

# **EXAMINERS' REPORT**

*June 2016 examinations*

## **Subject F104 — *Pension and Other Benefits* Fellowship Principles**

### **INTRODUCTION**

The attached report has been prepared by the subject's Principal Examiner. General comments are provided on the performance of candidates on each question. The solutions provided are an indication of the points sought by the examiners, and should not be taken as model solutions.

## QUESTION 1

i.

$$P_x(n) = P_{x-1}(n-1)(1 - q_{x-1/2}(n-1)) + M_x(n)$$

$M_x(n)$  migrants during  $(n-1, n)$  who survive to be age  $x$  last birthday at  $n$ .

$q_{x-1/2}(n-1)$  probability that a life aged  $x-1$  last birthday at  $n-1$  dies in  $(n-1, n)$  assuming those aged  $x-1$  last birthday at  $n-1$  have birthdays uniformly distributed over the calendar year.

$$P_0(n) = B(n)(1 - \frac{1}{2}q_0(n-1)) + M_0(n)$$

$\frac{1}{2}q_0(n-1)$  probability that a life born in  $(n-1, n)$  dies in  $(n-1, n)$ ,

And

$$B(n) = \sum_{\text{all childbearing years}} \frac{1}{2} (P_x^f(n-1) + P_x^f(n)) f_x(n)$$

$P_x^f(n)$  is the number of females aged  $x$  last birthday at  $n$

$f_x(n)$  is the fertility rate over  $(n-1, n)$  for women ( $f$ ) aged  $x$  last birthday at the date of the birth.

And all childbearing years is usually taken as 14-49

ii.

### Equalised PAYG system

uses level equalised rates over a fixed period of years, called the control period. The equalised contribution rate is calculated in advance so that expected income covers expected expenditure over the control period, if not in each individual year during the period.

### General average premium

Under this system the contribution rate is set such that a level rate will be payable throughout the lifetime of the scheme. In one sense the General average premium is the same as equalised PAYG but with an infinite control period.

iii.

Social security pension schemes are institutionalised arrangements set up at a national level by governments for the protection of the aged, the disabled and the dependants of those who die.

They may aim to either:

- Provide a basic benefit aimed to protect the most vulnerable members of society (a safety net)
- Or provide a full benefit aimed to ensure a good standard of living for all recipients

Governments may have the goals of:

- Looking after the population/ensuring an adequate standard of living
- Managing costs
  - o Achieving the maximum impact at minimum cost
  - o Providing some benefits (like a retirement pension) may lessen the reliance on other benefits (poverty grants, healthcare)
- Achieving desired cross-subsidisations (e.g. between wealthy and poor citizens)

- Achieving macroeconomic objectives
- Achieving political goals (e.g. elections)

iv.

- The scheme does provide a benefit to retirees so that is positive
- Although no information is provided on other benefits eg death or disability
- The benefit is related to salaries so that's ensuring some consistency in replacement ratios
- But the NRR will be highest for the wealthy who paid the most in tax
- And everyone pays the same contribution
- So the poor are subsidising the rich which is unlikely to be in line with the country's goals
- The poor (who need the benefit the most) will achieve the lowest NRR which means they are least likely to have a decent standard of living
- Those who did not pay tax (never worked, or were under the tax threshold if any) will not get any pension
- At 5% of salaries for everyone, this fund is not very expensive so it may encourage private savings in addition
- The benefit, skewed towards higher earners, may attract talent into the country

*In part i, most candidates were aware of this formula but had not learnt it sufficiently well. Details of age and year were muddled, and terms were often too vaguely defined (without reference to age last birthday for example). In part ii, most candidates did well and demonstrated that they understood the concepts. In part iii, the question was well understood but not enough points were provided by most candidates. The marks for part iv really depended on whether the candidate grasped the core problem of pensions being relatively higher for higher income earners. Better candidates understood this was a problem and could describe the consequences. Some candidates missed this core issue.*

## QUESTION 2

i.

$$PUAL = \frac{P \times S}{A} * \left( \frac{1+e}{1+i} \right)^{R-x} * a_R$$

Where:

P is Past Service

S is current salary

A is the accrual rate

e is the salary increase rate

i is the investment return

R is the retirement age

x is the current age

And  $a_R$  is an annuity (as per the rules of the fund) payable from age R

ii.

You can source data from

- The employer records:
  - Name and personal characteristics of each member (gender, age)
  - The date of joining the fund and the employer
  - Salary information
  - Any breaks in service
  - Any members who retired since the last valuation
  - Any members who left employment since the last valuation
  - Class of employee (if the fund has different membership categories)
- The accounts
  - Total contributions and benefits
  - Asset values
- Prior valuation data
  - Past service
  - Personal characteristics for members who were there 3 years ago

iii

Formula for the liability:

$$L_1 = L_0 * TS_1 / TS_0 * AS_1 / AS_0 * (1+i)^{Age_1 - Age_0}$$

Where

- The suffix 1 refers to this valuation and 0 refers to the previous valuation
- L is the total past service liability
- TS is the total annual payroll at the date of the valuation
- AS is the average service of the active members at the valuation date
- Age is the average age of the members at the valuation date.
- Formula for the funding level:  $FL = L_1 / \text{Assets}$  (where the total asset value is supplied)

*Part i was well answered. In part ii weaker candidates could not see what the data requirements would be and how this information may be stored elsewhere. There were some references to sourcing industry data which showed that there was no understanding of pension fund valuations. Part iii was universally poorly attempted. It was intended as a stretch question but no candidate could demonstrate any thought process of how the last valuation could be adjusted. Everyone fell back on the PUAL and could not make sense of the summary data provided.*

### QUESTION 3

The insurer has probably priced the optional cover assuming that members most in need of cover will take out more (ie it will be selected against).

This could be managed by:

- Accepting lower evidence of health limits or insisting members go for underwriting if they want to increase cover multiples. This is likely to be very expensive and may not yield much cost saving.
- Only allowing for increases in cover on certain life events such as buying a new home, getting married, having a child. The greater the correlation between the activity and good health the more effective this will be at controlling for antiselection.
- Putting a waiting period on cover increases for death by natural causes or
- Only allowing for increases at a specified date e.g. the policy anniversary
- At a minimum members should be actively at work when cover increases
- Choice could be limited to a narrower range of multiples to limit the incentive to anti-select.

There are possibly other reasons including:

- This could be an experience rated fund and the experience in the last year could have been poor, necessitating rate increases.

- The insurance cycle may have hardened resulting in increased rates across the board

Nothing can be done about the above 2 reasons.

- The insurer may have become relatively less competitive, may not want your business anymore or may simply not be comfortable with the benefit design and is hence pricing conservatively. Might want to get a quote from another insurer.

-Flexible benefits may lead to more complex administration and higher administration costs resulting in a higher premium

*Most of the answers given to this question were too generic. Candidates knew the bookwork but were unable to apply it well to the specific situation given in the question.*

## QUESTION 4

- Long term bonds can be a good match to pensioner liabilities because
  - Pensioner liabilities are generally long term
  - Bonds provide the requisite liquidity for pension payments
    - via regular coupons and redemptions.
  - Bonds are also likely to be a good match to pensioner liabilities since both behave similarly with respect to interest rate changes.
  - Bonds are likely to be cost efficient
- The suggested investment strategy may however not be regulation compliant
  - If there are concentration limits on individual securities and asset classes
  - There is a very high level of foreign investment that may not be allowed in a retirement fund.
  - Although the compliance issues would relate to the investment strategy of the entire fund, not just the pensioner assets.
- The trustees may want to consider investing in bonds of varying terms (not only long term bonds)
  - To protect the fund against changes in the shape of the yield curve.
- Most of the pension payments are likely to be made in local currency
- It may not be appropriate to have a large portion of foreign investment due to the introduction of currency risk.
- The pensioner liability is real in nature due to the inflation linked increases
  - Nominal bonds would not be a good match
  - A portion of the assets should be invested in real investments such as index linked bonds or equities.
  - If the tax regime allows for taxation on investment return, the tax implications of these investment changes should be considered before any implementation.
- As this is an open fund, there should be sufficient liquidity to finance pension payments although this should be considered.
- Although bonds are a good match it is not always necessary to have a perfectly matched portfolio
- The trustees may be comfortable taking some risk
  - Depending on various factors
- Such as their risk appetite and the overall funding level.
- An appropriate alternative: nominal bonds in proportion to the size of the liability with no allowances for future pension increases
  - The remainder of the portfolio should be invested in real assets such as equity or property to enable real growth for future pension increases.
- Foreign bonds would add an element of diversification to a single asset class portfolio.
- Additional expertise would be required if a large portion of the portfolio were held in foreign investments
- The trustee is speculating which is high risk for a pension fund
- Sponsor covenant should be considered in case bond prices fall if the strategy is implemented
- Costs associated with the strategy should be considered as they could erode return

*In general, candidates did not write enough for 10 marks. Most included a broad introduction that was not worth any marks and should rather have been a part of their planning. Only one candidate mentioned legislation and tax considerations. The points in the memo were covered by most at a high level but then candidates failed to “discuss” as per the question.*

## QUESTION 5

i.

Other examples of financial regulation include:

- require advance funding,
- require separation from the sponsor's other assets of any funds required to provide the benefits,
- require trustee control of funds,
- Annual audit requirement,
- authorisation of those individuals or organisations that manage or invest any funds, restrictions on the types of investments used for any funds (e.g. degree of self-investment, maximum level of equities ).

ii In an asset-based approach, the discount rate is determined by the mix of the assets and a discount rate implied by the current market conditions.

Market-related discount rates for bonds will most likely be based on bond yield curves and hence there will be no difference between the two methods for this asset class.

The market-related cash discount rate is likely to be lower than the corresponding bond yield and hence the new method will increase the discount rate for cash.

The discount rate for property is usually subjectively determined and that for equity is derived from market levels, to the extent that the premia for either would be higher than the 3% p.a. limit imposed by the regulation, the new regulation will reduce the discount rate.

The overall effect will depend on the mix of bonds, cash, equity and property in the portfolio and the extent to which the 3% cap applies. In a normal open fund where the implied risk premium from markets for equity and property are less than 3%, there may be a slight increase in the discount rate due to the cash holding and hence the funding level. However, if the implied risk premium is greater than the 3% cap, there would be a reduction in the discount rate and a lower level of solvency.

Given that assets are taken at market prices, to the extent that the equity risk premium is capped, assets and liabilities may move out of sync. A decline in stock prices may cause the estimated equity risk premium to rise above the 3% cap and reduce the overall funding level.

The overall effect may be reduced if the regulations allow for other changes that may affect overall solvency levels such as establishing or releasing contingency reserves, altering the level of prudence in other assumptions and changing the funding method. However regulators tend to prefer a slightly prudent basis so these loopholes may also be closed.

*Part i was bookwork but many candidates listed other types of regulation, completely unrelated to financial (as per the core reading) or prudential (the term commonly used in practice).*

*Part ii required candidates to think logically through a problem, noting the information they did not have. Answers tended to be very narrowly focused on the equity risk premium (and hence growth assets) as opposed to considering cash, bonds and how the assets would be valued. Put differently, the answers lacked breadth.*

## QUESTION 6

i.

- Model output is the funding level in other words assets over liabilities
- This would need to be developed from current assets and liabilities
- Deterministic model should be sufficient,
  - But will need to be stress tested
  - although a stochastic model may be more appropriate to understand the risks involved around timing of the transactions.
  - Would probably make the investment and mortality assumptions stochastic, if one went this route.
- Latest available asset data including
  - Details of proportions of assets per investment class
- And latest available membership data are needed including
  - Current pensions
  - Member date of birth
  - Sex
  - Spouse and child data if necessary.
- Expenses
  - The expenses that have been experienced in the fund over the previous financial year
  - These will form a base to work from for expenses in future years
  - An assumption regarding expense inflation will be required
  - Should also enquire from trustees if there are likely to be any additional expenses
- Any items that will affect the valuation of the liability will be required
  - For example fund rules or
  - Any increases that the trustees have already agreed to
- Legislation should also be consulted as it may prescribe valuation methods.
- Parameters required:
  - Expected returns on assets  
The statement of investment principles may be required to set the assumption.
  - Future expected pension increases  
Discretionary so may need to consult with trustees.
  - A nominal discount rate to determine the liability  
This may differ from the expected return on assets depending on the asset structure in the fund.
  - Future expected rates of mortality
- These are likely to be similar to those used in the past
- Latest valuation report will be required for this information.
- Likely to be quite prudent as no sponsor
- But not so prudent as to eliminate the possibility of pensioner increases

ii

- The two rates would need to be consistent
- Liabilities can either be valued using the fund's strategic asset allocation
- If there are any equities due to excess assets this may be equivalent to adding a risk premium above a matched discount rate
  - This might be rejected as not conservative enough as there is no sponsor
  - So either a risk-free rate/return on a matched portfolio should be adopted
  - Or should use the same basis as what the insurers will use to price the annuities.
- To model the assets the future return on investments would be required

- Should probably base this on strategic asset allocation, not current allocation
- Due to market movements and the need to rebalance.
  - The strategic allocation should, itself, be based on the underlying asset allocation of the insurers whose annuities the fund aims to buy.

*Part i was a non-standard modelling question. Candidates who scored well paid attention to the various parts of the question which required discussion of the output, data, assumptions and parameters as well as a description of the model itself. A wide variety of answers were accepted including fully stochastic models. Almost all candidates ignored expenses despite these being significant in closed funds.*

*Part ii was not well-handled. Candidates seemed to miss the point that they were being asked to consider a rate for assets and for liabilities and hence they should be consistent. This question was not a repeat of Question 5ii and candidates were expected to think through what the particular circumstances were in this case (no sponsor so a high need for prudence) and almost all candidates indicated a use of current allocation as opposed to a replicating portfolio which would be more prudent. Strangely many candidates who had a stochastic model for part i described deterministic parameters in part ii. Credit was given for candidates who dealt with the complexity added by using a stochastic model.*

## QUESTION 7

i.

A surplus will arise when actual experience is more favourable than expected experience (or experience assumed in the valuation basis). This could arise if the number of early retirements is higher than expected (and are expected to yield a surplus) or if the average early retirement benefit is lower than expected or some combination of the two.

ii.

The size of the surplus arising per member will be determined by the penalty and the extent to which it is taken account of in the valuation basis.

It is possible that the early-retirement penalties are not taken into account in the valuation for the sake of prudence. Thus each withdrawal will trigger a surplus.

Alternatively, the original intention of the penalty may have simply been to be actuarially neutral on the valuation basis and this was simply not updated over time, possibly to increase benefit certainty for members. If the valuation basis grew more optimistic over time the published penalty scales would have become punitive.

Alternatively, the penalties are correctly coded and are designed to be punitive but the withdrawal assumptions in the valuation basis are too low. Again, this may have been a deliberate decision of the actuary when setting the valuation basis if withdrawal itself triggers a surplus.

Alternatively, there may be a trend to early retirement which was not taken into account in the valuation basis.

iii.

It could be more than 3 years since the last valuation date (depending on submission deadlines) and the funding position could be very different now than at the last valuation.

Even so, there may well be sources of strain on the fund as well leading to very little or no surplus available for distribution. However, it may not be considered fair to generate excessive surplus on early retirements, which may include vulnerable employee groups so might want to take action to stop more surplus arising.

Set the valuation basis to incorporate the valuation penalties if these are not incorporated already.

Assess if the penalties are too punitive relative to the valuation basis (alternatively, may be useful to draw up a table of what actuarially neutral penalties will be.) May need to discuss changing the penalties with the trustees. These will need to be communicated.

Alter the valuation basis, if the experience investigation or trends suggests it is necessary.

May need to change other elements of the demographic basis if this was set at the correct level of prudence as a whole.

If there is a trend towards early retirement, one could consider lowering the retirement age for the fund but this may have significant cost implications unless other aspects of the benefit structure are changed as well.

The service cap could also be changed as this may encourage early exits.

If there is significant surplus, one can distribute accumulated surplus.

It would be fairest to distribute to those members who generated the surplus.

Although the fund rules and local legislation/regulation could be considered together with professional guidance.

This could be done via extraordinary pension increases or bonus pensions but the fund rules may prohibit this.

Pragmatic solutions may be preferred to more accurate solutions given that pensioners may have high mortality and once a pensioner has died they cannot share in the surplus that they generated. More accurate solutions may take too long

*Part i required students to work through how surplus arises in a valuation. Relatively few noted this and hence failed to see that the surplus is arising through the valuation basis not matching up to reality. The issue of penalties was not expected to be addressed here given the set-up of the question. Part ii required a breadth of response which few candidates achieved in their answers. Part iii was poorly handled. No candidate recognised that firstly they were told about the surplus arising on just one basis item and not the level of excess assets on aggregate and that even if this did represent the net surplus, the result could be completely out of date. As a result, many candidates focused on the mechanics of surplus distribution. Some of the better attempts suggested ways to stop excessive surplus arising.*

## QUESTION 8

i.

The member will have to take into account the value of the benefit as well as the risk. They can also consider non-retirement issues. This will all be underpinned by their personal characteristics.

Value of benefit:

- Compare the projected value of the DC benefit to the promised DB benefit
  - This will depend on the investment return of both funds
  - As well as the contributions into the DC fund
  - And the expenses in the DC fund
  - As well as insurance and other costs
  - And the accrual rate of the DB fund
- A range of investment returns could be considered to reality check the outcome
- Especially if investment choice is available
- Is the fund offering any sweeteners or enhancements to encourage the transfer?
- How are transfer values into the DC fund calculated?
- Does the transfer purchase units in the DC fund or is there a DB section being created with service transfers into it?
- Consider how surplus in the DB fund has been treated in the past – has it been used to increase member benefits?
- Consider whether pensions are payable from the fund or are to be bought from an insurer
  - Consider whether this is in the member's favour
  - While bearing in mind the DB fund is unlikely to remain operational until the last of the pensions are paid

Risk

- In the DC fund, members are taking on the risk of investment returns, fees, and other experience being different than expected
- The member should be compensated for taking such a risk
- Therefore the DC fund benefit structure should be more attractive before making the switch
- Any investment guarantees would be taken into account here
- There is also the risk that the DB fund will become closed
  - The expenses may increase over time making it more expensive for the employer
  - For this reason, and due to the reduced interest in the DB fund, it is likely that the fund will become wound up at some point in time.
  - The member should consider whether this is likely to happen during their career
  - If so, they should consider whether any enhancements will still be available at that stage
  - And whether the employer can be relied on keeping their covenant and ensuring the fund is fully funded

Non-retirement benefits

- Consider the death/disability benefits in the DC fund and how they compare to the DB fund
- Consider how transfer values are calculated in the DB fund and whether they are a fair reflection of the asset share. If the member believes they are going to withdraw before retirement, then the DC fund may offer a more generous/fair transfer out.
- Consider if any lump sums on retirement are offered in either fund, and whether there is any difference between the way these are structured
- DC funds are more transparent and more easily understood by members and that may be preferred

Member's characteristics

The member's decision may be affected by their personal characteristics:

- Older members close to retirement may be more likely to remain in the DB fund
- Younger members may value

- the portability of the DC fund benefits
- any investment choice
- the transparency
- Members who are less financially sophisticated may value the transparency of the DC fund (or the simplicity of the DB benefits)

ii. The fund is closed to new members.

- This means that the average age of the membership will increase every year
- This may be affected by withdrawals (more likely to be younger members) which will increase the pace of increase in age
- And by mortality (higher for older members) which will reduce the pace of increase a little
- Increasing average age means increasing cost of accrual
- So the contribution rate will go up each year
- Smaller membership numbers means higher expenses, which will also increase the contribution rate
- Older membership means higher cost of death benefits, if any, also increasing the contribution rate
- Any surplus or deficit in the fund will be spread over a smaller number of members (although this only makes a significant difference for non-scalable surplus/deficit items),
- And potentially a shorter period if all members are very close to retirement
- meaning that the past service part of the contribution may be larger (which means lower contribution if there was a surplus, and vice versa)
  - However any surplus may have been used to increase transfers out of the fund on conversion date

iii

- gradual removal of liabilities by the continuation of the scheme without any further accrual of benefits
- transfer of the liabilities to another pension scheme with the same sponsor
- transfer of the funds to the beneficiary to extinguish the liability
- transfer of the funds to an insurance company to invest and provide a benefit
- transfer of the liabilities to an insurance company to guarantee the benefits
- transfer of the liabilities to a central discontinuance fund, operated on a national or perhaps industry-wide basis.

iv. Discontinuance liabilities

- The discontinuance valuation has different assumptions and methodology than the ongoing valuation
- Assets: asset values may differ. Particularly, assets without a market value may be evaluated properly as though they are to be sold, which may reduce the asset value.
- Liability: liability assumptions are based on where the liabilities are to be transferred to. So if they are for example going to an insurer, the insurer's assumptions/quotation would have been used to value the liabilities
- The discontinuance valuation also provides for the costs of the discontinuance, which is an additional liability

*Part i was well done. Part ii required candidates to think through the development of an MCR. Most stopped at describing an SCR with no allowance for expenses, death benefits or amortised surplus. Part iii was bookwork and was well done. Part iv was not well handled. Candidates did not mention that a CUM valuation as opposed to a PUM valuation would be required due to the link with salary inflation being broken. Better attempts covered the change in assets.*

## **END OF EXAMINERS' REPORT**