INSTITUTE AND FACULTY OF ACTUARIES

EXAMINATION

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Subject CP2 – Modelling Practice
Core Practices

Paper 2

SUMMARY

Analysis of Automake's pension cashflow project

Objective

Our client, Martin, is the HR manager of Automake, a manufacturing company. The purpose of the project is to investigate the effect of two proposals to reduce the uncertainty of the future expected pension cashflows.

Proposal 1 is a Pension Increase Exchange (PIE) proposal. Members under age 65 would be invited on 1 January 2020 to exchange their existing pension with inflationary increases after retirement for a higher amount of pension at retirement with no increases. The higher amount should be set such that each member is offered the same percentage increase to their existing pension, such that the total expected present value of all future pension payment cashflows on the PIE proposal and the existing pensions are equal.

Proposal 2 is a Lump Sum (LS) proposal. Members under age 65 would be invited to take a lump sum at 1 January 2020 which is 110% of the expected present value of all their existing scenario future pension payments. The lump sum would eliminate all of the member's future pension payments.

In particular Martin would like to see the effect on the pattern of expected future cashflows and the total present value of the cashflows as well as graphs to illustrate these.

Data

Martin has provided summary data, grouped by current age next birthday at 1 January 2020, of the pension amounts per annum due to begin payment at 1 January in the year the individuals turn 65 years old for the 450 individuals entitled to a pension who are currently under age 65.

He has also provided details of:
- expected take up rates of the offers in the two proposals (40% for the PIE proposal and 30% for the LS proposal),
- expected future life expectancies from the 1 January of the year the turn 65 years old for each age group,
- pension payment details including; pension increases and the date from which pension payments start.
- the enhancement percentage to apply to the transfer values offered in the LS proposal

Sun Actuarial's statistics department has provided information on the expected future inflation and expected discount rate for cashflows.

The data looks reasonable in so far as:

- The average pension per individual appears roughly consistent across age next groups and increases with age (which could be justified as older members may have had higher salaries and longer service).
- The number of individuals per age next birthday group varies and shows no particular pattern but nothing suggests the numbers are unreasonable.

- There is no reason to doubt the proposal take up rates suggested by Martin which are between 0 and 1 and appear reasonable.
- The expected lifetimes increase as age next birthday decreases. This seems reasonable as other general studies have found that life expectancies are increasing over time.

Assumptions

- The data provided by Martin and the Sun Actuarial statistics department is accurate

- The take up rate of both the proposals would be as Martin estimated.

- Inflation is assumed to remain constant each year until all members are expected to have died.

- No individuals die before reaching retirement and therefore no mortality assumption before retirement is required.

- **There are no increases to pensions prior to retirement other than those already allowed for in the pension summaries at retirement**

- **There is currently no option for individuals to take any of the pension as a cash lump sum at retirement or exchange their benefits in any other way (other than the two proposals under consideration).**

- **All individuals retire on 1 January in the year in which they turn 65 years old and early or late retirement for any reason is not possible.**

- **No pension is payable after death to an individual's dependants or spouse**

- **There are no regulations that restrict Automake from undertaking either proposal**

- **Automake have sufficient liquid funds to pay the expected lump sums under the LS proposal based on Martin's predicted take up rate at 1 January 2020**

- **No consideration of the impact on Automake's company accounting figures is considered**

Method

Cashflow Projection

Existing

Expected future cashflows are projected for all future years starting from 1 January 2020. The youngest age group (age 55 next) is expected to live for 24.5 years from their retirement which is in 10 years so the projections extend for 24.5 + 10 = 34.5 future years.

Payment indicators for each age next group, for each future relevant year where a pension is in payment are set as 1 for a year in payment and 0 for a year before the age next is 65 or after the age group is expected to have died.

These are multiplied by "cumulative inflation increases" from retirement for each age group. The cumulative inflation increases are 0 in years when the payment indicator is 0 and start from an indicator of 1 in the year the group first receives a pension payment, increasing in each subsequent year of payment by multiplying by (1 + the assumed inflation rate).

The expected future cashflows are calculated by multiplying the total pension at retirement for each age next group by the corresponding cells from the "cumulative inflation increases" column for each future relevant year and summing for all age next groups.

Present value of existing pension payment liability

The present value of the existing inflation increasing pension payments as at 1 January 2020 is calculated for each age next group by:

- Discounting total expected cashflows for each future year to 1 January 2020.

PIE proposal cashflows

The post PIE proposal non-increasing pension payable from retirement is calculated by initially assuming it is equal to the existing pension payable from retirement multiplied by a dummy PIE pension ratio.

The expected post PIE proposal cashflows for each future year are calculated by adding:

- PIE take up rate (40%) x sumproduct function on the calculated post PIE proposal non-increasing pension payable from retirement for each age next group x the corresponding cells from the payment indicator matrix column for that age group.

- (1-PIE take up rate (40%)) x sumproduct function on the calculated existing inflation increasing pension payable from retirement for each age next group x the corresponding cells from the cumulative inflation increases column for that age group.

Present value of PIE proposal pension payment liability

The present value of the PIE proposal pension payments as at 1 January 2020 is calculated for each "age next birthday" group by:

- Discounting total expected cashflows for each future year to 1 January 2020.

Calculation of actual PIE pension ratio

The required PIE pension ratio is calculated by goalseek. The PIE pension ratio is varied such that the expected present values of both the existing and PIE proposal's future pension cashflows are equal.

LS Proposal

Sum of LS payments expected to be made as at 1 January 2020

The total lump sum offered is calculated by multiplying the expected net present value of the existing pension at retirement by an enhancement of 110% and the expected LS take up rate (30%).

LS proposal cashflows

The expected cashflow at 1 January 2020 is the sum of the expected LS payments from the LS proposal.

The pension payments from 1 January 2021 onwards are equal to (100% minus the LS take up rate (30%)) multiplied by the existing pension payment (before the LS proposal) for each year.

Expected net present value of pension payments after LS proposal

The expected net present value of the future pension payments after the LS proposal is calculated as at 1 January 2020 as the sum of the expected LS payments made at 1 January 2020 and the present value of the pension payment payments from 1 January 2021 onwards.

Results
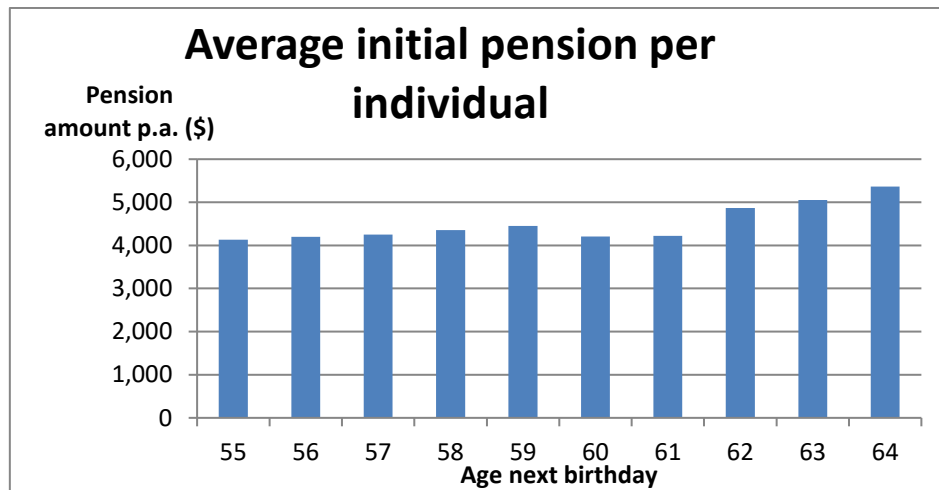
There is a general increase in average pension per individual towards older ages. This could be explained by the fact that older previous employees may have worked for Automake for longer and have achieved higher salaries. However there are some slight exceptions which could be due to the relatively small group sizes

Cashflows with and without allowing for the Pension Increase Exchange proposal

The following graph shows the expected future pension payment cashflows on the existing pension and after allowing for the PIE proposal for all members.
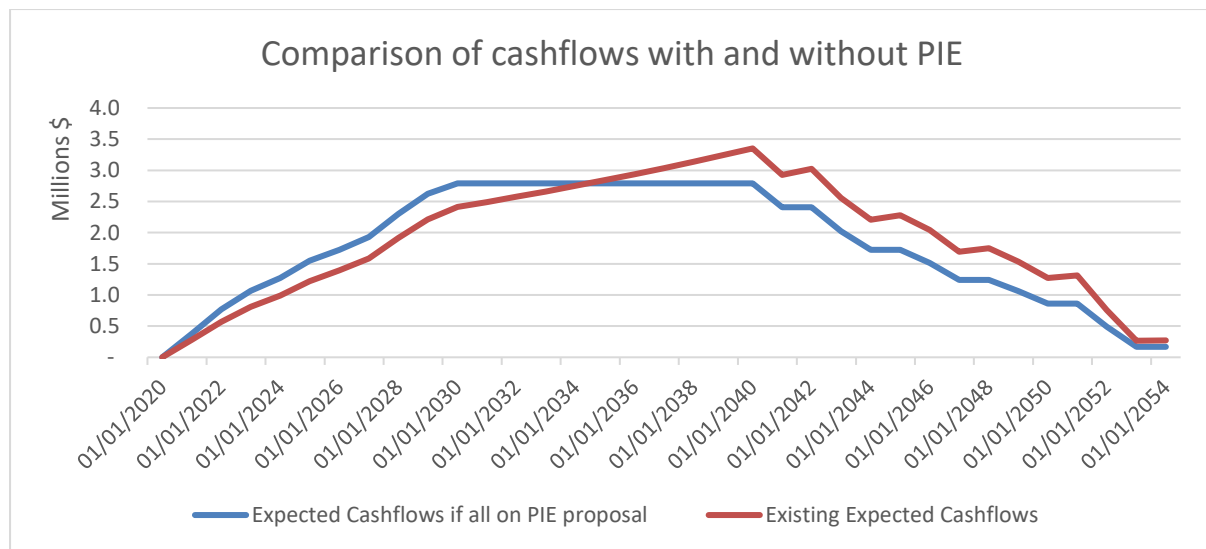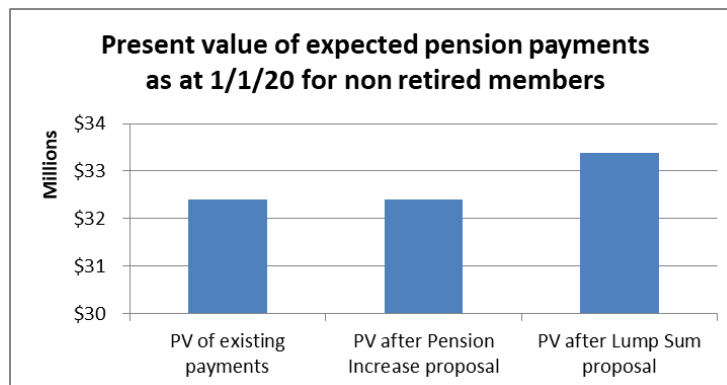

From the graph we can see that:
- The cashflows start at a similar level. This is because only a small proportion of the individuals start to receive a pension in 2021 and therefore the difference in pension amounts is less pronounced.
- The cashflows end at a similar level. Similarly, this is because there are relatively few individuals still receiving a pension in 2054 and hence the absolute difference is less pronounced.

- The PIE proposal cashflows increase year on year as more individuals start receiving a pension. The effect of the additional pensions coming into payment is more substantial than the pension increases that the existing pensions receive.
- In 2030 the final individuals begin to receive their pensions. After that date the PIE proposal cashflows are flat. This is because they do not receive any pension increases. Whereas the existing cashflows continue to increase as pension increases are granted.
- As individuals start to die the cashflows start to diminish. Once again we can see that the PIE proposal cashflows are flat in the years where no one is assumed to die, whereas the existing cashflows increase again.

Expected present value of pension payments

The following graph shows the expected present value of pension payments for the existing pension payments, pension payments after the PIE proposal and pension payments after the LS proposal:
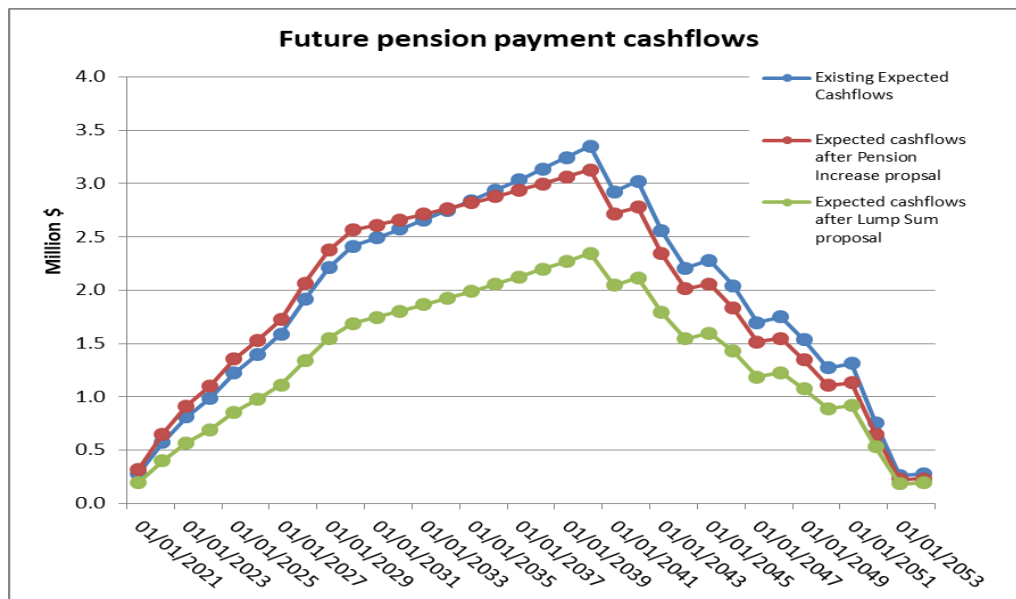

We can see from the graph that:

- The PV of the expected existing pension payments is equal to the PV of the expected pension payments after the PIE proposal. Both have a PV of $32,403k. The PVs are the same because the pension payments offered under the PIE proposal were calculated in order to give a PV equal to the existing pension payments.

- The PV of the expected pension payments after the LS proposal is $33,375 which is higher than that of the existing and PIE scenarios. The LS payments offered are calculated to give the same expected PV as the existing scenario but are then given an uplift of 10% so the PV after the LS proposal is greater than the existing PV.

- The difference between the existing PV and the PV after LS is equal to the existing PV multiplied by the LS take up rate multiplied by the ETV enhancement %.

(32,403 x 0.3 x 0.1) = 33,403 −32,375 = 972

Future pension payment cashflows

The following graph shows the expected future pension payment cashflows on the existing pension, after the PIE proposal and after the LS proposal.

In addition to the cashflows in the graph an additional $10,693,074 is expected to be paid as at 1 January 2020 for the LS proposal scenario only.

It can be seen from the graph that:

- For all proposals cashflows increase over time as more age groups reach retirement and reach a peak before gradually reducing as age groups reach their life expectancy.
- For all proposals cashflows converge towards zero at the year 2055 when the youngest "age next birthday" group is expected to die.
- The LS future cashflows are significantly below the existing and PIE future cashflows. However this ignores the large cashflow outgo at 1 January 2020 to pay the lump sums.
- The LS cashflows are lower because some individuals are expected to be removed from future cashflows by paying the equivalent value of all cashflows at 1 January 2020.
- The LS expected cashflows follow a similar pattern to the existing expected cashflows. This is because after the initial LS bulk payment at 1 January 2020 the remaining individuals who did not take up the offer get their existing benefits.
- Overall, the earlier period when the PIE cashflows are higher offsets with the later period where the PIE cashflows are lower so that the expected PV of the PIE and existing scenarios are equal. The reason the PVs are equal despite the gap between the PIE and existing cashflows being smaller for the earlier period, is because the earlier cashflows contribute more to the expected PV because they are discounted for less time.

Conclusions

- The PIE proposal removes uncertainty about future inflation increases for those individuals who take up the offer. Uncertainty around expected lifetimes remains for individuals who take up the PIE offer because the pensions are still paid for the whole lifetime.
- The LS proposal removes all uncertainty for those members who take up the offer because all future pension payments are eliminated by paying a lump sum payment at 1 January 2020. The future cashflows are expected to be significantly reduced after the LS proposal based on the take-up rate assumed.
- The expected PV after the LS proposal (including the LS payments at 1 January 2020) is higher than the existing and PIE proposal expected PV. Automake will need to consider whether it is worth paying a higher expected PV overall to reduce the uncertainty of expected future cashflows.
- Automake will also need to consider if they can afford to pay the large LS payment at 1 January 2020 compared to their ability to meet any unexpected future cashflows on the existing scenario.
- Automake's risk appetite and ability to meet cashflows at 1 January 2020 and stretching into the future to around the year 2054 will be key factors influencing whether the proposals are possible and/or appealing.
- Actual cashflows will not be known until they occur and will be affected in particular by actual future inflation, actual take up rates and when actual mortality experience.

Next steps

- Validate the data provided.

    - Independently verify if the LS enhancement percentage and expected take up rates offered for the LS proposal appears reasonable, possibly by comparing with similar projects for other clients or in the media.

    - Carry out more investigation into the mortality rate of the 450 previous employees to validate the expected lifetimes provided by Martin. The expected lifetimes could be compared to those assumed in other clients with similar previous employees.

- Confirm that Automake has the funds available to meet the expected lump sum payment at 1 January 2020. Do they have liquid assets and are they willing to use these assets to extinguish future pension payments. Would the funds be better put to use on other business activities to strengthen the business so that they can meet the existing expected future pension cashflows more easily?

- Consider a shock scenario of a greater than expected number of members taking up the LS proposal. Would Automake be able to meet the cashflow demand? Would a contingency plan be needed if a higher take-up occurred to cancel the project, obtain additional funds or reduce the enhancement offered.

- Research any regulations around PIE and LS proposals and ensure the calculations and options offered comply with these. For example do the individuals need to be offered independent financial advice to help them make the decisions or any other legal protection offered to members.

- Check if the value of the non-increasing pension offered in the PIE proposal has to be of equal value to the existing benefits or can a different – lower – amount be offered.

- Confirm whether any material changes have taken place between 1 January 2019 and the time the final proposals would be executed. For example have national inflation index indicators or the appropriate discount rate changed significantly. Update the projections if necessary to ensure that the project is still expected to be worthwhile.

- A comparison between LS enhancement rates and the resulting take up rates in previous projects by other companies could be carried out by creating a scatter chart of the two variables.

- Model future inflation stochastically so that a range of future cashflow values can be provided. This would give Martin an idea of the magnitude of the inflation uncertainty that the PIE proposal will be removing.

- Allow for the assumed inflation pension increases to vary over time i.e. reflect an inflation curve rather than a single assumption.

- Sensitivity test the results to changes in expected lifetimes. For example if medical advances such as a cure for cancer significantly increased life expectancy or flu epidemics significantly reduced life expectancy.

- Allow for expected lifetimes to vary over time or more complex mortality patterns to be allowed for.

- Consider tax implications, e.g. will the members or Automake be effected by the paying out of the large lump sum payments at 1 January 2020.

- Confirm the costs of executing the proposals to see if they outweigh the expected benefits to be gained

- Consider if there are other ways to manage the inflation and life expectancy risk, for example by use of a hedging investment strategy or by buying lifetime annuity assets which will exactly match the future pensions for members when they retire.

- Consider the impact if both proposals are run at once, including the impact on costs, take up rates, future cashflows etc.

- Ask Automake's accounting advisors to report on the potential impact to their formal accounts.

- Consider if it is fair or acceptable for all age groups to receive the same proportion increase to starting payment at retirement under the PIE proposal (given they have different life expectancies). Investigate the proportion increase to starting payment separately for each age group to aid the investigation.

- Obtain a peer review of the work performed.

END OF SUMMARY