

The Institute of Actuaries of India

**Subject ST4 – Pensions & Other
Employee Benefits**

18th May 2007

INDICATIVE SOLUTION

Introduction

The indicative solution has been written by the Examiners with the aim of helping candidates. The solutions given are only indicative. It is realized that there could be other points as valid answers and examiner have given credit for any alternative approach or interpretation which they consider to be reasonable.

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Q.1

- a) Sponsor covenant can be defined as the combination of the ability and willingness of the sponsor to pay or the ability of the trustees to require the sponsor to pay sufficient contributions to ensure that the scheme's benefit can be paid as they fall due.
- b) Broad issues:
- i. What is the company structure? What part of the business contributes to the maximum value to the company?
 - ii. What are the liabilities of the employers and what are their priorities?
 - iii. What risks does the business face?
 - iv. What is the financial strength of the company? How strong is the balance sheet? Credit rating?
 - v. What would the scheme receive if the employer failed?
 - vi. What can the employer afford upfront?
 - vii. What can the employer afford in the future?
 - viii. What is the employer's long-term strategy?
 - ix. What is the long-term future of the market?
 - x. What are the legal powers of the trustees?
- c) List of circumstances:
- i. The scheme is well funded therefore no reliance is placed on the sponsor.
 - ii. The sponsor covenant is strong enough to be deemed as certain.
 - iii. The sponsor covenant is so weak as to be deemed nil.
 - iv. The sponsor has no further liability.
- d) Advantages:
- i. Providing greater security to the scheme members.
 - ii. Providing information regarding the sponsor's willingness and ability to contribute.
- Disadvantages:
- i. Cost of compliance of regulations.
 - ii. Indirect costs – a false impression of security when there might be other problems.

[10]**Q.2**

- a) List of options:
- i. Commutation of accrued pension for a cash lump-sum at retirement.
 - ii. Exchange of accrued deferred pension for transfer value.
 - iii. Early retirement from pensionable service.
 - iv. Early retirement from deferred pensioner status.
 - v. Commutation and retirement on grounds of incapacity or ill-health.
 - vi. Purchase of pension using additional voluntary contributions.
 - vii. Increase in pension to allow for late retirement.
 - viii. Exchange of accrued pension for increased dependants' pension.
- b) Factors for setting terms of any option:
- i. Market conditions – Cost of securing the same benefit terms with an insurance company or market prices for assets that could be used to mitigate the financial risks.
 - ii. Cost neutrality from the scheme's point of view.
 - iii. Cost neutrality from a member's point of view, including taxation and time cost of money.
 - iv. Market experience about the terms currently offered to existing scheme members and the acceptance rate of these terms.
 - v. Consistency between the terms for different member options.
 - vi. The characteristic of the financial terms as part of the scheme benefit structure.

- vii. Member communication and planning so that the terms are fixed for sufficiently long and members can plan financially. Also consider any consequent exposure to risk arising from this.
 - viii. Scheme funding and benefit security, including current underfunding, scheme funding and investment strategy, the sponsor covenant and future exposure of the scheme to risk in general.
 - ix. Risks to the scheme from the large-scale exercise of a particular member option.
 - x. Existence of any pension protection fund.
 - xi. Prudence in assumptions on the grounds that the pension-promise is the primary benefit and members do not have to exercise the option.
 - xii. Concerns that it may be harder to make the terms less generous in future (if the change in financial condition worsens) than it is to improve them now.
- c) Variable versus fixed interest rate to calculate pension commutation:
- i. Variable factor makes the scheme financially neutral provided that the factor also depends on age and sex.
 - ii. Variable factors would produce different lump-sums for different retirement ages – a source of non-equity.
 - iii. Employees may not perceive the resulting variable benefits to be fair.
 - iv. Fixed factor can be popular and generous where interest rates used for discounting are low.
 - v. This can lead to anti-selection; however, many will select the lump-sum regardless due to the freedom it will provide.
 - vi. Variable factor may not be consistent with other benefit design.
 - vii. Variable factor makes it difficult for employees to plan in advance.
 - viii. Administration is more difficult for a variable factor.
 - ix. Which interest rates to use for the variable factor?
 - x. What is the industry practice and competitor's approach?

[15]

Q.3

a) Definitions:

The **AASCR**, expressed as a percentage of earnings, is the present value of all benefits that will accrue to present members after the valuation date, by reference to service after that date and projected final earnings divided by the present value of total projected earnings for all members throughout their expected future membership.

The **EASCR**, expressed as a percentage of earnings, is the present value of all future benefits for a member joining at the assumed entry age, by reference to projected final earnings divided by the present value of total projected earnings for the member throughout his/her expected membership.

b) Movement of SCRs and MCRs over time:

AA

Initially $AASCR = AAMCR$, as there is no surplus or deficit. If the membership profile is stable in terms of age, sex and salary distribution then the AASCR will be stable over time. However, paying the AASCR will generate a surplus so the AAMCR will be lower than the AASCR at the subsequent valuation.

If there are no new entrants to the scheme then the average age will increase and the AASCR will increase. However a surplus will have built up and if the surplus is spread over the future working lifetime of the members the AAMCR will equal the initial AASCR.

EA

The EASCR is stable over time unless the assumed entry age is changed. If the average

age is greater than the assumed entry age then at the initial valuation scheme will have a deficit. Therefore the EAMCR will be greater than the EASCR until the deficit is removed.

If new entrants join at the assumed entry age then they have no impact on the surplus or deficit. If they join at a younger age than assumed thus will be a source of surplus and vice versa. The EAMCR at the second valuation will be lower if new entrants join at a younger age than assumed and vice versa.

- c) Source and reason of surplus:
- i. Funding method used: AASCR is higher than is needed to meet the cost of the benefits that the member is accruing, therefore leading to a surplus.
 - ii. Investment returns: If these were greater than expected a surplus will arise which is often the largest source of surplus
 - iii. Salary growth: If salaries grow more slowly than expected, the accrued benefits will be lower than expected. More contributions will have been paid than needed and a surplus will emerge.
 - iv. Withdrawal rate: Higher withdrawal than expected will lead to surplus if the benefits payable on withdrawal are less valuable than the actuarial value.
 - v. Mortality experience: Effect on surplus will depend on whether the death-in-service benefits are insured. If insured, heavier mortality will lead to a surplus. If not, then the impact will depend on the reserve held for a member relative to the value of the death benefit payable.
- d) CU method:
- i. Pace of funding affected and not the total cost of benefits.
 - ii. Lower contributions than PU/AA in early years.
 - iii. Higher contributions than PU/AA in later years.
 - iv. Contribution rates more volatile than PU/AA.
 - v. Less security for members.
 - vi. Greater chance of deficit from unfavourable experience.
 - vii. Less investment freedom because of greater risk of deficit.
 - viii. Check against statutory requirements.
 - ix. Could offset effect by using stronger assumptions.

[15]

Q. 4

- a) Advantages and disadvantages of means-tested benefits:
- Advantages:
- i. Cost-effective way to guarantee that everyone achieve a certain standard of living in retirement.
 - ii. Redistributive, if taxes are raised from those with more wealth and means-tested benefits are paid to those with little wealth.
- Disadvantages:
- i. Degrading to human dignity to offer what amounts to charity.
 - ii. May discourage people from providing for themselves.
 - iii. May create a poverty trap whereby increases, in a person's income, merely reduce the value of the state benefit.
 - iv. May encourage people to squander or hide their existing wealth so that they meet the means-tested requirement.
 - v. May be perceived to be unfair to those who provide for themselves.
 - vi. Means-tested benefits are not taken up by all who are entitled to them, in particular, if the rules are complex.
 - vii. More complicated to administer.

b) Calculations:

40 years later:

$$\text{BSP} = 50 * 1.05^{40} = 352.$$

$$\text{MIG} = 100 * 1.05^{40} = 704.$$

A's private pension arrangement: (note all interest rates are equal to 5%):

$$\text{Accumulated fund} = 1,000 * 0.05 * 40 * 1.05^{40} = 14,080.$$

$$\text{Annual pension} = 14,080/20 = 704.$$

$$\text{BSP} = 352.$$

$$\text{Total Pension} = 704 + 352 = 1,056.$$

$$\text{Additional MIG} = 0.$$

B's private pension arrangement: (note all interest rates are equal to 5%):

$$\text{Accumulated fund} = 250 * 0.05 * 40 * 1.05^{40} = 3,520.$$

$$\text{Annual pension} = 3,520/20 = 176.$$

$$\text{BSP} = 352.$$

$$\text{Total Pension} = 176 + 352 = 528.$$

$$\text{Additional MIG} = 704 - 528 = 176.$$

c) Comments:

- i. A's annual income will be slightly better than means-tested benefit because of the private pensions arrangement. However A has lost out because he or she has not benefited from the full State entitlements although contributed for it (through tax).
- ii. B has also lost out because he or she need not have saved privately as he or she is getting the State top-up anyway.

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Q. 5

a) i) Current Unit Funding Method

The actuarial liability for active members is calculated taking in to account all types of decrement and pensionable salary is not projected. In calculating the liability as at the end of the control period, the pensionable salary is projected to that date. In such calculations allowance is made for increase in the benefits between the relevant date and the assumed date of retirement, the date of leaving service or date of death as appropriate. The increase to be included are those applicable to preserved pensions as required by the rules of the scheme or legislation, if any. (1)

ii) Projected Unit Method

The actuarial liability for active members either as at the valuation date or as at the end of the control period is calculated taking in to account all types of decrement. In such calculations pensionable pay is projected from the relevant date upto the assumed date of retirement, date of leaving service, or date of death as appropriate. (1)

iii) Defined accrued Benefit Method

The actuarial liability for active members either as at the valuation date or as at the end of the control period is calculated on the assumption that the scheme will be discontinued on those dates. The actuarial liability is normally assessed on the basis of actuarial assumptions consistent with those used for long term funding . It is assumed that members will be entitled to the discontinuance benefits which are defined in the rules of the scheme before reduction of benefits under application of any priority rules in a fund with a short all in assets. Additionally (but not alternatively) calculations may be made which assume that members will receive higher discontinuance benefits, by exercise of discretion, and both the actuarial liability and the standard contribution rate would then be calculated by reference to those higher benefits. (3)

b) i) Control Period

The period over which the standard contribution rate has been calculated to remain constant, assuming that the funding ratio at the beginning and end of the period is 100%. The control period which is normally one year or more but which could be less than one

year should be specified in the funding report. (1)

ii) Actuarial Surplus

The difference between actuarial value of assets and the actuarial liability is called actuarial surplus. (1)

iii) Vested Rights

Benefits to which a member of a scheme is entitled whether or not they remain an active member of the scheme, (1)

iv) Valuation rate of interest

This term is usually used to refer to the discount rate used to calculate the present value of the projected cash flows (either from the assets or the liabilities or both). It is often the rate of investment return expected on the assets but could be some other rate as well. (2)

v) Terminal Funding

An arrangement whereby a payment to meet the present value of a benefit is made only at or about the time when the benefit is due to commence. (1)

vi) Replacement rate

The percentage of annual retirement income derived from savings to the final salary received. (1)

vii) Pension Equity Scheme

A scheme in which the benefits are expressed in terms of a fund value related to final salary, which accumulates through indexation of the fund, in line with salary growth, and the addition of future accrual. The accumulated fund value is used to purchase the required form of benefits when those benefits become due. (2)

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Q. 6

i)

i) The advantages of PAYG are;

- It allows benefits to be introduced at a worthwhile level in the early years.
- It avoids exposure to market volatility and insolvency of provider institutions.
- There are low transaction costs
- It can increase solidarity within the community as it transgresses the costs/benefits over generations.
- It makes it easier to organise payment according to need with contributions according to ability to pay.

ii) The concept of smoothed PAYG and how it can operate

Smoothed funding under PAYG is common with the extent of smoothing varying from country to country. Schemes that are close to a pure PAYG maintain a fund only as a working balance. A working balance is necessary because;

- The differing incidence of contribution (income) and benefit (outgo),
- The time lag inherent in changing contribution requirements,
- The uncertainties involved in projecting benefit outgo even a year or two ahead.

The method involves balancing the total benefit outgo and the total contribution income. The balancing involves;

- Putting aside funds raised in a particular period that are not needed because they exceed the benefit outgo in that period.
- Using some of the excess funds to cover benefit outgo in later periods where insufficient funds are raised to cover benefit payments in that period.

The above avoids atleast some of the fluctuations in contributions that would otherwise be required under a pure PAYG system. The mechanism for managing this balance is complex but the smoothing process does result in schemes that are financially more robust.

iii) Book reserving including issues relating to security of benefits, from members' perspective and the manner in which "Third Party Guarantees" can operate to enhance the security for the members.

Book reserving

Book reserving is an approach to helping ensure benefit payments can be met when no

explicit segregated funds have been set aside to meet the benefits, i. e. when PAYG approach is being used. A book reserve is defined as a provision in a company's accounts for a benefit liability payable in the future for which no funds have been set aside. In this way book reserving can be equated to method of accounting for costs.

Whatever is the approach adopted for the timing of contributions relative to benefit payments, it is often a requirement for a company to notionally set aside funds relating to benefit promises made to its employees. To the extent that these notional funds, or book reserves, exceed any actual funding they may be recorded as a liability in the company's formal accounts. In other words, if a company decides not to set aside sufficient funds to meet future benefits, it may either;

- not put aside any cash and set up reserves – the balance sheet of the company will show the full value of benefits as liabilities and there will be no specific asset earmarked to provide the benefits, or
- set aside some cash and set up reserves in the company's accounts to cover any short fall relative to the notional cost of providing the benefits.

If the book reserves are calculated annually, this method is similar to a contribution except that the contribution remains invested within the company.

The effectiveness of book reserving depends on;

- the size of the reserve relative to ultimate cost of benefits.
- The security of reserves.

Security under Book reserves

Winding up priority

The security of benefits depends on the priority of those benefits in the event of employer becoming insolvent. In order to achieve an acceptable level of security, it may be necessary to give the benefits a high priority so that they can be provided from the employer's remaining assets before these are used to settle other debts.

Third party guarantees

The legislation may require such guarantees of additional security to be provided such as;

- financial guarantee from a parent company,
- financial guarantee from shareholders
- letter of credit from a bank,
- an insolvency (of the employer) insurance policy,

solidarity agreement within an industry or profession to meet other companies' debts.

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Q. 7

- a) Suggest actions that could be taken when setting the Investment strategy to mitigate the investment risks of running the pension scheme

Some possible actions are;

- Matching – ensure the nature and term of liabilities are taken in to account when setting an investment strategy. An ALM exercise could be carried out.
- Concentration of assets – diversity can be encouraged by setting ranges on the types, currencies or sectors of assets that can be invested in.
- Riskier assets – certain assets can be precluded.
- Procedures – put in place independent monitoring procedures.
- Investment fraud – a separate custodian to the investment instruments can reduce this risk.

- b) The factors that affect the risk profile of a pension scheme

The risk profile of a scheme is affected by;

- Size (large, medium, small)
- Type (DB, DC or Hybrid)
- Maturity (new, mature, closed)
- Growth (new members or closed to new members)
- Sponsors (single or multi-employer)
- Country operated in (developed/under-developed)

Regulatory framework (none/lots of/somewhat)

- c) You are the new benefit manager of the company having the Pension scheme which has generous non-contributory final salary scheme. Staff representatives have made it clear that employees are unhappy that there is a deduction of a proportion of the basic State pension from their scheme pension.. How might you address the problem without changing the benefits?

The value of a two-way communication and education exercise in a situation like this can not be over estimated.

It needs to be two-way to identify real cause of the problem;

- The complaints about the offset may only be a symptom of the problem not the cause e.g. low paid and/or part-timers feel that they are discriminated against. Therefore questions must be asked of the membership, e.g are the benefits what the members need? A workshop with feedback from the members could address this.
- Alternatively it may be an issue of education. Members may need to be taught the value of benefits they have got. For example there may not be a offset in a competitors' scheme but they may have a retirement age of 65 compared to one of 60 in this scheme. Suitably presented informative literature and educational meetings can address this problem.

Failure to address the issue can cause employment problem, low levels of scheme membership, and lead the employer to question seriously the value for money that they are receiving from the pension scheme.

- d) How would you assess the additional risk for the pension scheme if it provided a defined benefit promise with a defined contribution underpin?

An underpin is a guarantee of a minimum benefit payment. For this the guarantee applies if the value of the rolled up contribution is greater than the value of the final salary scheme.

We need to know how the underpin is calculated and how likely the defined contribution is to bite. If it is unlikely to bite, the situation is very similar to that for defined benefit. If it is very likely to bite, the situation is the same as for a money purchase scheme.

After the above, the best way to assess the risk and its effect on contribution rates, investment strategies or solvency levels is through ALM techniques. Asset Liability modelling involves running hundreds of simulations of asset and liability behaviour to explore the likely impact on contribution rates or solvency levels for different investment strategies.

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Q.8

- a) One of the Scheme Trustee has commented that government fixed-interest bonds are the best investment for a final salary pension scheme because they are secure. Comment on this statement.

For developed countries government bonds are secure in the sense of low risk of default. However, this ignores the security of benefits i.e. matching. Fixed interest government bonds can give a guaranteed nominal return and a good match for level or fixed increase pensions.

However, final salary liabilities are not normally set in nominal terms. Government fixed interest bonds therefore give a poor match for most salary related liabilities and do not therefore provide security of the benefits. It also ignores expected long term return. Empirical evidence suggests that the government bonds will not give the best long term expected return.

- b) Discuss the factors that you would consider in determining an appropriate investment strategy, if the scheme were defined benefit with defined contribution underpin.

We need to know how much members and sponsor contribute to the defined contribution underpin and hence how likely the DC underpin is to bite. If it is unlikely to bite, the situation is very similar to that for DB scheme. If it is very likely to bite, situation is the same as for a DC scheme.

After this the best way to determine appropriate investment strategy is through using ALM techniques. ALM involves running hundreds of simulations of asset and liability

- behaviour to explore the likely outcome of different investment strategies.
- c) What are the main advantages of fixed-interest government bonds?
The advantages of fixed interest government bonds;
- No income volatility (other than re-investment)
 - High income
 - Guaranteed capital payment if held to redemption.
 - A good match for benefits if nil or fixed increases.
 - Diversification from shares
 - Very low risk default
 - Marketability is usually very good.
 - Low expenses as compared to other assets
- d) What conditions need to be fulfilled to realise the quoted returns from indexed-linked bonds?
To be guaranteed to receive the gross redemption yield;
- The bond needs to be held to redemption
 - Reinvestment of coupons needs to be at the same real return.
- e) What are the main advantages of domestic-fixed interest corporate bonds over government bonds? What additional risks are introduced?

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