

EXAMINERS' REPORT

November 2017 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.

The theory is that individuals adjust their consumption in each year to maximise their remaining expected discounted lifetime utility. Because individuals have a lifetime budget constraint, that is, over their lives, they cannot consume more than they earn, less taxes plus net transfers, and because they are assumed to be risk averse, this implies that in each year, they consume something like their permanent income. If their actual income from all sources is less than their permanent income, they borrow. Young people are often in this situation. If the opposite is true, they save, this is easier at older ages. In retirement, consumption is financed from savings.

According to this hypothesis, the accumulation and decumulation of financial assets –including retirement savings – is a tool to allow individuals to smooth out fluctuations in income, taxes and transfers.

The product is intended to smooth out some of the humps in consumption which happen when individuals stop paying their mortgage. Individuals using this product will have a smooth savings trajectory which will begin with saving towards a house but switch over to saving for retirement as spare funds become available. Therefore, they are borrowing early in life and then smoothly start saving later in life, and in retirement can live off the product.

ii.

Myopia – individuals have short term horizons. This product contracts long-term savings.

Hyperbolic discounting – this product takes advantage by asking individuals to commit a % of income, which will increase in future, but individuals do not value those increases highly at the time of purchase.

Complexity – the product is relatively simple to understand.

Inertia – the product requires a pre-commitment and then savings will happen automatically and increase automatically.

Part i was in part bookwork-based and was generally competently done although candidates who did not know the definition lost marks trying to explain in their own words. Weaker candidates did not understand how to relate the product to the LCH.

Part ii was well answered, with weak candidates not relating the bias to the product.

QUESTION 2

i.

Longevity risk is the risk that pensioners live longer than expected.

This causes solvency and liquidity risk.

Solvency risk: The risk is that pensioners live longer than expected when contribution rates were set, and as a result that funding levels will fall and cost of funding will increase.

Liquidity risk: this is the risk that pension outgo exceeds contribution income. This would mean that the fund may suffer from liquidity problems each month if sufficient liquid assets are not available.

Stakeholders:

- Employer
 - o Since the Fund is DB, any increase in funding costs will in the short term be borne by the employer
 - o A deficit in the fund will reflect on the balance sheet of the university
 - o There is a reputational risk if the deficit is large and made public
 - o The liquidity problem may affect the investment strategy in the fund, causing more assets to be held in liquid, short term instruments like money market. This would mean lower returns which makes funding more expensive for the employer again
- Active members
 - o While active member contributions are fixed in DB funds, an increase in funding costs may lead to a change in fund design in the long term to alleviate the cost to the employer
 - For example, reduce accrual rate, increase retirement age, or reduce other benefits
 - o In the long run there is a possibility of the fund being closed down due to funding problems
- Pensioners
 - o Pensioners carry some risk that pensions cannot be paid due to poor funding
 - o Any discretionary benefits such as pension increases may be reduced if funding is poor
- Regulator
 - o If the fund is in deficit, this may cause need for more oversight for the regulator
- Prospective employees
 - o While this is unlikely, low funding levels may cause employees to be wary of joining the University.

ii. Risk management

- Self-insurance: Where a fund sets up measures internally in order to mitigate the effects of a certain risk. Some of the measures include:
 - o Establishing a risk reserve funded by a small addition to contributions or reduction in contribution towards retirement funding
 - o Holding a minimum percentage of assets in highly liquid investments or cash to avoid liquidity risks associated with large lump-sum benefit payments
 - o Establishing a solvency reserve to increase the security of liabilities when there sufficient fund assets available.

- Buy-outs: Where there is a large-scale purchase of annuities from a life office in respect of a group of pensioners, in their name.
- Buy-ins: Where annuities are purchased in respect of a group of pensioners but the policy is written in the name of the fund. Any liability reverts back to the fund if the insurance company were to fail.
- Longevity swaps: Where the risk that pensioners live longer than expected is transferred from a fund to a swap-provider. Under a longevity swap contract, the fund pays a series of payments to the swap provider based on the mortality they expect to experience, and the swap provider pays to the fund the actual payments required.

iii.

- The new members are likely to have higher mortality, so the premium increase is warranted but there is insufficient information to ascertain if the level of increase is warranted.
- The new membership is only a small proportion of the membership. Their impact on salary bill is likely to be even smaller, so the impact on the premium rate suggests that the mortality rate for the new members is very much heavier than for the existing members.
- It is possible that premiums are increasing for another reason:
 - o Experience of the fund
 - o Stage of insurance cycle / profit margins
 - o Insurer is actually trying to discourage the client from remaining with them
 - o General changes in mortality in the country
- The options available to the fund include:
 - o Obtaining a quote from other insurers and comparing, and possibly switching insurers
 - o Considering partial or full self-insurance
 - o Accept the increase
 - o Reduce benefits on death

Answers for part i were fine, but a little superficial. Part ii was bookwork and relatively well done. Weaker candidates did not understand how DB works and how employers/members are affected by funding. Very few realised that liquidity considerations were relevant.

Part iii was poorly done with candidates showing very little insight that would be expected at the F104 level.

QUESTION 3

i.

- Specify the objectives
- Decide on a time horizon
- Test the strategy by performing a large number of simulations
- Measure the achievement of the objectives
- Vary the item being optimized
 - o Repeat the simulation and measurement process each time
- Decide which of the investment strategies is most suitable.
- Explain and discuss the results with the client
- Identify strategies that should be concentrated on
- Test the strategies more thoroughly
 - o To check that they remain reasonable
- Give final advice to the client

ii.

- The liability is real in nature because benefits are based on final salary which is expected to increase over time.
- The liability is denominated in the domestic currency.
- And pensions paid from the fund increase with inflation.
- Growth in equity and property could be expected to increase similarly to wage increases
- But there may be volatility in the growth of these assets in a developing country.
- Since the fund has been closed for some time, average wage increases may be closer to inflation due to a high average age of membership.
- Index-linked bonds may offer less volatile returns than equities and property
- And may therefore be a more suitable investment
- However these may not be available or might be expensive in a developing economy.
- The liabilities are shorter than in an open fund but they are still medium to long term, especially since pensions are paid from the fund.
- However duration of liabilities depends on mix of cash and pension taken at retirement.
- Nominal bonds are likely to have too short a duration for the liability, this exposes the fund to reinvestment risk.
- In addition the cash flows provided do not keep pace with inflation which is a mismatch to the nature of the liability.
- The fund is likely to have a net negative cash flow position
- Since contributions are paid in respect of a shrinking membership base.
- Liquidity needed to pay pension and lump sum benefits will need to come predominantly from the investment structure.
- The coupon payments could provide liquidity but are likely to be insufficient over time due to the effects of inflation
- Rental and dividend payments that can be expected to come from property and equity investments cannot be guaranteed
- And may not be regular.
- Where large lump sum payments are required (death benefits and lump sums at retirement) the fund is very exposed to liquidity risk.
- The property holdings will likely be difficult to sell
- And may need to be sold at depressed prices eventually.

- The equity marketability will depend on the economy but may be poor in a developing economy
- Bonds may be sold off quickly but this will exacerbate the liquidity issue over a longer term.
- Since the fund is closed to new entrants this suggests that the sponsor may not have a huge level of commitment to ensuring financial soundness
- Better matching in terms of liquidity may be more appropriate
- For example some cash, higher amount in bonds (ILBs where possible) or listed equities only.
- If possible offshore investments should be considered to improve diversification of the portfolio as a whole.
- The self-investment aspect should be reconsidered since it aligns the funds fortunes with that of the employer.
- Insurance policies could be purchased for members near retirement.
- Property expenses may be high, reducing returns.
- An alternative to direct property investment is to invest in property shares if available.

iii.

- Limit direct exposure to property
 - o In the interest of mitigating liquidity risk
- Limit or prohibit self-investment
 - o Reduces the risk to the fund in the event that the sponsor fails
 - o Especially where the sponsor has already showed low level of commitment to a defined benefit arrangement.
- Require a minimum level of secure liquid assets
 - o Reduces credit and liquidity risk
- Place limitations on the type of equity investments, for example prohibit private equity investments
 - o Reduces fund volatility
 - o Returns more likely to be aligned with GDP and wage inflation.
 - o Forces diversification in the portfolio.

iv.

- The fund needs to replace 25% of its current asset holding with assets other than property.
- Other funds will need to do the same thing so
- There will be an excess supply of property in the market
- Forcing down prices in order to make a sale
- And increased prices of other assets as funds demand more of these.
- DB funds will have to buy high and sell low overall negatively affecting their funding level and potentially driving them into deficits.
- Furthermore significant expenses might be experienced in selling properties.
- Similar arguments apply for equities/alternative investments
- Whose prices may be driven up by demand

Part (i) of this question was poorly answered considering that it was a bookwork question. Parts (ii) and (iii) were reasonably well done. There were very few good attempts for part (iv) with students failing to follow a logical process.

QUESTION 4

i

- The Attained Age Method is a prospective method
- Whereas the Projected Unit Method is an accrued benefit method
- Therefore the AAM aims to keep contributions stable over time
- The stable contributions should then accumulate to the value required to pay the benefits that are expected to accrue over the future period of membership.
- Whereas the PUM targets a standard level of funding
- And the SCR is calculated to maintain this target.
- The PUSCR can be modified if experience does not follow parameter values.
- The AASCR allows for future service to retirement (benefit payment) date
- The PUSCR allows for future service to the end of a control period of n years only
- Both methods allow for future salary increases to retirement (benefit payment) date
- The actuarial liability calculation is equal under these two methods.
- The AAM is typically used in closed funds that have an increasing average age
- The PUM is typically used in open funds where new entrants keep the average age stable over time.
- AASCR and PUSCR will be equal when the control period and the term to retirement are equal.
- AAM has a faster pace of funding than the PUSCR.

ii.

- Values calculated for accounting purposes are typically required on an annual basis
- The PUSCR is relevant for a particular control period (say 1 year) where after it can be updated for any deviations of the liability from actual experience
- It makes sense to measure the cost of the benefit fund using a method that produces results over a specified period
- The Projected Unit Method may also be seen as the most realistic cost of the benefit fund
- Since the contribution rate is the minimum required to fund the benefits that accrue until the next calculation date
- And is likely to be the maximum rate that the employer is actually willing to pay.
- The PUSCR may reduce balance sheet volatility since it targets a specific funding level.

iii.

$$\text{AASCR} = \text{PUSCR} * (R-x) * \frac{a_{\overline{1}|}}{a_{\overline{R-x}|}}$$

$$29.5\% = \text{PUSCR} * (65 - 47) * \frac{\left(\frac{1.075}{1.09}\right)}{15.8206}$$

$$\text{PUSCR} = 26.3\%$$

$$26.3\% = \frac{1 \times S \times 1/A \times \left(\frac{1+e}{1+i}\right)^{R-x} \times a_R}{S a_{\overline{1}|}} = \frac{1}{45} \times \left(\frac{1.075}{1.09}\right)^{18} a_R$$

$$0.9862$$

$$a_R = 15 \quad (\text{or } 14.973 \text{ unrounded})$$

$$PUAL = \frac{P \times S}{A} \times \left(\frac{1+e}{1+i}\right)^{R-x} \times a_R \times 800$$
$$PUAL = \frac{300000}{45} \left(\frac{1.075}{1.09}\right)^{(65-47)} \times 15 \times 800 = R62\,339\,797$$

Alternatively, PUAL = R62 227 689 using unrounded annuity factor.

Most candidates scored well on this question.

QUESTION 5

i.

The trustees should consider

- Whether the current strategy meets all the current regulatory requirements
- In terms of limitations with respect to asset classes allowed.
- The overall objectives of the strategy – why it was initially put in place
- And whether those objectives are still appropriate for the fund.
- Whether the current strategy is tax efficient in terms of the type of investments and the prevailing tax laws.
- Whether the current strategy is cost efficient in terms of investment and overall management expenses incurred by the fund.
- The membership profile of the fund needs to be considered (or put differently consider the needs of the membership)
- As well as the extent to which the current strategy addresses the risk appetite profile of the average member.
- For example, if there is a large spread of members in terms of age it may be more appropriate to have a default strategy that follows a lifestaging profile
- The method by which investment returns are allocated (monthly or daily) and whether the methodology is appropriate for most fund members.
- The ease with which the investment strategy can be communicated to and understood by members.
- Any insurance policies that are in place
- And whether the investment strategy is supported by and supports the insurance framework of the scheme.
- The benefits offered e.g. lump sum or annuitisation at retirement
- This will affect the level of liquidity made available from the investments.
- The level of diversification of the current investment strategy and whether it meets the overall risk-return objectives in the fund.
- Also the degree of flexibility that the manager has to deviate from the strategic asset allocation.
- The ease with which members are able to opt and switch out of the strategy should it be implemented as the default
- And whether it lends itself well to members opting out, for example members could opt for a subset of portfolios within the default.
- Whether the strategy is active or passive and whether that will be appropriate for a default strategy.
- The date at which the investment strategy was last reviewed and updated
- If it is out of date it may be necessary to implement something new as the default strategy.
- Any costs associated with changing investment strategy needs to be considered.
- Any guidelines issued by the regulator with respect to the default strategy will need to be adhered to.
- Reserve accounts in the fund and how they are invested
- Will the reserve account investments form part of a default or not.

ii.

- Operational risk is introduced at implementation where funds change their default investment strategy from what is currently in place
- And where new portfolios are introduced so that members can opt out of the default.
- For example, switches may not be made correctly or in time.
- Expense risk arises if administration systems are not well equipped to handle changes to underlying investment strategies

- Or if switching members out of the default introduces additional transaction or administration costs.
- The risk that members who choose to opt out make poor decisions.
- Regulatory risk may be introduced if there are onerous regulatory requirements
- For example, education and communication to members.

iii.

- Cash and money market investments offer stable returns
- Which may be desirable close to retirement as a measure of capital preservation.
- They are also liquid investments which are appropriate where large lump sum disinvestments are required.
- Lifestaging also changes the asset mix gradually over time and hence reduces risks associated with trying to time the investment market.
- But can be problematic for late or early retirements.
- Since the objective of the fund is to provide a reasonable standard of living after retirement, the investment strategy near to retirement should support the provision of a long term income (even if a lump sum is paid from the fund)
- Cash and money market investments are not a good match for long term income provision
- And do not fluctuate in line with annuity costs.
- For example, if interest rates fall members invested in cash will be negatively affected
- Since the capital value of their benefit will not move in the same way as the cost of an annuity.
- Overall the suggestion is not appropriate
- since long term instruments such as nominal and government bonds also provide stable returns and liquidity
- and are a better match to the prospect of income provision post retirement.
- In addition, the poor inflation-protection offered by cash may even make this inappropriate for matching lump sum benefits.

Part i required candidates to outline a broad range of considerations but many fixated on the needs of members. A number of candidates lost focus on the fact that this was a large retirement fund and hence savings outside the fund and desired replacement ratios would be unknown to the trustees. In part ii, better candidates identified that cash was a poor match for annuities but many candidates missed this obvious point.

QUESTION 6

- i. Stage 1: decline in mortality rates at all ages, but particularly infant mortality. This will result initially in an increase in the number of children but this will reduce the old-age dependency ratio, and in time the youth dependency ratio.
Stage 2: decline in fertility. Rate of population growth, particularly at working ages, slows. Child dependency ratios fall but adult dependency ratios rise.
Stage 3: mortality and fertility in balance. Old age dependency ratios rise dramatically.
- ii. Older people in the population would have been vaccinated and younger people would not have been. Assuming the vaccinations have remained effective, younger people might have a higher susceptibility to this disease. This may increase mortality among younger people and working age people depending on how deadly this disease is. In the short term, the number of workers might decline. Depending on how susceptible young children and babies are to catching and dying from this disease, over time, the number of workers may decline further. This would result in collection of contributions for the fund declining while benefit outgoes would remain the same. This may force either an increase in contribution rates or a decrease in benefits or both. In the longer term, we expect the vaccination programmes to resume and in the absence of other mortality shocks, as the effected cohort ages, the dependency ratio will decrease. This may result in lower contributions or higher benefits or both.

Part i was basic book work and well-prepared candidates scored marks easily. Part ii required reasoning. Candidates who considered the impact on the young and old separately and the impact over time were able to generate sufficient marks.

QUESTION 7

i.

A period of investigation should be chosen that is long enough to give sufficient data for credible results but still short enough to be relevant.

Member data should be divided into homogeneous groups, bearing in mind concerns about the number of members in each group being too small to provide a statistically credible result.

Crude mortality rates can then be calculated by taking the number of deaths and dividing by a calculated exposed to risk value.

The results can then be compared with the mortality tables adopted in the valuation, say with a Chi-squared test to determine whether there is a statistically significant difference.

A comparison can also be made with other relevant standard tables to determine if they appear to be more appropriate to the fund.

ii.

No.

The investigation dealt only with pensioners. There may still be a number of active members on the fund with their own death benefits, which contributes to the mortality risk on the fund.

Just because the assumptions agree with our estimations based on past experience, it doesn't mean that either are actually correct or a good indication of future experience.

The mortality tables and improvement factors are not the only basis items associated with the scheme's pensioner mortality experience. If reversionary annuities are offered, the age gap between the spouses, percentage married and reversionary percentages (if a choice) all influence the mortality risk.

The mortality risk itself involves a cohort of annuities not running off as expected. Within the cohort, there will be some larger pensions and some smaller ones. The mortality table and improvement factors deal only with the number of people expected to die, not who will die within the cohort. There is still significant risk that the deaths will be disproportionately concentrated among members with smaller benefits and hence the annuity outgo will be higher than expected. This risk will be heightened if the pensioner pool shrinks (for example if the fund closes) and the law of large numbers no longer applies.

While having appropriate valuation assumptions are important for solvency/funding risk purposes, it doesn't actually manage other risks associated with mortality risk like the risk the contribution to the employer becomes unaffordable. The valuation basis also doesn't ensure that there is sufficient liquidity available or that assets and liabilities are appropriately matched if durations are longer than anticipated. Mortality experience may increase the importance of other risks such as inflation risk if the pensions are paid for longer than anticipated.

The fund may have taken some steps to control mortality risk e.g. by reducing the risk on contingent annuities by having a low reversionary percentage or making actuarial adjustments to pensions paid to younger-than-expected widows or using a solvency reserve. However, particularly if the fund closes, it may be necessary to share the risk via insured annuities either in the name of the pensioner or the fund. A longevity swap could also be used.

Part i was basic book work but many candidates seemed unprepared for this question. There also seemed to be confusion as to how to calculate a mortality rate despite this being covered in earlier subjects. Part ii was poorly done. Most candidates identified that historic experience need not predict future experience but failed to pick up on other points.

QUESTION 8

i.

- Members are likely to prefer to have access to at least some cash at retirement date
- Particularly lower paid workers may have debt to pay off
- Or would prefer to invest the money in small businesses
- Annuity rates may not be favourable to union workers, if they do not account for impaired mortality
- This means that it is not in their interest to convert
- There may be other benefits such as a state pension which is sufficient for union workers in retirement
- Benefits may be so small that the expenses of a regular pension are making it not worthwhile
- Unions may be trying to curry favour with members
- Unions may not understand long term consequences of their request, in terms of using up the benefit too early
- Pension income may reduce eligibility for other benefits.

ii.

- Members may spend recklessly and run out of retirement benefits early in life
- Then rely on state benefits

iii.

- The state could allow access to cash for part of the benefit at retirement only
- This is likely to be politically more popular than forced annuitisation of the full benefit
- And protects the state (and members) against the risks of irresponsible spending early in retirement.
- Full access to cash can be given in where benefits have a capital value that is lower than a certain threshold.
- The change could be implemented but
- the earliest age at which retirement can occur could be simultaneously increased
- or preferential tax treatment could be applied to members who opt to annuitise.
- The state could support and regulate flexible drawdown options that are less stringent than guaranteed annuities but place limitations on cash access.
- The state could educate members about the dangers of 100% withdrawals
- There could be a minimum amount of annuity that has to be purchased before any amount can be taken in cash
- Individuals could be given annual drawdown options followed by a cash withdrawal at a later age, accompanied by annuitisation of the remainder (other valid ideas accepted)
- State could regulate/require insurers to provide impaired products

This question required a wide range of ideas and while performance was not poor overall, candidates did not demonstrate that they could think widely enough.

END OF EXAMINERS' REPORT