

INSTITUTE AND FACULTY OF ACTUARIES

SUMMARY

May 2015

CA2: Model Documentation, Analysis and Reporting

Paper 2

Flexible retirement strategy

Objective

Our client is the Retirement Strategist for the Government of Actuarial, William Easton. Mr Easton has proposed a flexible approach for individuals to draw an income on retirement and has asked for assistance in modelling the impact of this strategy.

Under the existing approach individuals save throughout their working life in accordance with a set investment strategy and use the accumulated fund to purchase an annuity when they reach retirement, at age 65.

The new approach will have a different investment strategy and the accumulated fund will not be used to purchase an annuity. Monies will remain invested after retirement at age 65 in accordance with the investment strategy and an annual income will be withdrawn from the fund.

The purpose of this project is to compare fund projections and the level of income under the existing and new approach.

In particular, Mr Easton would like to compare the level of income that can be achieved by an individual who begins saving for retirement on 30 June 2015 and retires at age 65. Under the new scheme it is assumed the individual will live to between ages 87 and 88.

Data

Mr Easton, the Retirement Strategist for the Government of Actuarial, has provided the following data items:

- The date of birth and retirement age of the individual to be considered.
- The date at which the calculation is performed.
- The individual's current salary.
- The level of salary inflation experienced in recent years.
- The contribution rates into the fund (employer and individual/employee).
- The assumed annuity rate on retirement.
- The investment strategy under the existing approach, which varies by the number of years to retirement.
- The investment strategy under the proposed scheme which consists of 40% equities, 40% bonds and 20% cash throughout the projection.
- The investment pot is rebalanced to reflect the splits set out in the investment strategy.

- The assumed investment returns for each asset class.

The investment returns provided look reasonable in so far as equities have a higher expected return than bonds, which in turn have a higher expected return than cash.

The original investment strategy appears reasonable as the fund is invested in less volatile assets as the individual nears retirement. In addition it is also noted that the percentages in the investment strategy add to 100%.

Assumptions

- Contributions are assumed to be received on average half way through the year of age.
- Salary is assumed to increase annually on the individual's birthday.
- 100% equities are assumed to be used for investment periods more than 11 years from retirement age.
- The individual is assumed to use all of the investment pot to purchase an income.
- The individual is assumed to die between age 87 and *before* his 88th birthday so that no income is paid out at age 88.
- The income calculated is as at the individual's retirement age i.e. it is given as a future value not in terms of today's prices.
- **The rate of employer and individual/employee contributions is assumed to remain constant.**
- **Fixed rate returns are reasonable for the duration of the investment.**
- **Under the existing approach the income reflected is a gross income.**
- **The parameters given provide a reasonable basis on which to build illustrations.**
- **The average salary in Actuarial does not change between now and the start of the projection.**
- **Retirement income from the fund is assumed to be taken as a lump sum at the beginning of each new year of age (including the year of retirement).**
- **Income is withdrawn from the each asset class in proportion to the value of each asset class.**
- **Under the existing approach it is assumed the income purchased is a level income for the individual only (i.e. no spouse's benefits). This enables a valid comparison with the income from the new approach.**
- **Contributions are payable monthly.**

- **The rate of salary inflation will remain constant at the level experienced in recent years.**

Method

Existing scheme

The individual's salary is increased, each year, over the course of their working life by multiplying the previous year's salary by $\{1 + \text{the salary increase assumption}\}$.

Each year the individual and employer contribute a proportion of the individual's salary into a fund, in line with specified contribution rates. Specifically:

- Employee Contribution = Salary at start of year of age \times Employee contribution rate
- Employer Contribution = Salary at start of year of age \times Employer contribution rate

The total contribution during a year of age will be the sum of the employee and employer contributions.

The contributions are invested into different asset classes as prescribed by the investment strategy which varies according to the term to normal retirement age. In general, a greater proportion is invested in equities when the individual is many years from retirement age.

The amount contributed into a particular asset class over a year of age is calculated as the total contribution multiplied by the percentage of the fund allocated to the asset class in question. Under the existing strategy this will vary according to the number of years until retirement.

The funds receive investment returns in line with the assumptions and are rebalanced at the start of each year of age in line with the investment strategy.

In the first period of the projection (from the calculation date to the individual's next birthday) the contributions and investment return are adjusted to allow for the fact it will only be a partial year. All other periods in the projection are complete years.

The fund at the end of the year of age, in each asset class, is given by:

$$\begin{aligned} \text{Fund at year end in that asset class} = & (\text{Total fund at previous year end} \times \text{proportion of fund in that asset class}) \\ & \times (1 + \text{return for that asset class})^{(\% \text{ of year individual is working})} \\ & + \\ & (\text{Amount contributed into the asset class over the year}) \\ & \times (1 + \text{return for that asset class})^{(0.5 \times \% \text{ of year individual is working})} \end{aligned}$$

The total fund at the end of the year is found by summing over all of the asset classes.

When the individual reaches retirement the total fund is used to purchase an annuity.

The income that can be bought is found by taking the total fund at retirement divided by the annuity rate specified.

Proposed scheme

The calculations have been repeated as above, but with a number of amendments to reflect the new scheme proposals.

The investment strategy is updated to reflect the new fixed splits of 40% equities, 40% bonds and 20% cash over the lifetime of the investment in line with the client's proposal.

Contributions are only made until the year before the assumed retirement age is reached. From this point onwards the contributions are zero.

Following retirement, the funds will still continue to receive investment returns in line with the assumptions and are rebalanced at the start of each year in line with the new investment strategy.

From the assumed date of retirement, income is withdrawn. It is assumed that income is taken at the start of each new year of age, including the year of retirement. In this way it can be deducted from the start of year fund value before the investment returns are applied (which is otherwise done in the same way as for the existing scheme calculations). The following formula has been used:

Amount of Fund at Individual's Birthday in that Asset Class before taking Income =
([Fund at Previous Birthday – **Income taken on Previous Birthday**] × % of fund in that Asset Class at Previous Birthday)
× (1 + Return for that Asset Class)

Affordable level of income

In order to determine the level of affordable income an assumed age of death between ages 87 and 88 has been used.

The annual income has been varied until the fund value on the individual's 87th birthday is 0.

Results

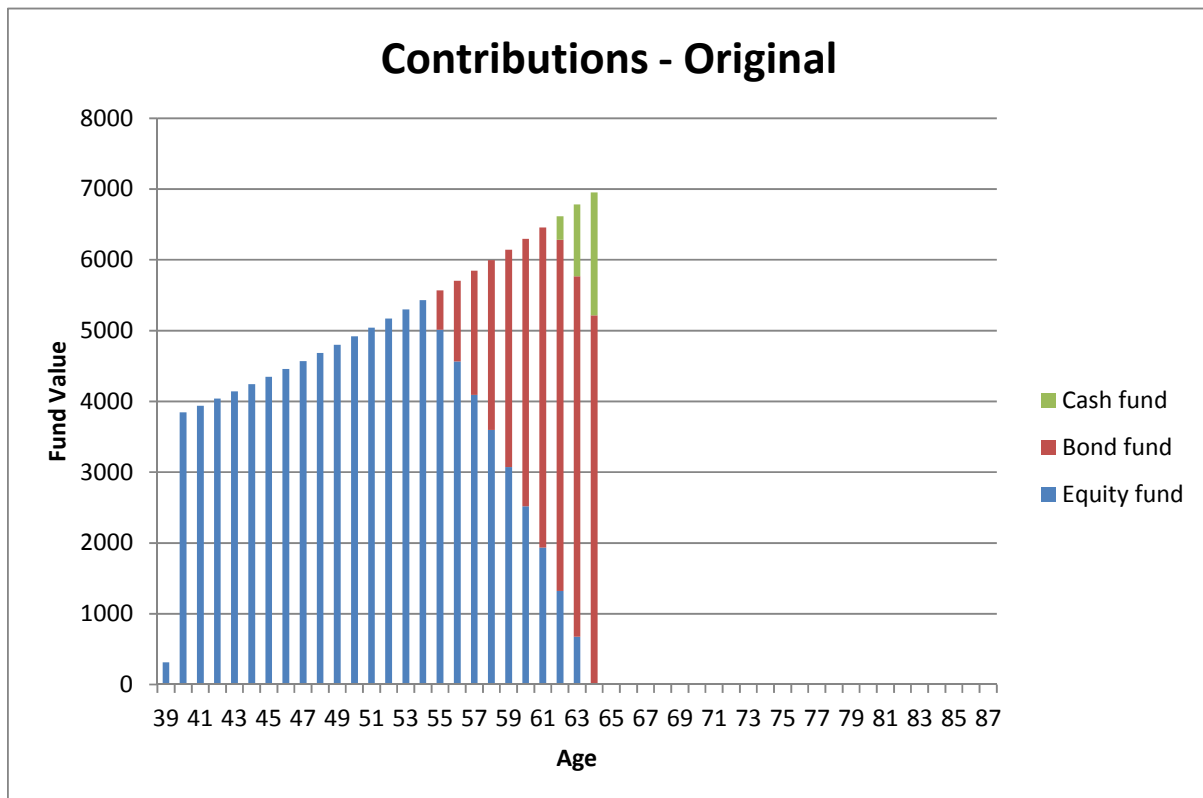
Existing scheme

Under the existing scheme the total contributions made (employer plus individual) over the period would be \$131,612. These would be expected to accumulate to a total fund of \$285,913 at normal retirement age and achieve a level annual income of \$10,032 for life thereafter.

This income will continue for as long as the individual lives, therefore the risk element associated with unknown mortality is removed.

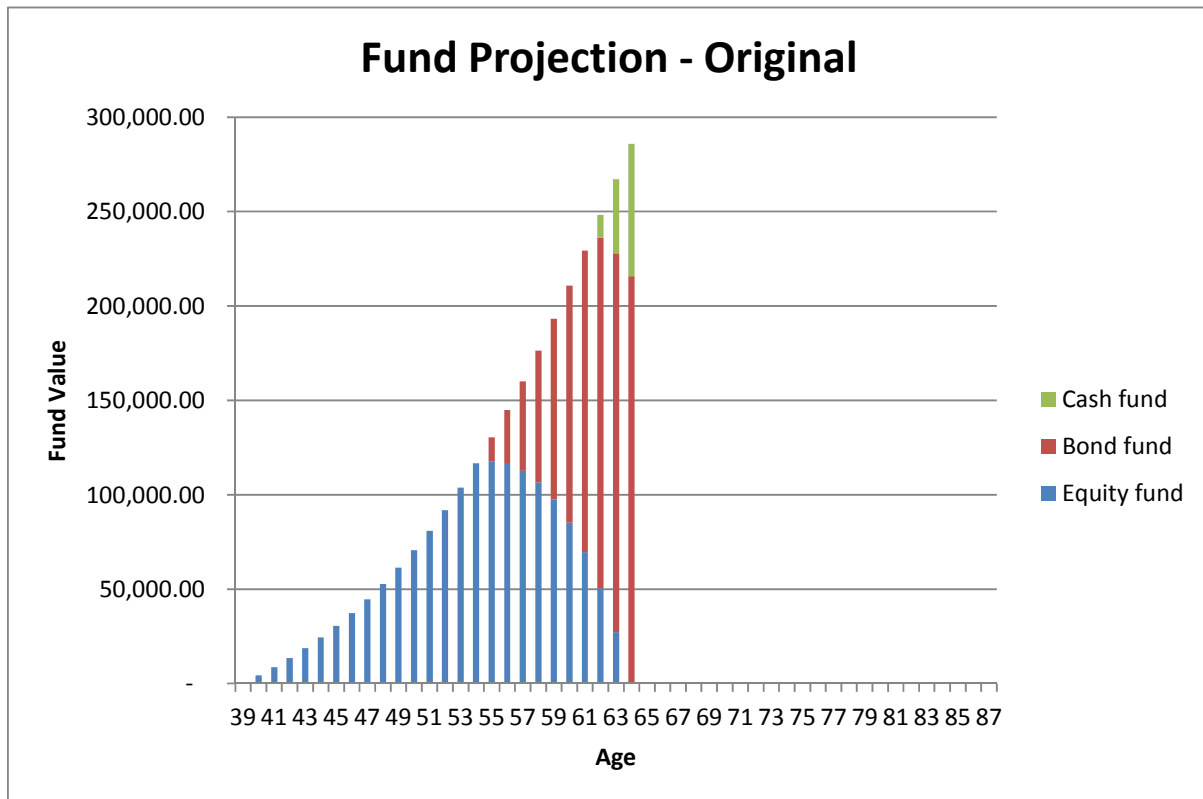
If the individual only lives a short time in their retirement then they will not receive an income equivalent to the value of their fund. If, however, they have a long life they may end up receiving an income in excess of the value of their fund.

Under the existing approach the total annual contributions, split by asset class, are as follows:



- It can be seen that as the individual's age increases the percentage invested in cash and bonds increases. This is consistent with the original investment strategy.
- Contributions increase with time. This is because they are related to the individual's salary which also increases annually with inflation.
- It can be seen that the first payment is much lower than in later years. This is because the first period only represents a partial year from the calculation date to the individual's next birthday.

The fund will evolve as follows:



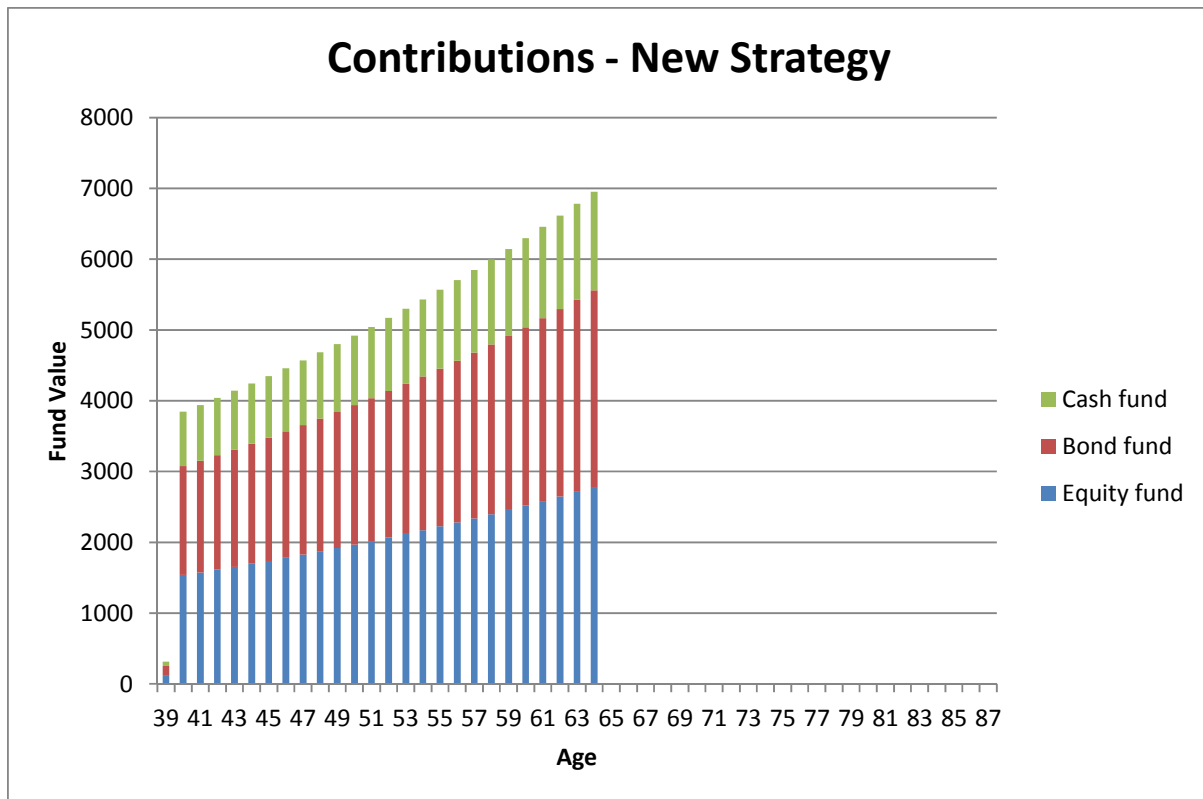
- At the start of the term the investment strategy is fully in equities. Once the projection reaches 10 years before retirement the fund starts to be rebalanced more towards bonds. Even closer to retirement, cash is invested in.
- The fund composition is consistent with the chart showing how contributions are invested.
- Closer to retirement the fund is invested in lower yielding assets. However, the fund continues to increase at an accelerated rate. This is caused by the effect of inflation on the salary which results in larger contributions that offset the effect of the lower yielding assets.
- In the year of the member's retirement the fund diminishes to zero as it is all used to purchase an annuity.

New approach

Under the new approach the level of contributions is the same at \$131,612. These are expected to accumulate to a total fund of \$252,285 at retirement.

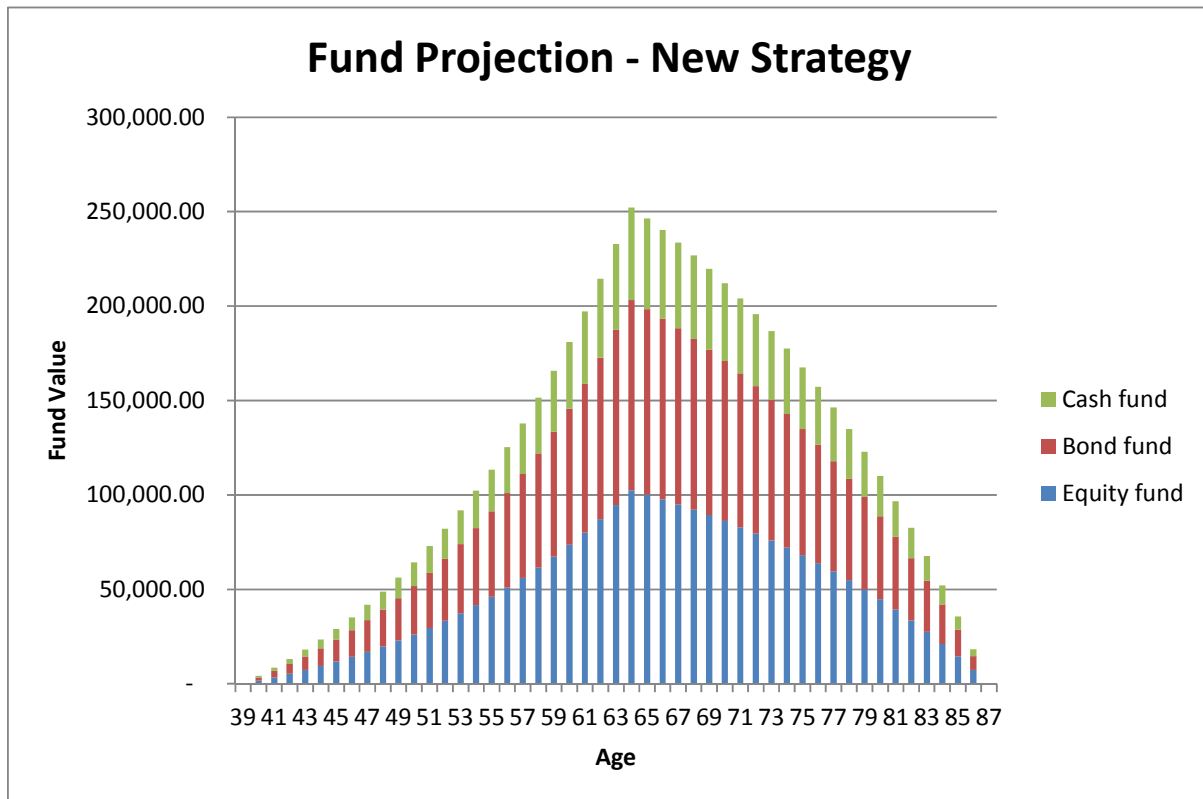
Assuming the individual will live until between ages 87 and 88, this can support an annual income of \$18,268.

Under the new approach the individual's contributions are as follows:



- It can be seen that the proportion invested in each asset class remains constant over time. This is consistent with the proposed new investment strategy which rebalances the fund each year in accordance with the fixed proportions.
- As before, the first payment is much reduced. This is again because the first period only represents a partial year from the calculation date to the individual's next birthday.
- As expected, the total level of contributions under the existing and new strategy is the same. The salary and time to retirement in both scenarios is the same.

The fund will evolve as follows:



- It can be seen that the proportion invested in each asset class remains constant over time. This is consistent with the proposed new investment strategy and the fact that the fund is rebalanced each year.
- The maximum fund value of \$252,285 is lower than under the current scheme (\$285,913).

In the new strategy the fund is invested in all 3 asset classes from the start. In the original strategy there is a very high proportion of equity investment during the early years. The high return from equity therefore results in a higher fund value. This is partially, but not fully, offset by the fact that under the original strategy the equity proportion is reduced to zero as the individual approaches retirement.

- Under the new strategy the fund is not all “spent” at retirement. Once retirement is reached no further contributions are made and an annual income is withdrawn.

As the level of income exceeds the investment return the fund stops increasing and starts to decline.

- The fund remains in existence all the way up to the individual’s death. The fund is expected to be zero at the individual’s last birthday because the income has been calculated such that the fund is depleted at this time.

Conclusions

- The level of income in the new approach is greater than that provided by the original approach.
- Even though it is expected people will live to between ages 87 and 88, the annuity is likely to be based on a more prudent mortality assumption...
- ... and a more prudent investment return assumption, e.g. assuming 100% investment in bonds.
- The annuity will allow for profit margins.
- Under the new approach the risk of living longer than expected is being taken by the individual rather than an insurance company.
- The results are heavily dependent upon achieving the assumed investment returns.

Next steps

- Validate information provided – in particular the expected return levels.
- Consider different investment strategies – for example:
 - additional asset classes could be allowed for.
 - a different pattern of change over time.
 - different asset proportions.
- Allow for different incomes in retirement, both on the annuity and income drawdown bases and see what impact this has on results – for example:
 - Allow for the income to increase in line with inflation.
 - Allow for the income to be joint life (for the individual and their spouse).
 - Allow for income to decrease with age (individuals might want more income in their early retirement when they are more active).
 - Allow for income being drawn down having a different % asset split than the fund.
- Model different income payment/drawdown frequencies (e.g. monthly rather than annual).
- Model investment returns that change over time – appropriate yield curves could be used to model expected returns over time.
- Model salary inflation that varies over time.

- Allow for any expected change in average salary between now and the start of the projection.
- Model a range of individuals instead of a single individual – could be expanded for benefit statement purposes. Allow for different ages, salaries, retirement ages, contribution rates, longevity at retirement.
- Determine how many years the original level of income could be supported under the new strategy.
- Model stochastic investment returns – a range of possible outcomes can be presented to give the individuals an indication of the best and worst case scenarios.
- Allow for a more flexible drawdown approach post retirement – income required can change over time rather than be fixed.
- Sensitivity test retirement age – how much will income change if the individual was assumed to retire earlier or later.
- Sensitivity test contribution rates – how sensitive are the results to the level of income being saved.
- Confirm contribution receipt timing (e.g. may be annual rather than monthly) and remodel if necessary.
- Sensitivity test assumed age of death and impact on supportable level of income.
- Back test model using real life data.
- Update model as the individual's career progresses to allow for actual contributions and returns – this would help the individual to refine their expectations as experience evolves.
- Model a break in contributions – maternity leave, redundancy (shock event).
- Allow for different ages to start contributing – see what impact the starting age of contribution has on the size of the investment fund and therefore the income that can be achieved in retirement.
- Model contribution percentage that varies over time, i.e. by age.
- Allow for taxation if relevant (e.g. tax rates may differ for each scheme).
- Restate the income amounts in today's prices.
- Obtain a peer review of the work performed.

END OF SUMMARY