

Institute of Actuaries of India

Subject ST4 – Pension & Other Employee Benefits

November 2013 Examination

INDICATIVE SOLUTIONS

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.

Solution 1 :**(i)**

- The benefits are defined therefore benefits payable should be unchanged
- Increased security of accrued benefits, especially for pensions in payment and deferred pensions
- Sponsoring employer may have to pay increased contributions in the long run and /or the employee s contribution rate may be increased
- Therefore possible lower security for future benefit accrual ultimately loss of future accrual
- And possible lower job security for active members
- Reduces chance of discretionary benefits

(ii)

- Investing in assets without taking account of the details of the liabilities can leave substantial mismatch risks. For example:
 - Currency risks
 - Nature of liabilities (fixed or index linked)
 - Duration risk if the term of the liability exceeds that of the bonds
- Take into consideration scheme specifics, which include:
 - Size of the fund and likely to increase or decrease
 - Size of employer
 - Is the scheme closed to new entrants
 - Likely changes to the liability profile in the short, medium or long term
 - What are the expected cash flows for benefit outgo
 - The current funding position
 - Decision on company/government bonds

[6 Marks]**Solution 2 :****(i)**Employee Risks

- Investment or market risk - Poor investment returns may cause a reduction in benefits or may limit future benefit increases
- Inflation risk - Inflation erodes the value of participant's benefits
- Job tenure risk - risk of losing potential benefits if leave job too early - e.g., final average pay plan will not account for future salary increases or may lose vesting status if leave before vesting.
- Risk of wrongdoing (corruption or mishandling of plan assets)
- Political risk – laws can change which could result in a reduction of benefits or an increase in employee contributions
- Replacement ratio risk – benefit not adequate at retirement
- Implicit contract risk – sponsor will not honor pension payment

(ii)

Society, Taxpayer and Employer Risks

- Investment risk – poor investment returns may cause an increase in taxes
- Plan design risk – if plan features are not designed appropriately, risk of the system being manipulated and costs increasing
- Job tenure/demographic risk – if employee works longer than expected, costs increase
- Political risk – benefits could be increased
- Intergenerational transfer risk – risk that one generation of taxpayers pays more than another
- Replacement ratio/benefit adequacy risk – insufficient benefits may result in taxpayers supporting participant through other social programs

(iii)

Public Sector Employer Risks

- Employee morale – decrease in benefits affect morale
- Funding risk – competing needs for funds when making budget decisions
- Volatility of costs – government entities favor a predictable budget process emphasizing level funding

(iv)

Government Risks

- Risks associated with issuance of pension obligation bonds
- Revenue allocation risk – may need to divert funds from other government programs to fund plan costs

[10 Marks]

Solution 3 :

Problems of “flex” schemes

Pricing

- Medical premiums would be higher for older employees with dependents as compared to a young unmarried employee. Should this be factored into the way the program is priced?
- Care would be needed with any age discrimination legislation.
- Is it valid to assume the same price for “buying” and “selling” benefits?
- Should the cost of “buying” be more if the employer has to use expensive temporary agency staff to cover employees taking flex? Should it be priced in a different way for those who work shifts?

Selection

- Younger employees are more likely to select the increased leave entitlement and older members increased medical benefits. The principle of selection is particularly relevant when offering cash alternatives for “risk” benefits.
- For example, the take-up rate for a private medical insurance scheme may be lower amongst the younger members if they believe that they are unlikely to use it ...
... if it is the same price for all members then they are likely to accept the cash alternative and the older members the medical insurance. This will raise the average age of the scheme and the cost of medical claims.

Core benefits

- Should there be a minimum level of benefits below which employees cannot fall?
- For example, if there is an option to allow the member to reduce holiday entitlement:
Consider:
 - Is it sensible, for the employer, to allow annual leave to fall below, say, 2 weeks?
 - What will be the effect on the employees’ health if they only take 2 weeks per annum?
 - Is absenteeism going to increase if holidays fall below a core minimum?

[4 Marks]**Solution 4 :**

(i)

Liability for Actives and Deferreds is 325cr

Excluding Spouse Death at retirement gives 260cr ($325 - 20\% \times 65$)

260cr is present value of projected pension at retirement

- using a factor of $(80\% \times 14 + 20\% \times 9)$ i.e. 13 on the pension at retirement

Revised factor is $(60\% \times 14 + 40\% \times 9)$ i.e. 12 which need to be applied on the pension at retirement

So revised liability of member’s pensions = $12/13 \times 260\text{cr} = 240\text{cr}$

Revised total accrued liability is $240 + 65 = 305\text{cr}$, i.e. fall of 20cr

Total normal cost is $11.25\% + 5\% = 16.25\%$ of salary

Net cost for member’s pensions is $16.25\% \times 0.8 = 13\%$

Allowing for maximum commutation = $12/13 \times 13\% = 12\%$

Add back SDAR = $12\% + 0.2 \times 16.25\% = 15.25\%$

Deduct member contributions = $15.25\% - 5\% = 10.25\%$

Impact is a fall of 1% in employer’s regular contributions

(ii)

Improvement to 90% of value of pension

Revised value of benefits at retirement is

$(80\% \times 14 + 20\% \times 0.9 \times 14) = 13.72$

Revised liability is $13.72/13 \times 260 + 65 = 339.40\text{cr}$, i.e. increase of 14.4cr

Revised NC is $13.72/13 \times 13\% + 3.25\% - 5\% = 11.97\%$ of salary, i.e. increase of 0.72% of salary roll

(iii) Both (i) and (ii)

Revised value of benefits at retirement is

$$(60\% \times 14 + 40\% \times 0.9 \times 14) = 13.44$$

Revised liability is $13.44/13 \times 260 + 65 = 333.80$ cr, i.e. increase of 8.8cr

Revised NC is $13.44/13 \times 13\% + 3.25\% - 5\% = 11.69\%$ of salary, i.e. increase of 0.44% of salary roll

[9 Marks]

Solution 5 :

(i)

- Need to split members in homogeneous sub-groups based on age, service or according to other factors that are expected to be closely correlated to salary growth.
- Consider only actives throughout inter-valuation period as new entrants and exits distort picture.
- The analysis could be performed by the production of table along the following lines:
 - In column (1), age (as per the definition) at this valuation date
 - In column (2), salaries at previous valuation for members now age x (represents members aged (x-3) last time)
 - In column (3), salaries at this valuation for members age x
 - In column (4), (3)/(2) is the increase in salary in the three years period for (x-3) to x. (2)
- Any stable pattern of differences between the figures in this column at different ages may then indicate the existence of a correlation between salary growth and age
- It may be further investigated, whether this age related salary growth is consistent with the assumptions or other possible tables for such growth, the following extra columns could be added to the analysis table:
 - In column (5), $sx/sx-3$ (s is an assumed salary inflation including general inflation rises as well as promotional/age-related rises)
 - In column (6), (4)/(5) as the Actual/Expected
- Any differences will be explained by both general salary increases and promotional/age-related increases.
- Need now to consider how to split between promotional rises and general salary inflation.
- One can speak to the employer to find out what their general increases have been. This can be done by the following approach
 - promotional scales used as given by employer or by considering the average profile of salaries at last and this valuation
 - consider progress of national average earnings
- May note that this analysis cannot be expected to be perfect. Some subjectivity involved.

b)

- Results of the analysis should not be used blindly.
- Consideration should be given to whether the period under investigation was typical and experience is likely to be representative of future experience.
- Trends, if any, due to economic cycles etc. should be detected and allowed for.
- Care should be taken to ensure that sub-groups analysed are sufficiently homogeneous.

- Credibility of data should be tested to ensure that results of the analysis are statistically credible. In particular, the group is under consideration is a medium sized and expected to have enough credibility to use as the basis for future experience projection.
- If need, appropriate adjustments may be made to the assumptions to create a margin for prudence.
- Compare the results with what may be expected against market information and benchmarks (e.g. assumptions used by similar companies).

[12 Marks]

Solution 6 :

Surplus carried forward from previous valuation

Any surplus at this valuation would partly be due to any surplus at the previous valuation. However, there was no surplus at the last valuation if assets were taken at pure market value

... or a discounted cash flow approach used and at that time discounted value equaled market value, or any smoothing factor was 1.

Investment experience

It would appear that there has been a good return on assets. To estimate what that return may have been, assume:

- Total scheme contributions are 20% pa
- Pension payments increased uniformly.

The average return is given by i , solving:

$$150 * (1+i)^3 + 3 * (12.0 - \frac{1}{2} * (10+15)) * (1+i)^{1.5} = 250$$

By trial and error or however, i is approximately 18.9% pa.

This is significantly above what was assumed and must account for most of the surplus that has arisen.

If the expected return had been achieved, we would have assets worth an estimated:

$$150 * (1.06)^3 + 3 * (12.0 - \frac{1}{2} * (10+15)) * (1.06)^{1.5} = 177$$

In isolation, this rate of interest has therefore produced a surplus of around 73m over the three years against the assumed rate of 6% pa. The total surplus is 50m so it would appear that excluding this item, there is a deficit of some 23m.

Alternatively, a much simpler approximate calculation might assume that contribution income and benefit outgo cancel each other. This approach gives a return of 18.5% pa.

Of course, assets might not be valued at market value!

For an ongoing valuation, a market value of assets is usually used.

Salary experience

There is insufficient data to make a proper analysis.

Average salaries are a useful indication, but it is the salary history for those members with longer past service that is important.

The average salary has risen from 5,000 to 5,400 – an annual increase of 8%

The overall effect may be a source of surplus or a source of deficit.

For example, if members with larger past service liabilities (e.g. senior managers, older members) have received higher than average salary increases at the expense of the other members, salary experience would be a source of deficit and vice versa.

New entrant experience

Scheme membership has fallen, which suggests few new entrants. This could be a source of surplus or deficit.

For example, it would be a source of deficit if the Projected Unit Method has been used with an implicit assumption of a stable population, since contributions are too low if the average age of the scheme increases.

Withdrawal surplus / deficit

The effect of withdrawal experience depends on the relative values of the benefits paid on withdrawal and the reserves held in the scheme if the employee had remained an active member of the scheme.

The benefits on voluntary withdrawal are typically less than the reserve in the scheme, since the link to salary is lost, so withdrawals are typically a source of valuation surplus.

However, whether or not withdrawal experience is a source of surplus on the valuation basis will depend on the level of withdrawals assumed versus those experienced.

A larger than expected number of withdrawals would produce a surplus on the valuation basis, whilst a lower number than expected would produce a deficit.

Many employees have left this scheme over the period (net fall of 3,000), but these may also have occurred through retirement, death or a one-off redundancy exercise (or does this suggest a bulk transfer to another scheme). The number of pensioners and deferred pensioners has increased by 2,000 over the period.

Without knowing what rate of withdrawal is assumed in the valuation, we cannot say whether this item gave rise to surplus or deficit over the period.

An educated guess based on the significant reduction in active members of the scheme suggests that there may have been more withdrawals than expected, and so this was an item of surplus.

Mortality surplus / deficit

For deaths in service, this item may give rise to:

- a major release of surplus (if the benefits are fully insured)
- a major source of deficit (if benefit is uninsured and exceeds member's reserve)
- or have little impact if:
 - the benefits are partially insured
 - the death benefit is similar to the reserve held, or
 - the actual number of deaths is close to that assumed.

In this case, pensioners account for a very large proportion of total liabilities, and so pensioner mortality experience may be significant for the scheme's finances.

A larger number of such deaths in excess of those expected would give rise to a surplus; lighter mortality than anticipated would produce a deficit.

The numbers of people involved are fairly large. This would be expected to give rise to a fairly stable number of deaths.

Therefore, if the scheme basis is realistic, the item is unlikely to be a significant source of either surplus or deficit.

However, if the scheme basis is cautious (e.g. mortality too low for pensioners) then the item could be a significant source of surplus.

Retirement experience

Normal retirements should not usually give rise to a surplus or a deficit on the valuation basis because they are expected to occur.

Early retirements can have a significant impact on the financial condition of the pension scheme.

A surplus may occur on a member's early retirement if the value of the early retirement pension is less than the reserve held for the member (i.e. penal early retirement factors used). Conversely a deficit will occur when early retirement pensions are generous (e.g. when the accrued pension is paid without reduction)

For the scheme as a whole, a surplus on early retirements could arise in one of two ways:

- if individual retirements were on generous terms and fewer were experienced than were expected, or
- if the terms were penal and more were experienced than were expected.

Pensions payable to members retiring on grounds of ill health are often more generous than on voluntary early retirement, so each case of ill-health retirement may be a source of deficit.

However, the effect on the scheme as a whole will depend on the number of ill-health retirements expected. If there are fewer than assumed, this may be a source of surplus

There appears to have been a large number of retirements from this scheme, so this may have had a large impact (depending on the terms for early and ill-health retirement).

Pension increases

Increases to pensions in payment that are not provided for in the valuation basis will have a significant impact – particularly in view of the fact that the pensioner liability probably accounts for over 50% of the total liability.

Have there been any discretionary increases to pensions in payment? If these were not allowed for in the previous valuation, the item could be significant

For example, if 2m of the 5m increase in pensions was unexpected, this could account for a deficit of approximately 30m (assuming an average annuity for pensioners of 15).

Contributions paid

We do not know what contributions have been paid into the scheme. If these were less than the value of liabilities accruing, this could be a significant item of deficit.

Benefit changes

Benefit changes which are for future service only will have no effect on the past service liability, or the financial position as shown in the question.

Changes which affect past service benefits may have a large impact on the financial position of the fund (e.g. promising more generous pension increases).

Changes in valuation assumptions

A change in the valuation assumptions since the previous valuation could have had a major impact on the scheme.

For example, the gap between i and pension increases will have a major impact on all liabilities, whilst a changes in the gap between i and salary growth would have affected the active liability greatly. Other changes would also have an effect

Change in valuation method

A change from, for example, the Entry Age Method to the Projected Unit Method can substantially alter the level of the actuarial liability. However, the words “past service liability” normally refer to a Projected Unit Method or Attained Age Method actuarial liability, so this item is unlikely to be relevant here.

Conclusion

Looking at the market value of assets, the most important item of those listed above was almost certainly the favourable investment return relative to salary growth.

Further information is required to be more definite on the individual impact of the other items, which probably collectively reduced the surplus.

[17 Marks]

Solution 7 :

(i)

Advantages of presenting results using a range of assumptions and for alternative economic scenarios

In any valuation there will be uncertainty about the appropriateness of the assumptions used for the valuation process.

A best estimate basis will not always be most appropriate for a valuation, for example the results on a more prudent basis may also be investigated to try to improve security.

By running the results on different assumptions it is possible to better understand how the results would differ if the assumptions were not borne out but the experience of the scheme followed alternative assumptions.

In this way the actuary can better understand the risks associated with recommending a given course of action (e.g. contribution recommendation, changes in investment policy) and explain this to the client. Furthermore the client is also better able to exercise judgement.

Sensitivity testing (i.e. changing individual assumptions) can highlight which assumptions have the biggest financial impact on the scheme, and the likely range of results. It can also indicate which assumptions are the most important.

Sensitivity testing will be particularly important if a deterministic approach is adopted where the assumptions have fixed values.

Changing the economic scenarios (scenario testing) is useful to highlight the impact on the scheme of many assumptions changing at the same time, as is likely to happen in practice. It is possible to investigate "worst case scenarios", for example the impact on the scheme of the domestic economy falling into recession can be understood.

The scenario will be made as realistic as possible, so changes will also be factored into the demographic assumptions where appropriate. For example, in a recession it might be expected that voluntary withdrawals would fall but redundancies would increase. If probabilities are attached to each scenario the actuary and client can further understand how much risk is being taken with the current strategy.

Scenario testing can be carried out whether a deterministic or stochastic approach is adopted. For example, under a stochastic approach the use of different distributions will be examined.

The results of the analyses can be used to help the actuary better understand the financial significance of the assumptions and risks involved in a given strategy and impact on the position of the scheme. This in turn leads to the actuary better advising the client.

The analyses will also be carried out for different valuations (e.g. solvency, funding, statutory tests) so as to show how they are affected in different ways.

Such testing can help the client decide on future benefit design and affordability.

Such calculations may be necessary to value any guarantees offered by the scheme.

Calculations on a variety of bases are important in valuations for the purpose of mergers or acquisitions and/or negotiations with employees or their representatives.

(ii)

Main sections in a funding valuation report

Background information

- Who the report is addressed to and the scope of the report
- The date of this and the previous valuation
- The name and details of the actuary preparing the report

Compliance

- That the report has been prepared in accordance with any applicable Guidance Notes and regulation and copies of statutory certificates if necessary

Summary of benefits

- A statement of benefits, including allowance made for additional discretionary benefits
- Whether any benefits have been excluded, for example additional voluntary contributions and their attaching assets
- Insurance arrangements in place

Summary data

- A summary of the membership data
- A summary of the assets held

Inter-valuation period

- Contributions paid over the inter-valuation period
- Material developments during the inter-valuation period including deviations in experience from assumptions at the previous valuation

Funding calculation

- A statement of funding objectives
- Summary of financial and demographic assumptions, with key assumptions highlighted
- Funding method
- Confirmation of consistency of approach used to value assets and liabilities

Results of the valuation on given approach (ongoing, solvency etc.)

- Funding level

- Recommended future contribution rate
- Reconciliation of the results with the previous valuation

Further action

- Agreed client actions, e.g. contributions to be paid, benefit changes
- Agreed actions by actuary including when the next review will occur

(iii)

The issues for the trustees

Security of the scheme – the ability of the scheme to provide benefits. The impact on the security of the scheme for the remaining members of this, or will members receive reduced transfer values? Are more funds available if there is a deficit?

Use of the funds – how will members use the funds? Will the funds be squandered, or will there be any restrictions on the use of the funds?

Fairness – will this option result in all categories of members being treated equitably. Are there any winners or losers against other possible options?

Scheme design – what allowance is made for complex and discretionary benefits under this option and the other options? Are material individual characteristics taken into account in some options? What is their worth?

Investment policy – assets will need to be realised and this could result in uncertainty where there are volatile assets and potentially high dealing costs. Is it a good time to realise assets in the market?

Risk – DB risks will be removed from the scheme and the risks will be transferred to the beneficiaries for those who take up this option.

Advice – is there a need to provide advice to members as to whether to take this option and, if they do, subsequently what to do with the funds?

Legislation, administration and communication considerations.

(iv)

Setting the terms

Regulation

- Regulation may dictate the approaches permitted on discontinuance.
- If this approach is permitted then there may be legislation that will affect the terms. For example, anti-discrimination legislation may mean that unisex factors must be used or the basis may be prescribed to some degree. In addition, there may be minimum and maximum amounts that can be paid.

Security

- The terms should be set so that the exercise of this option should not jeopardise the financial security of the scheme.
- Terms could be set using the ongoing funding basis so that the exercise of this option would have no effect on the ongoing funding level. Alternatively, a best estimate basis could be used so as to be cost neutral in terms of the actual cost of benefits.

Funding position

- The funding position of the scheme should be considered, if it is underfunded and the employer is not in a position to make up the shortfall then the funds to be transferred to the beneficiaries will be reduced.
- If the scheme is in surplus, then ownership of the surplus will need to be considered and, in particular, whether the funds to be transferred will be augmented.

Selection

- The terms for this option should be set to minimise any risk of selection, e.g. those in poor health could be more likely to take the fund if the terms do not reflect their health status.

Sponsor's view

- The sponsor's view needs to be considered. For example, the sponsor may wish to encourage members to take this option so that the DB risk is removed and therefore the terms could be set to be generous.

Fairness

- The terms should be set to provide value for money in respect of the DB benefits being given up. The terms should also be fair to members who take, and who do not take, this option. This suggests cost-neutral terms.
- Equity should be considered against the terms offered on any alternative options.

Market conditions

- The terms are likely to reflect current market conditions as liabilities are being extinguished and this is a short-term valuation. Thus the current investment policy will need to be considered.

Simplicity

- The terms should be simple so that the option is simple to administer and communicate. This may lead to terms which do not reflect individual circumstances, this could increase the risk of selection.

Expenses

- The trustees need to agree who will meet the expenses of offering this option, and therefore whether the terms need to include an expense allowance.

Take up rate

- If it likely that most members will take up this option, then selection is less of a risk. In addition, if assets need to be sold, the terms may need to reflect the cost of a quick bulk sale of assets.

- If few members are likely to take up this option then individual terms (to reflect the selection risk) or broad brush terms (to minimise the marginal expenses of the exercise) may be used.

Use of funds

- The terms may reflect how the funds would be used. For example, if members are required to purchase a deferred or immediate annuity with an insurance company then the terms may reflect the terms upon which such contracts are available.

Options

- The trustees need to consider how to allow for options that are not cost-neutral, e.g. commutation factors. Should it be assumed that all/none take-up the options or allow for a proportion?

[21 Marks]

Solution 8 :

(i) The lack of private provision may be due to:

- concerns about the security and risks of such provision
- a lack of knowledge about the importance of making provision
- a lack of provision leading to a lack of competition in the market and high costs, further reducing private provision
- apathy and the belief that the State will provide sufficient benefits
- low wages, so no spare money to make savings
- a lack of tax and other incentives (relative to other savings vehicles)
- a lack of incentives for employers or other providers to offer schemes
- lack of paternalism by employers, e.g. if the workforce is highly mobile
- over-regulation of occupational schemes, making employers less inclined to offer them, due to the time and costs associated with compliance
- over-regulation of private providers, e.g. on selling, solvency margins etc.
- high charges (for personal pensions or occupational schemes).

(ii) The tax concessions could apply to:

- employer contributions – deducted from profits before deduction of any corporation tax
- employer contributions – individual not taxed on them, *i.e.* not classed as taxable benefit in kind
- employee contributions – deductible for tax purposes
- alternatively all contributions could be subject to a lower level of tax than otherwise (*e.g.* than earned income or profits)
- investment income (*e.g.* dividends, rental income, coupons) to receive beneficial tax treatment
- investment growth (realised and unrealised gains) to receive beneficial tax treatment
- pension to receive beneficial tax treatment, *e.g.* not taxed as income
- cash lump sum to receive beneficial tax treatment, *e.g.* not taxed as income
- death benefits to receive beneficial tax treatment, *e.g.* not taxed as income
- benefits (pension and/or lump sum) subject to a lower level of tax than otherwise (*e.g.* earned income).

(iii)

Advantages of the proposal

- if combined with reducing State benefits it can control State costs
- option allows proposal to be politically acceptable than if the arrangement is compulsory
- easily copes with contribution holidays, career breaks, change of employment
- requiring employer contributions should help ensure a non-trivial amount of money is saved, leading to meaningful benefits
- State regulated and therefore in a developed country expected to be secure
- a funded arrangement so may have positive impact on investment markets,
- creates demand for investments, more secure
- offering investment choice enables individuals to tailor investments to their risk appetite and circumstances
- money purchase in nature and therefore transparent and easy to understand
- money purchase, this may allow flexibility over the form and timing of the benefit
- there should be benefits from economies of scale, i.e. lower administration and commission costs

Disadvantages of the proposal

- does not cover long-term unemployed, long-term carers, sickness
- not compulsory, and so does not ensure employed individuals have private provision
- may have a negative impact on existing private provision, e.g. will existing final salary schemes be more likely to close?
- does not guarantee the pension since money purchase in nature and the investment risk and longevity risk falls on the individual ...
 - ... e.g. there is a risk of poor investment returns over the period to retirement or a fall in value at retirement
 - ... e.g. there is a risk of the conversion terms at retirement being worse than expected due to longevity improvements
- individuals may feel they do not have sufficient knowledge to make investment choice, or may just make inappropriate choices ...
 - ... leading to the need for a default option or individuals paying for investment advice
- contributions made may not be sufficient to provide an adequate pension
- may be unpopular with employees as required to contribute and reduces cash in hand
- if the State offers tax incentives as encouragement then there is an associated cost
- a significant change to the system with associated costs, e.g. education will be required and a new administration system
- additional regulation will be needed
- there may not be a large enough market to support the buyout of benefits at retirement

[17 Marks]
