. 114; Takayama 2013, p. 11). This scheme resembles a DB scheme during the pre-retirement phase, since the interest rate used to accumulate funds is guaranteed by the employer and is independent of the scheme's actual investment returns, hence the employer bears the investment risk. However, after retirement the risk is passed on to the member, who has to bear the longevity risk or purchase an annuity from an insurer.

The second hybrid scheme considered is a self-annuitising scheme. Before retirement this scheme resembles a DC scheme – contributions are fixed and accumulated at the actual rate of scheme's investment returns. However, at the point of retirement the amount accumulated within the member's account is used to "buy" a life benefit within the scheme, according to a fixed, pre-determined annuity conversion rate (Wesbroom & Reay 2005, pp. 13–14). Hence, the member bears the investment risk, and the employer bears the longevity risk.

4. Modelling Assumptions

4.1. General Remarks

All the schemes under consideration (DB, DC, cash balance and self--annuitising schemes) provide or aim to provide the same level of benefit.

A replacement rate of 60% of final salary was chosen as that target. This was based on the World Bank recommendation of a replacement rate equal to 50% of final salary (World Bank 1994, p. 294) and a replacement rate of around 75–95% as proposed by Palmer (2008, p. 24). Within each scheme there is only one member, who joins it aged 25 and remains an active member of the scheme until retirement at age 65. Assumptions about the rate of the scheme's investment returns, salary increases, interest rates, and survival probabilities used to calculate annuity conversion rates were made, and an annual contribution rate required to achieve a 60% replacement rate was calculated (this is referred to as the base contribution rate). Next, investment and longevity risks were introduced by varying the rate of investment returns and survival probabilities in the life table. A corresponding increase or decrease in the contribution rate required to maintain the target replacement rate was calculated.

4.2. Base Contribution Rate

All the calculations were made in relation to real values and amounts. The real rate of the scheme's investment returns was set at 4% p.a. This was based on the long-term assumptions of J.P. Morgan (2018), i.e. a 5.25% nominal rate of return and 1.5% inflation in Europe. In reality, this assumption will vary from scheme to scheme and possibly from member to member depending on the chosen investment strategy, risk attitudes, and time to retirement, but for the purpose of this article it was assumed that all schemes follow the same investment strategy. The real rate of salary increase was set at 1.5% p.a. based on J.P. Morgan's assumption (2018) of real GDP growth in Europe. In order to calculate the annuity conversion rate, the real interest rate was set at 0.5% p.a., and survival probabilities from the 2017 unisex life tables published by the Central Statistical Office in Poland were used (GUS 2018).

The benefit, equal to 60% of final salary, takes the form of a life annuity payable yearly in arrears. Using an interest rate of 0.5% p.a. and the 2017 unisex life tables, an annuity conversion rate of 16.67 was derived. Thus, for every monetary unit of the required pension amount, 16.67 monetary units have to be accumulated at retirement age 65. It is assumed that this conversion rate is used by an insurer to price annuities. For the chosen financial assumptions this means an amount equal to approximately 10 times final salary needs to be accumulated within the scheme at retirement in order to purchase the target benefit.

The base contribution rate, assuming a rate of investment return of 4% p.a. and salary increases of 1.5% p.a., was calculated to be 15% of salary. This was divided equally between member and employer, i.e. each party contributes 7.5% of salary into the scheme every year. It is assumed that the contribution is paid annually at the end of the year.

4.3. Specific Scheme Assumptions

In a DC scheme, the target benefit of 60% of final salary is set and annual contribution rates of 7.5% of salary for both the employer and member are agreed. If the assumptions are borne out, an annuity of the desired amount will be purchased at retirement. If the actual experience differs from that assumed, member contributions will need to change in order to achieve the desired level of benefit (employer contributions are fixed at 7.5% of salary). If the investment returns are lower than expected, or increases in longevity cause the insurer to increase the price of the annuity, the member's contribution rate will need to increase; if investment returns are higher or longevity lower than expected, the member's contribution rate will decrease. This means that while bearing the investment risk and longevity risk (via the risk of a change in annuity prices), the member bears the upside as well as the downside of risk. In practice, it is more common for members to pay a fixed contribution rate and bear the risk through the variability of benefits, but for the purpose of this article it is assumed that the member chooses (and is allowed) to vary their contribution rate.

In a DB scheme, the employer promises the member a benefit of the target amount. The employer bears the investment risk and the longevity risk, just as the member does in the DC scheme described above. For the purpose of comparison, it is assumed that the employer will buy out the liability when the member retires, i.e. will purchase an annuity similarly to a member in a DC scheme, rather than pay out the pension from the scheme. The employer's contribution rate is calculated in the same way in which a member's contribution is calculated in a DC scheme[1]. Any impact of regulation, which could require the sponsor of a DB scheme to use more pessimistic or prudent assumptions to fund the scheme is not considered.

[1] Often in a DB scheme, the contribution rate is set every year (or every couple of years) based on the benefits accruing over the next year (couple of years) of service (GCAE 2001). In this article, in order to compare DB and hybrid schemes with a DC scheme, it is assumed that in all schemes the contributions are calculated every year as constant rates of salary over the time remaining to retirement, taking into account the projected value of contributions already accumulated.

In a cash balance scheme, 15% of salary is credited to the member's account at the end of every year. An interest credit is calculated using a real rate of 4% p.a. This means that a lump sum equal to 10 times the final salary is promised at retirement. If the investment returns differ from that assumed, the employer's contribution rate will need to be adjusted. However, it is the member who bears the longevity risk in this scheme. If annuity prices change (due to changes in longevity), a lump sum of 10 times final salary may not be enough to purchase the desired benefit amount. Hence the member's contribution will need to change. As the member's contribution rate in this scheme is fixed at 7.5% of salary, the extra contributions made by the member due to changes in longevity can be considered to be paid as additional voluntary contributions.

In the self-annuitising scheme, annuity conversion rates are fixed at 16.67. It is assumed that the employer will buy out the liability with the insurance company, hence any changes in annuity prices will cause the employer to adjust their contribution rate accordingly. The member bears the investment risk, so changes in investment returns will need to be rectified by variation in the member's contribution rate.

Finally, a new type of hybrid pension scheme, proposed by Gierusz (2019) is modelled. In this scheme, each member has an individual account into which contributions made by the employer and member are paid. At retirement, an annuity providing the desired benefit level for life is purchased. A target benefit level (60% of final salary) is chosen, and the base contribution rate required to achieve that benefit is calculated. Using the assumptions described above, this will be a contribution rate of 7.5% for the member and 7.5% for the employer. Every year, a change to the contribution rate, required to achieve the target benefit in the case of changes in investment returns or longevity, is calculated and divided between member and employer as follows: a change of up to 5 percentage points (p.p.) is paid by the employer, while anything required above 5 p.p. is paid by the member.

Next, four different scenarios are considered in which investment returns or survival probabilities change, causing a change in the required contribution rate.

5. Calculation Results

Scenario 1

The following model of future investment returns is considered: the rate of return every year is a random variable following normal distribution with set mean and variance. In scenario 1, this mean is equal to 4% and the standard deviation is equal to 2%. A random sample of 40 rates of return was drawn (one for each year of service in the scheme), and year by year a contribution rate required to achieve the target benefit in each of the considered schemes was calculated. Figures 1 and 2 illustrate the contribution rates payable in each of the considered schemes.

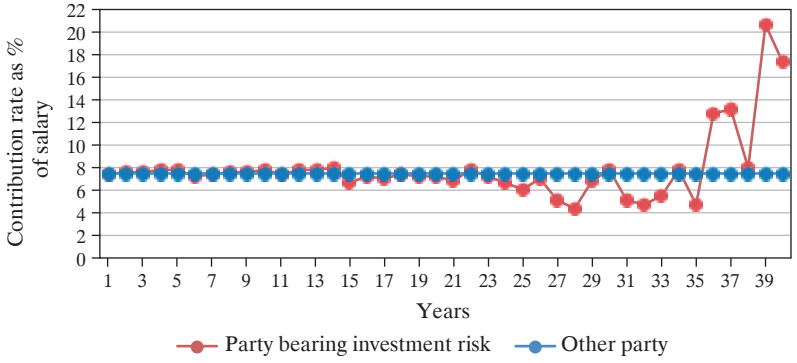

Fig. 1. Contribution Rates under Scenario 1 in a DC, DB, Cash Balance or Self-annuitising Scheme

Source: author's own work.

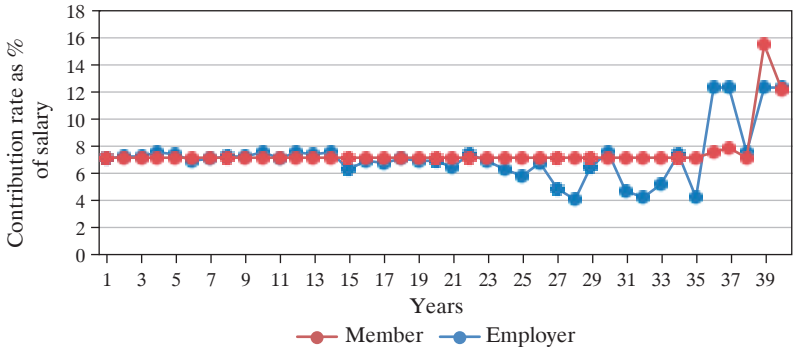

Fig. 2. Contribution Rates under Scenario 1 in the Proposed Scheme

Source: author's own work.

As shown by Figure 1, a change in investment return rates according to scenario 1 causes a fluctuation in the contribution rate of a party bearing the investment risk (a member in a DC or self-annuitising scheme, an employer in a DB or cash balance scheme). On average, they pay a contribution rate which differs by 1.5 p.p. from the base contribution rate. If the member chooses not to adjust their contribution rate in a DC or self-annuitising scheme, the benefit at retirement decreases slightly to 59% of final salary.

In the proposed hybrid scheme, as shown in Figure 2, the extra contribution is shared between employer and member. The employer's contribution rate is different from the base rate by 1.1 p.p. on average, the member's contribution rate by 0.4 p.p. The member needs to adjust their contribution in 10% of all years.

Scenario 2

In this scenario, a decrease in the real rate of the scheme's investment returns is considered. The rate of investment returns follows normal distribution with a mean of 2% and standard deviation of 2%. Figures 3 and 4 illustrate the contribution rates payable in each of the considered schemes.

As shown by Figure 3, a change in investment return rates according to scenario 2 causes an increase in the contribution rate of a party bearing the investment risk. In the case of a DC or self-annuitising scheme it is the member, while in the case of a DB or cash balance scheme it is the employer. They pay a contribution rate which on average differs by 11.3 p.p. from the base contribution rate. If the member chooses not to adjust their contribution rate in a DC or self-annuitising scheme, the benefit at retirement decreases to 34% of final salary.

In the proposed hybrid scheme, as shown in Figure 4, the extra contribution is shared between employer and member. The employer's contribution rate is different from the base rate by 3.9 p.p. on average, the member's contribution rate by 7.4 p.p. The member needs to adjust their contribution in 63% of all years.

Scenario 3

In this scenario, an increase in the real rate of the scheme's investment returns is considered. The rate of investment returns follows normal distribution with a mean of 5% and standard deviation of 2%. Figures 5 and 6 illustrate the contribution rates payable in each of the considered schemes.

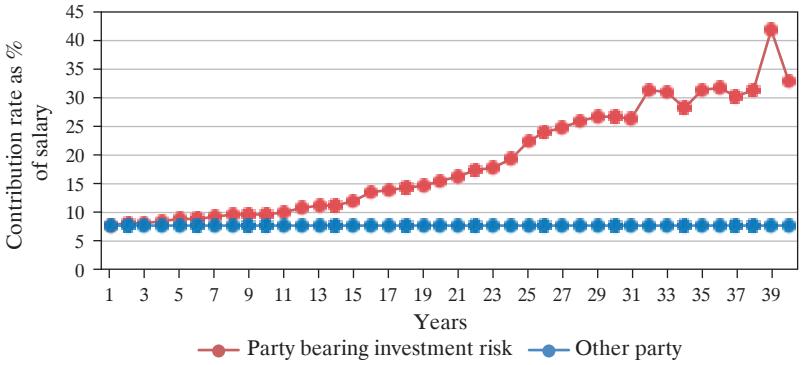

Fig. 3. Contribution Rates under Scenario 2 in a DC, DB, Cash Balance or Self-annuitising Scheme

Source: author's own work.

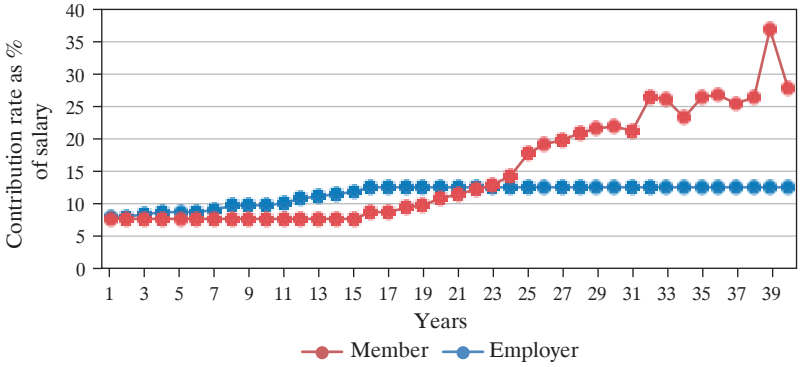

Fig. 4. Contribution Rates under Scenario 2 in the Proposed Scheme

Source: author's own work.

As shown by Figure 5, a change in investment return rates according to scenario 3 causes a decrease in the contribution rate of a party bearing the investment risk. In the case of a DC or self-annuitising scheme it is the member, while in the case of a DB or cash balance scheme it is the employer. On average, they pay a contribution rate different by 2.3 p.p. from the base contribution rate. If the member chooses not to adjust their contribution rate in a DC or self-annuitising scheme, the benefit at retirement increases to 68% of final salary.

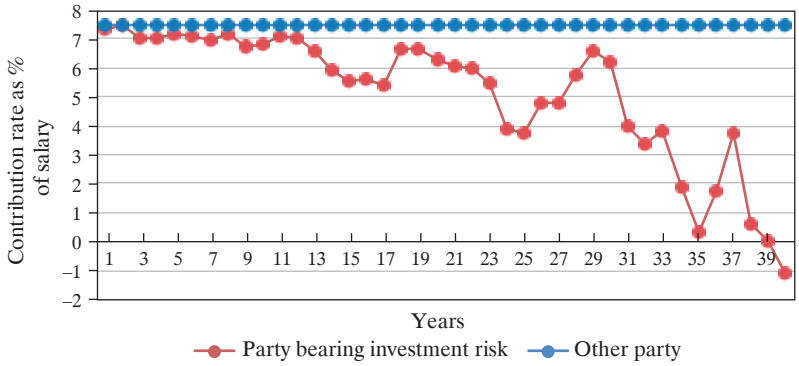

Fig. 5. Contribution Rates under Scenario 3 in a DC, DB, Cash Balance or Self-annuitising Scheme

Source: author's own work.

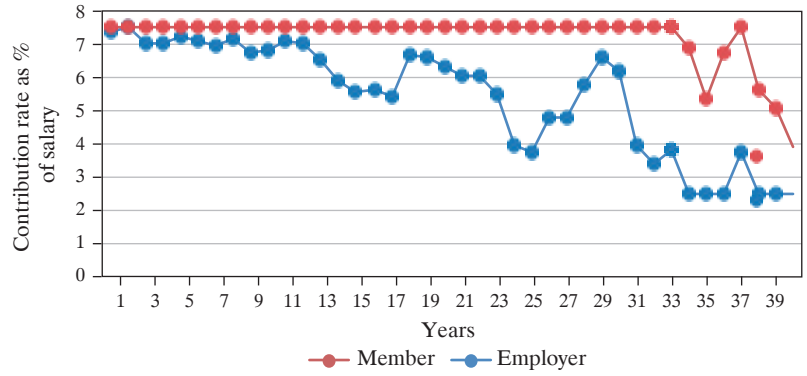

Fig. 6. Contribution Rates under Scenario 3 in the Proposed Scheme

Source: author's own work.

In the proposed hybrid scheme, as shown in Figure 6, the extra contribution is shared between employer and member. The employer's contribution rate is different from the base rate by 2.1 p.p. on average, the member's contribution rate by 0.3 p.p. The member needs to adjust their contribution in 15% of all years.

Scenario 4

In addition to changes in rates of return (according to Scenario 1), an increase in future longevity is considered. Survival rates change in a way which corresponds to rating the life table down by 5 years, i.e. the survival

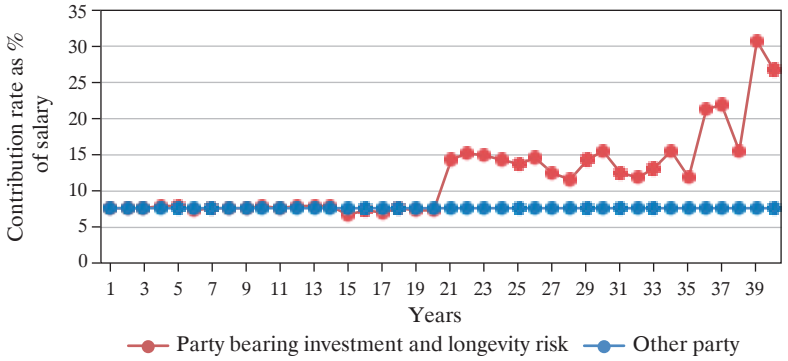

Fig. 7. Contribution Rates under Scenario 4 in a DC or DB Scheme

Source: author's own work.

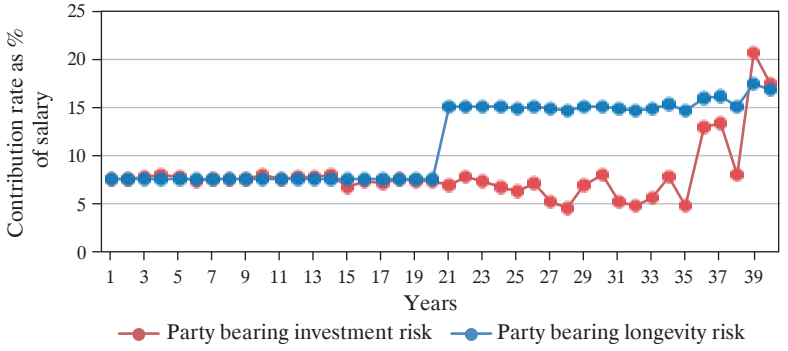

Fig. 8. Contribution Rates under Scenario 4 in a Cash Balance or Self-annuitising Scheme

Source: author's own work.

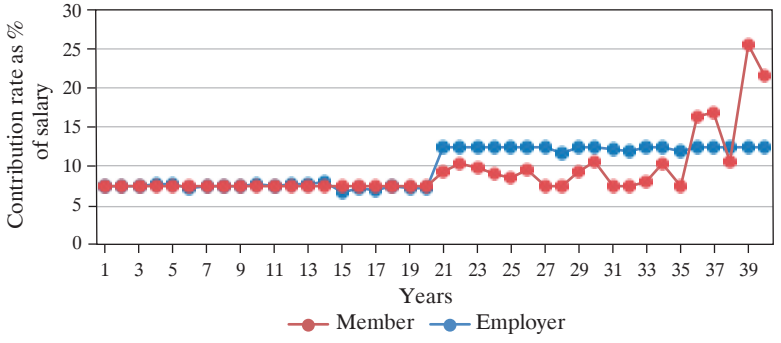

Fig. 9. Contribution Rates under Scenario 4 in the Proposed Scheme

Source: author's own work.

probabilities which applied to a person aged 60 in the original table now apply to a person aged 65. This means lower mortality rates and an increase in annuity conversion rates (due to increased longevity) from 16.67 to 19.86. This increase happens once, at the start of year 21. Figures 7, 8 and 9 illustrate the contribution rates payable in each of the considered schemes.

As shown by Figure 7, a change in conditions according to scenario 4 causes a fluctuation in the contribution rate of a party bearing the investment and longevity risk. In the case of a DC scheme it is the member, while in the case of a DB scheme it is the employer. On average, they pay a contribution rate different by 4.4 p.p. from the base contribution rate. If the member chooses not to adjust their contribution rate in a DC scheme, the benefit at retirement decreases to 50% of final salary.

Figure 8 shows that in the case of cash balance and self-annuitising schemes, the contribution of a party bearing the investment risk (the employer in a cash balance scheme, the member in a self-annuitising scheme) fluctuates. The party bearing the longevity risk (the member in a cash balance scheme, the employer in a self-annuitising scheme) has the contribution rate increased at the end of year 21. The rate then fluctuates slightly due to changes in the investment return rate (thus even though this party is said to bear only the longevity risk, the need to provide extra funds due to a change in longevity while investment conditions change means that they also bear some investment risk). On average, the party bearing the investment risk pays a contribution rate different by 1.5 p.p. from the base contribution rate. The party bearing the longevity risk pays a contribution rate different by 3.9 p.p. on average. If the member chooses not to adjust their contribution rate in a cash balance scheme, the benefit at retirement decreases to 50% of final salary. If the member chooses not to adjust their contribution rate in a self-annuitising scheme, the benefit at retirement decreases to 59% of final salary.

In the proposed hybrid scheme, as shown in Figure 9, the extra contribution is shared between employer and member. The employer's contribution rate is different from the base rate by 2.6 p.p. on average, the member's contribution rate by 1.8 p.p. The member needs to adjust their contribution in 40% of all years.

6. Practical Considerations

There are several issues that need to be considered if such a theoretical concept for a scheme was to be implemented in practice. Firstly, members of a pension scheme tend to appreciate a fixed, known level of benefits, but

may be unwilling to increase their contribution rates. In many countries participation in occupational pension schemes is voluntary, hence members cannot be forced to adjust their contributions. In such cases the scheme setup can be adjusted so that while the employer needs to adjust their contribution rate as described above, the member is not required to do so. As a result, the benefit amount achieved in the scheme will be variable, although to a lesser extent than in a DC scheme due to adjustments in the employer's contribution.

Communication with members in such a scheme would be crucial. Members might not understand or be willing to accept the fact that the employer's contribution rate can decrease. In practice it is more likely that instead of decreasing their contribution rate, employers will allow the surplus to accumulate as a buffer for when circumstances are adverse.

In the proposed scheme, the contribution rate is recalculated annually. This should be done by an independent party (e.g. an actuary) so that there is no moral hazard of the employer attempting to influence the contribution rate. However, if the actuarial fees are covered by the employer, this can in turn lead to moral hazard for the actuary. A regulator may need to be involved to provide guidance and oversee the process of setting the contribution rate. Annual recalculation of the contribution rate can be costly, especially if there are many members in the scheme. It can be changed to a bi- or triannual recalculation, but the variability of the contribution rate could increase as a result.

Under the considered model, it is possible for contribution rates to be negative. In practice this would mean funds being returned to the employer and/or member. Such payments may be forbidden or subject to an unfavourable tax treatment. It is therefore possible that instead of funds being returned, a member will opt for the funds to remain in the scheme and increase the benefit amount. The issue of the return of surplus to the employer is very complicated and, depending on laws of the country concerned, may not be possible or may be heavily restricted.

It is also worth noting that the regulations in a given country may prohibit hybrid schemes or limit their form. In Poland, for example, only DC schemes are possible.

7. Conclusions

In a DB scheme, both investment risk and longevity risk are borne by the employer. Modest investment returns and low interest rates have caused the costs and risk of such schemes to increase, leading some employers to close

their DB schemes (Clark & Monk 2006, p. 44). They often choose to offer employees a DC scheme instead. However, in such a scheme the risk is borne by the member, who often does not have adequate means to manage the risk. Hybrid schemes provide a mixture of both traditional forms, allowing risk to be shared between employer and member. The exact approach to risk sharing depends on the form of hybrid scheme. In the two forms considered in this article, it is achieved by allocating a given type of risk to a certain party. In a cash balance scheme, the employer bears the investment risk and the member the longevity risk, while in a self-annuitising scheme the opposite is the case.

In the proposed scheme, the risk is shared between member and employer irrespective of its type. An upper and lower limit for extra employer contributions is set. If an increase in the required contribution means the extra contribution exceeds the upper limit, the member is called upon to pay the remainder of the extra contribution, and analogously in the case of a decrease in contributions. In this way, the risk is shared between both parties. The employer will always need to adjust their contribution when such adjustment is required, but only up to a certain limit, so the employer is sure that the extra contribution (and therefore the variability in contributions) will be no greater than a known value. The member's contribution will only need to be adjusted in a certain number of instances, if actual experience is very different that assumed. These features allow for better financial planning for the two parties involved. However, there are several practical issues that must be considered if such a theoretical concept for a pension scheme were to be implemented in practice.

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