

# **Institute of Actuaries of India**

## **Subject ST4 – Pensions and Other Employee Benefits**

### **September 2018 Examination**

## **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.

**Solution 1:**

i)

a) **Employer Perspective**

Advantages:

- Greater cost certainty on a go forward basis
- Removes the potential volatile DB costs due to fluctuations in interest rates (although volatility still exists for inactive members)
- Removes investment risk from the employer
- Potentially simpler financial disclosure going forward (no active service cost)
- All employees have the same benefit on a go forward basis
- Plan design fits a more mobile workforce
- No possibility of unfunded liability for future service (still would have an accrued liability for inactive members)
- Removes mortality (longevity risk) from employer

Disadvantages:

- Short term accounting implications (settlement, curtailment, enhanced conversion value)
- DC balance for past accruals may be high if in a low interest rate environment
- May not fully eliminate DB entitlement as deferred vested and retired members still have DB benefits
- obligation to ensure employees understand DC plan and DB to DC conversion choices and their implications
- Employees in DC plan tend to retire based on business cycles (i.e., more retire when economy is robust), which may not be ideal timing for employers
- Can no longer use DB plan as a tool to retain employees

b) **Employee Perspective**

Advantages:

- ER may provide an enhanced DC value if past benefits are converted therefore providing the employee with a greater benefit
- Employees have greater flexibility on how their funds are invested
- Employees have more flexibility with benefit options at retirement
- Benefit value may be more equitable for younger employees under a DC plan than under a DB plan, due to the higher value for a year of accrued service for older employees under a DB plan
- Under a DC plan, members receive the full value of their benefit (i.e., their account balance) regardless of whether they terminate prior to retirement, but may not receive the full value of their benefits (i.e., no ancillary benefits) if they terminate prior to retirement under a DB plan .

Disadvantages:

- DC plan may not provide same level of benefit as DB plan going forward
- Employees now assume investment risk
- Potential lower long term rates of return as an individual employee may not be take on as much investment risk as an employer as they are less able to take on risk
- Employees may not have financial knowledge to manage own investments

- If communication is not good from employer, may misinterpret employer plan objectives or make misinformed choices regarding DB to DC conversions
- May not provide enough income at retirement
- Need to plan for uncertainty and volatility of individual vs. group longevity
- Volatile annuity purchase costs at retirement
- Ancillary benefits cannot be provided with DC plans
- DC accounting used for all active employees` service cost (service cost equal to DC contribution)

[10]

## ii)

**a) Inflation risk – the risk that inflation will decrease the value of the benefit**

- Career average benefit (CAB) formula results in the employee bearing all the pre-retirement inflation risk since each annual accrual is not adjusted by inflation. The benefit is then paid as an annuity and does not increase with inflation, which decreases the purchasing power of the retiree.
- The inflation risk on the DC portion is borne entirely by the employees since they are responsible for investing their contributions. If the return on investment does not match or exceed inflation, the value of the benefit is reduced. At retirement, the DC portion of the benefit is transferred to the participant as a lump sum. At that time, the employee must try to earn a return greater than inflation. Further, employees can hedge their risk by investing in inflation adjusted securities.

[3]

**b) Longevity Risk**

- DB portion of benefit is paid as an annuity and the entire risk is borne by the company. The company is obligated to pay the benefit as long as the employee is alive.
- DC portion of the benefit is paid as a lump sum and the entire risk is borne by the employee. Company has no obligation to pay any benefit if assets for an employee run out.

[3]

**c) Investment Risk**

- The company bears the entire investment risk on the DB portion of the benefit; both pre and post retirement. They are required to earn an **investment** return sufficient enough to pay all retiree benefits or **contribute** to make up the shortfall.
- The employee bears the entire investment risk for the DC portion. Once the company makes the contribution required by the plan, the employee is responsible for earning returns, both pre- and post-retirement, sufficient enough to provide income for the duration of their lifetime.

[3]

**iii) Recommend plan design changes that accomplish this goal:****To reduce inflation risk, the company could:**

- Change from a career average formula to final average pay formula. This would reduce the pre-retirement inflation risk since the final benefit would be based on a pay more similar to retirement
- convert on an actuarially equivalent basis, thus making it cost neutral to the company.

- DC benefits would be paid for by the employee making it cost neutral.

**To reduce longevity risk, the company could:**

- Offer annuities in the DC plan. They could be offered at an actuarially equivalent basis, making it cost neutral.
- The benefits would vary by investment return at no cost to the company.

**To reduce investment risk, the company could:**

- Offer a guaranteed investment option that provides a minimum guaranteed return and is paid for by limiting the upside return. For example, the option could guarantee 3% return and limit the highest return to 10% (or whatever threshold is determined to make the option cost neutral).

[3]

[22 Marks]

**Solution 2:** The current system is open to abuse by employers and is unfair to scheme members who do not remain with their employers until the day before they retire. Companies can keep costs low by making employees leave service before retirement age.

Individuals in this position could find it impossible to build up an adequate pension between the date of leaving service and retirement.

The government should specify a **vested** period i.e. number of years' service after which a benefit must be vested in the scheme.

The period should not be too short or the scheme would have to provide many small benefits which would result in very high admin costs for relatively little benefit.

The period should not be too long or the current abuses / inequities could continue. Need to also consider what benefits, if any, are paid before the end of vesting period.

The fairest way to calculate the vested benefit would be to assume that the normal retirement benefit accrues uniformly over scheme service if there is inflation then the benefit would lose value over time to offset this there should be some form of revaluation required

The revaluation would best be linked to the increase in consumer price inflation or earnings. So as not to impose too great a cost on schemes, it would be possible to place an upper limit on the rate of revaluation.

But if this is done and inflation is higher, the value of benefits could be seriously eroded.

The same terms and conditions for benefits should be available to leavers as are available to stayers e.g. commutation, spouses benefits (as a right or in exchange for pension), pension increases

Beware of effect on costs and implications for employers introducing protection for leavers may reduce security for other members

May reduce reliance on means tested benefits – benefitting state.

[6 Marks]

**Solution 3:**

**i) Describe anti-selection and how it may affect the cost implications of company's decision:** Anti-selection occurs when people elect their option based on their own individual understanding of their risk. For this benefit election, people who anticipate their health costs will be lower than Rs. 10,00,000 (including their 10% contributions) will elect option 1, and sicker people who anticipate their health costs will be higher than Rs. 10,00,000 will election option 2. While options 1 and 2 may be cost neutral to company's based on the average participant, since all participants will elect what is best for them, the total cost to company will likely be higher than it currently is. [2]

**ii) Describe the risks of these two options from the perspectives of both NOC and the retirees:**

Option 1 Risks for company:

- Liquidity risk: company must have enough liquid assets to be able to pay out Rs. 10,00,000
- Accounting risk: large numbers of lump sum payments could trigger settlement accounting

Option 1 Risks for Retirees:

- Longevity risk: Retirees run risk of outliving their resources and then not being able to afford medical care
- Investment risk: retirees in charge of investing lump sum to make it last

Option 2 Risks for company:

- Longevity risk: benefits still guaranteed for the lifetime of the participants who elect coverage
- Inflation risk: Healthcare costs assumed to increase over time, probably at higher rate than general inflation and NOC will have to continue to pay for coverage

Option 2 Risks for Retirees:

- Inflation risk: retirees still have to pay 10% of medical benefits, and due to inflation, these costs will likely continually go up, possibly more than regular inflation
- Plan sponsor risk: If company goes bankrupt or changes the plan to increase cost sharing participants may have gotten more benefit by taking option 1. [8]

[10 Marks]

**Solution 4:**

**i) Segregated fund advantages:**

- Full control over choice of mix of assets between various sectors
- And choice of individual assets within each sector
- Full benefit of good investment performance
- Cost of managing own pool of assets is cost effective for large schemes
- Can arrange asset / liability modelling

Segregated fund disadvantages:

- Costs of managing own pool of assets may not be cost effective for small schemes
- No investment guarantees
- Provision of services, e.g. admin, actuarial, documentation needs to be arranged separately

Insurance company managed fund advantages:

- Direct exposure to investment markets without the necessity to invest in individual stocks
- Gain benefits of diversification
- Explicit scale of investment expenses
- As part of package, may be able to arrange for the insurance company to provide various services, e.g. admin, actuarial, documentation
- Can arrange certain level of asset /liability modelling, e.g. fixed interest fund to back pensions in payment

Insurance company managed fund disadvantages:

- No investment guarantees
- Income reinvested, so not available for cashflow without disinvestment of assets
- Investment expenses may be higher than for a private fund, especially for a large fund
- Insurance company may not provide full range of support services, so some of these may need to be provided separately
- Fixed interest fund may have wrong average term to match annuity profile

With profit contract advantages:

- Smoothed investment returns
- Provision of certain investment guarantees
- Possible provision of guaranteed annuity options
- Generally offer integral package of services e.g. admin, actuarial, documentation

With profit contract disadvantages:

- Depending on bonus structure, may not gain immediate benefit of market rises In falling markets, may be subject to market adjustments on monies disinvested
- Surrender penalties, e.g. if block of money moved to alternative investment medium
- Income / dividends from underlying assets reinvested, so not available for cashflow
- Charges implicit and may be disproportionately high, especially for a large fund

[8]

ii) Assets available if contributions to with profit contract cease

Factors affecting future bonus rates

- Surrender value available
- Enhancements available if assets switched to in house managed fund

- Compare discounted value of with profit assets, allowing for expected future bonus rates, with the alternative surrender value offered Guarantees available under with profit contract Impact on cost of services e.g. admin, actuarial, documentation [4]

[12 Marks]

**Solution 5:****i) *Pros and cons of a defined contribution scheme – employer’s viewpoint***

- A major advantage is that the cost is known, as a percentage of earnings, since there is no investment or general experience risk. However, the employer will not gain from good investment performance.
- Expense risk may or may not lie with the employer, depending upon whether the employer meets the expenses separately or expenses are taken from the members’ accounts.
- The associated expenses involved in running the scheme can be less for a small defined contribution scheme than for a small defined benefit scheme, since compliance costs tend to be higher for the latter.
- However for a large defined contribution scheme there are significant administration costs of running very many individual member accounts and therefore these schemes can have higher expenses than large defined benefit schemes.
- An employer may end up with unhappy employees if the pensions are relatively poor due to adverse experience, *e.g.* poor investment return or annuity rates at retirement. This may lead to pressure on the employer to improve benefits.
- Many employees will prefer the perceived predictability of defined benefit schemes.
- Therefore a defined contribution scheme may not fulfil its prime task, *i.e.* attracting and retaining staff, particularly more senior staff.
- A defined contribution scheme may prove more popular than a defined benefit scheme if the majority of employees fall into the categories that tend to fare better under a defined contribution arrangement, *e.g.* young, highly mobile.

[5]

**ii)**

- If the scheme was non-contributory, then compared with a contributory scheme the cost to the sponsor would be higher
- ... or the benefits would be less generous, if the cost to the sponsor were unchanged.
- However, this is not completely clear cut as the pension contributions may be part of the overall cost to company (CTC).
- Employee contributions should not be:
  - too low – otherwise collection, with the associated costs of administration, would not be worthwhile
  - too high – unless the package of benefits is exceptionally generous.
- A key factor will be the level of member contributions required by schemes operated by competitors.
- In particular, comparison should be made with those in the same industry or similar category of employees
- The employer’s intentions and aims for the scheme are extremely important.

- Virtually all members will opt to join a non-contributory scheme. Is universal coverage important, *i.e.* is the sponsor paternalistic?
- Alternatively the sponsor may wish to promote the concept of sharing responsibilities with the employees, *i.e.* self-empowerment and independence rather than reliance on the sponsor.
- A non-contributory scheme will be simpler to administer.
- DC arrangements are more likely to be contributory, since the member's fund is demonstrably the member's own property.
- The decision may depend on the availability and scope of tax benefits on contributions from either the sponsor or the members. [10]

**iii) *Factors to consider before making a recommendation***

- What the employer can afford is a very important consideration.
- The schemes of competitors should be taken into account, which should include competitors in the same industry.
- In theory the first step is to decide on the target benefits, *i.e.* the benefits you would hope to provide for an employee after an agreed period of service.
- The main considerations here are:
  - the effective target accrual rate
  - the definition of pensionable salary
  - the level of pension increases, if any
  - the amount of spouse's / dependant's pension
  - the level of lump sum death benefits
- May wish to consider an overall target net replacement ratio, say 50% of final salary.
- This may take into consideration other retirement benefits and integration with other statutory benefits.
- The employer may decide to provide protection benefits separately, *e.g.* a lump sum on death in service plus a spouse's pension of, say, 25% of salary or ill-health insurance for salary continuation. This may not be included in the cost of the DC scheme.
- Once the total contribution rate has been determined, the split between the employer and employee needs to be decided.
- The contribution rate required from employees will be influenced by competitors' schemes and by whom the employer wishes to target for scheme membership.
- Employees may not wish to contribute as this reduces their net take-home salary, especially younger employees. So may need to keep this limited.
- Whether to offer choice to employees to contribute? A fixed rate across all ages, or varying with age / service?
- Tax considerations of employer and employee contributions?
- A very important point to remember before making your recommendation is that unless you change the scheme rules in the future, you will not be able to change the contribution rate.
- In particular, it will be unpopular to try to reduce the employer contribution rate in the future.
- Therefore, your assumptions are important and will directly determine how expensive the scheme will prove. [10]

**iv) *Main economic assumptions***



- Your assumptions should be a *best estimate*, unless the employer has specifically stipulated that it wants you to err on the cautious side to reduce the probability of pensions at retirement being less than members expect.
- If you use prudent assumptions (and best estimate is borne out in practice), you will “force” the employer to ultimately provide much more generous, and hence costly benefits on average than were intended (since this is a defined contribution scheme).
- The gaps between assumptions are more critical than absolute values.
- The most important assumptions are:
  - *interest rate (i) – salary growth (e)*
  - *Annuity rates*
- Derive  $i - e$  from the historical relationships  $i - inflation$ , and  $e - inflation$ .
- The value for  $i - inflation$  will depend on the mix of assets you expect to hold, noting members may be offered investment choice.
- The value for  $e - inflation$  depends on how you expect productivity to improve in the future.
- For  $i - e$ , past experience will give some indication of the future, but economic outlook and judgement will be required.
- For annuity rates, considerations should be given to mortality improvements and insurance companies’ expense inflation.

[5]

**[30 Marks]****Solution 6:****i) Advantages**

- Administration saving (assuming paid direct to member by insurer) – no need to operate a pensioner payroll or deal with tax implications.
- Buy-out terms may be relatively cheap at retirement as there may be a competitive market.
- No investment, mortality or (if paid direct to member) expense risk remains within the scheme.
- Operating a scheme that is heavily weighted by pensioner liabilities can cause difficulties – the sponsor’s contribution rate can become volatile if the payroll decreases in relative size to total liabilities. It may be easier to buy-out the pensioner liabilities and run a much smaller scheme.

**Disadvantages**

- Not as easy to keep in contact with pensioners – no automatic communication channel.
- Awarding discretionary pension increases is problematic – either additional pension paid each year from the scheme or the scheme has to buy out another tranche of pension.
- The scheme loses any investment or mortality profit.
- Buy-out terms may be expensive at certain points in time.
- Buy-out costs include expense costs and a contribution towards the insurer’s profit.
- It can be difficult to buyout benefits if they have unusual features.
- Can be difficult to plan funding of the scheme as annuity costs can be volatile.
- May present the scheme with cash flow problems as 100% of the cost of the pension must be found at retirement.
- Investment constraints due to the need to realise assets as a retirement approaches.

[5]

ii) **Mortality analysis**

- Collect all relevant data at a specific date, *e.g.* previous valuation date.
- Split the data into homogeneous groups (as far as possible), *e.g.* by age, sex, member/beneficiaries, mode of retirement. The extent to which this can be carried out will be limited by the volume of data available.
- Calculate the exposed to risk, and derive rates of mortality experienced using the actual number of deaths.
- The credibility of the results depends on the volume of data used for the analysis. This may be insufficient for reliable results, especially for smaller schemes.
- If there is insufficient credible data then the alternative approach is to:
  - group the data by age and sex (and any other splits that does not produce statistically unreliable data)
  - calculate the expected number of deaths from a standard mortality table at each age
  - compare with the actual number of deaths experienced.
- This may be more appropriate for smaller schemes to work out any adjustment to the standard table.

[5]

[10 Marks]

**Solution 7:**

i) *Main features of the formal valuation for the company accounts*

- The purpose is to provide audited information to the outside world, for example to enable stakeholders to have a realistic understanding of the company's defined benefit and long term obligations.
- The approach (method and elements of basis) to valuing assets and liabilities (and dealing with surplus/deficit, benefit improvements *etc.*) is likely to be prescribed, at least to some degree. In addition, disclosure requirements are likely to be prescribed.
- Assets are likely to be valued at market value or fair value.
- Liabilities should ideally be valued using a market-related approach to ensure consistency with the asset valuation.
- The overall basis used is likely to be close to best estimate.
- Accounts will be based on the accruals concept – this suggests the Projected Unit method may be appropriate.

*Differences between the accounts valuation and the funding valuation*

- The purpose of the funding valuation is to provide information on the future contribution rate and the funding level. It can also help determine the future benefits to be offered by the scheme and its investment strategy.
- The approach taken to the funding valuation will usually be subject to less prescription.
- Under the funding valuation assets may be valued using a market value or discounted value approach – the key requirement is consistency with the approach used to value liabilities.
- A prudent basis is likely to be used for the funding valuation in order to ensure the security of members' benefits.
- Funding methods other than the Projected Unit method can be equally valid for the funding valuation.

[5]

**ii) Discontinuance valuation assumptions vs ongoing valuation assumptions**

- The assumptions for a discontinuance valuation will depend on the approach being adopted for discontinuance.
- For example, if funds are likely to be transferred to a third party:
  - Then a discontinuance valuation is influenced more significantly by the short term, *i.e.* current market conditions.
  - Winding-up expenses need to be included in the discontinuance valuation.
  - May take into account the terms offered by insurance companies.
  
- If the scheme is expected to continue to run as a closed scheme:
  - The assumptions may still differ from those of an ongoing valuation.
  - The ongoing valuation will use long-term assumptions that can take into account the expected return from a portfolio of assets that will probably contain a significant proportion of equities.
  - If the scheme is assumed to continue in a closed state, the valuation of the liabilities will need to reflect the term over which the scheme can continue in this manner.
  
- The approach may be dictated by legislation.
- The benefits may be different on discontinuance again depending upon the approach taken, *e.g.* the link with final salary could be broken.
- There is no future service to value.
- An ongoing valuation may allow for some discretionary increases to benefits (*e.g.* pensions in payment) at a higher level than in a discontinuance valuation.

[5]

**[10 Marks]**

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