

Institute of Actuaries of India

Subject ST4 – Pensions and Other Employee Benefits

March 2018 Examination

INDICATIVE SOLUTION

Solution 1:**i) Option 1: Continue to manage his investments and annual payouts himself.****Advantages**

- He has immediate access to the money
- He can withdraw more if the funds do better than expected
- His heirs will have a death benefit (remaining funds) when he dies
- He can buy an annuity at some point in the future

Disadvantages

- There is lesser initial income (withdraw small amounts in the early years; as the balance grows over time with interest, withdraw larger amounts) than the annuity option which may pay a level amount for life
- He bears the risk of poor investment performance
- He could outlive the account
- He has to manage the money

Option 2: Use all of his personal savings to buy an immediate lifetime annuity.**Advantages**

- He has higher initial income
- He cannot outlive the income
- He has no investment risk
- He has no investment decision to make

Disadvantages

- He loses flexibility over the timing of withdrawals
- He loses the possibility of much greater asset returns
- There is no death benefit (unless specified in the annuity)
- He is locked-in to one insurance company (credit risk)

[4]

ii)**a) Inflation**

The individual can include the following in his / her investment strategy in order to protect from inflation:

- Investment returns from common stocks have increased more rapidly than consumer prices in the long run. But in the short term, stocks don't offer reliable protection against inflation. The historically higher returns from stocks are not guaranteed and may vary greatly during retirement years.
- Inflation-linked Government bonds grow in value and provide more income as the Consumer Price Index goes up. Many experts say that retirees' investments should include some of these securities.
- Inflation-linked annuities adjust payments for inflation up to a specified annual limit. Annuities with a predefined annual increase may also be available. These kinds of annuities cost more than fixed-payment annuities with the same initial level of income

[2]

b) Interest Rate

Lower interest rates tend to reduce retirement income in several ways; the following are investment strategies that can be considered to help with mitigating interest rate risk:

- Income annuities provide retirees with a guaranteed fixed income, despite changes in the interest rate environment, but most do not adjust the income for inflation.
- Investing in long-term bonds or dividend-paying stocks also offers protection against lower interest rates, although the value of these investments will fluctuate. The risk is that rising interest rates will reduce the value of such assets available to meet unexpected needs.

[2]

c) Stock Market

- Stock market investors should diversify widely among investment classes (including bonds and other non-equities) and individual securities, and be prepared to absorb possible losses. Because it may take many years to recover losses, older employees and retirees should be especially careful to limit their stock market exposure.
- A variety of pooled investment funds exist, e.g. mutual funds, exchange-traded funds, hedge funds.
- Hedge funds, which are private investment funds that participate in a range of assets and a variety of investment strategies, may offer some protection, but they can be complex and have high expense charges.
- Stock funds offer opportunities to invest in both Indian companies and international stocks.

[2]

[10 Marks]**Solution 2:****i)**

- Longevity Risk - risk that retiree will live longer than expected
- Inflation risk – risk that future inflation may increase individual's cost of living
- Market risk - risk that investment income from assets is lower than expected
- Health risk – risk that participant might have higher health expenses during retirement than budgeted for
- Investment risk – risk that participants make poor investment decisions
- Interest rate risk – risk that interest rates are low at the time of retirement causing the cost of annuitizing to be high annuity
- Fraud risk – risk that participant may obtain misguided advice

[4]

ii)

- Introducing automatic enrollment - ensures employees are saving for retirement
- Encourage enrollment, e.g. incentivize participation
- Effective communication campaigns
- Adding automatic escalation of contribution rates with age – helps employees save more than they otherwise might save
- Offer access to online investment advice – helps employees increase their financial knowledge, which in turn helps them make better investment decisions

- Offer investment decisions to be made by the Company - helps prevent employees from making poor investment decisions
- Offer default investment options based on life styling – helps prevent employees from making poor investment decisions
- Possibility of minimum guarantee of interest rate, or at least capital guarantee
- Negotiate better rates with fund managers to ensure higher net returns to members
- Offer choice of different insurance companies at the time of annuity purchase, with various annuity options
- Match x% of employee contributions up to y% of pay – encourages employees to save more to get the company match; also increases the amount being contributed to employees' accounts balances

[4]

[8 Marks]**Solution 3:**

Issues to be discussed:

- Why are you opting for a DC Scheme?
- Past History e.g. design, cost of DB scheme
- Are you considering the proposed scheme as part of your total remuneration package (CTC) or in isolation? Part of Flexible benefits package?
- Comparison with benefits for current employees
- Comparison with package offered by competitors
- NPS or superannuation?
- If superannuation, self-administer or invest with insurance company?
- If insurance company, traditional product or unit linked?
- Any Global pension policy?
- Member expectations
- Employee Profile, likely no. of new hires,
- Average age and likely interest for pension, may impact take-up rate
- Targeted population, e.g. offer to all grades, different contribution rates for different elements of the workforce (call centre staff, execs/junior).
- Range of Income Replacement Ratio targeted, or possibly target DB benefits
- Contribution rate? Any cost constraints?
- Sophistication of payroll system. Can it handle age and service related contribution rates?
- Salary definition on which contributions based (Only Basic salaries?)
- Will members contribute?
- Flat rates or a company matching approach to contributions
- Range of Investment options
- Will members be allowed to choose investment options? Any higher risk options required?
- Member understanding of investment and pension issues. Note not all employees will be investment experts
- Offer default investment option?
- Frequency of review of investment options for members
- Approach to administration/investment/insurance

- Facility of on-line statements and projections for members.
- Death in service benefits
- Incapacity benefits
- Implementation cost and effort
- Initial and ongoing communication

[10 Marks]

Solution 4:

i) Projected Unit Method (PU)

The actuarial liability is the present value of all benefits accrued at the valuation date by reference to projected final earnings.

The value of the assets will eventually equal the actuarial liability assuming the standard contribution rate has been paid and all the assumptions are borne out in practice.

As such all the past service benefits for members will be covered by the assets held.

The standard contribution rate is found by dividing the present value of all benefits accruing in the year following the valuation date by reference to service in that year and projected final earnings by the present value of members earnings in that year.

The standard contribution rate will be stable if the age, sex and salary distribution of the membership remains constant.

This generally implies a continuing flow of new entrants - this scheme is closed.

Attained Age Method (AA)

The actuarial liability is the same as under the projected unit method.

But the actuarial liability is not maintained by the payment of the standard contribution rate.

The standard contribution rate is found by dividing the present value of all benefits which will accrue to members after the valuation date, by reference to service after the valuation date and projected final earnings by the present value of total earnings for all members throughout their expected future membership.

The standard contribution rate is higher than the projected unit method provided the average term to retirement is greater than 1 year.

No account is taken of new entrants.

As a result if the scheme is closed to new entrants the contribution rate paid remains stable if the assumption are borne out in practice.

If the scheme remains open to new entrants the method overstates the contribution rate required because new entrants tend to enter at a younger age than the average age of the existing membership.

Hence surplus should result which can be used to reduce AA rate.

[4]

ii)

AASCR =

$$[(R-x) * S / A * \{(1+e)/(1+i)\}^{(R-x)} * aR] / S * a_{R-x}$$

PUSCR =

$$[1 * S / A * \{(1+e)/(1+i)\}^{(R-x)} * aR] / S * a_1$$

Where

x = age at date of valuation

R = Assumed retirement age

A = rate of pension accrual

S = current salary/pensionable salary

e = annual salary inflation

i = valuation rate of interest or discount rate (pre-retirement)

aR = annuity at age NRA (allowing for pension increases and contingent spouse's benefits)

a_{R-x} = annuity to determine present value of future earnings (allowing for timing of contributions and salary increases)

[4]

iii) Characteristics of each approach:

Capital injection i.e. lump sum payment.

- Clears deficit quickly if paid at beginning
- Thus increases member security
- Less secure if paid at end of period
- Cash flow lumpy
- Could have tax relief implications.

% of salary over a specified fixed term or the remaining lifetime of the active membership.

- Payments are stable in real terms if membership profile constant.
- Potential problems if membership reduces unexpectedly.

Payments of specified monetary amounts over a given term which may increase in line with a specified index (e.g. CPI).

- More appropriate if membership is declining
- Not linked to an unknown salary inflation assumption

[4]

[12 Marks]

Solution 5:

i) Assume that the employee opting for the 1/45th accrual is an average employee, ie has the average age of the scheme.

Assume the contribution rate is a realistic long-term estimate of the ongoing cost of funding the pension with no allowance for meeting any past service surplus or deficit.

Assume the contribution rate relates to pension benefits only at (*i.e.* no additional lump sum benefits) so that we can adjust contribution rates by taking a ratio of accrual rates.

Expected cost of funding 1/45th pension = $25\% * (1/45) / (1/60) = 33.33\%$

Additional annual cost to employee = $33.33\% - 25\% = 8.33\%$ of Basic salary = $100,000 * 12 * 50\% * 8.33\% = \text{INR } 49,980$

The employee can fund this additional cost by giving up part of his / her leave entitlement.

Assuming one day leave entitlement costs the same as one day of work and assuming a total calendar days of 365 days in a year

Giving up one day of leave entitlement is worth: $100,000 * 1 / 365 = \text{INR } 3,288$

Therefore the employee could retain 100% of salary but give up:

$49,980 / 3,288 \approx 15$ days of leave entitlement to fund the extra accrual.

[4]

ii) Problems of “flex” schemes

Pricing

The calculation used several simplifying assumptions.

An employee of average age was assumed. In fact the contribution rate would be lower for a younger employee and higher for an older one to reflect the cost of benefit accrual increasing with age.

Is it valid to price leave entitlement as we did, *i.e.* annual salary divided by the number of calendar days in the year?

Selection

It can be seen that younger employees are more likely to select the increased leave entitlement and older members increased pension.

The principle of selection is particularly relevant when offering cash alternatives for “risk” benefits, e.g. medical insurance

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? Is “flex” a total choice across all benefits or only within a defined range of benefits?

For example, in part (i) one option was to allow the member to reduce holiday entitlement by around 15 days. Consider:

- Is it sensible, for the employer, to allow annual leave to fall below a certain threshold?
- What will be the effect on the employee’s health if they take little to no holiday?

[6]

[10 Marks]

Solution 6:

i)

a) Salary increases

- Salary increase = Inflation + real wage growth + employer specific adjustments + age component
- The window encourages high level/senior employees to terminate. The remaining employees will be younger/lower salaried and will see more promotion to the vacated senior positions, increasing the salary increase assumption
- A select and ultimate table should be used to reflect the short term nature of the window.
- If the assumption was already graded by age/service, it is possible that no change to the assumption is required.

[2]

b) Retirement rates

- Valuations should in general use a retirement rate table.
- Increase rates at ages where early retirement subsidies are first available.
- Reduce rates immediately before subsidies take effect.
- Use separate rates for those eligible and those not eligible for a subsidy.
- A single age assumption does not reflect the effects of subsidized early retirement.
- A select and ultimate table should be used.
- Rate should increase during the window.
- Rate should be reduced after the window for a short period (i.e. 1 year) after the window.
- Rate may be reduced for a longer period if employees wait for the next window.
- Rate should increase amongst those with 25+ years of service

[2]

c) Termination of employment

- The actuary to consider for termination of employment assumption: :
 - Occupation
 - Employment policies
 - Work Environment
 - Hazardous work conditions
 - Location of employment
- Termination rates should take into account plan provisions such as early retirement benefits.
- Those who will be eligible for the window will have a very low rate of termination prior to the window. After the window, with a shorter average service turnover will likely be higher.

[2]

ii) Risks to Plan sponsor

- Employee that you want to retain leave, and those you want to leave remain
- Liquidity of plan assets is a concern because of the lump sum option
- The full cost of the window is an accounting charge in the current period.
- Employee communications are critical, as morale may be affected by the reasoning for the window
- A culture shift after the window (younger workers, more mobile) may make the DB plan less effective, and a new design should be considered
- The plan would become more underfunded.
- Legal issues such as ratio percentage test, non-discrimination

Risks to employees

- Longevity risk – Outliving assets
- Inadequate replacement ratio – Will need to spend less
- Interest rate/investment risk – The lump sum option is at risk of providing less income than the pension plan would.
- Inflation Risk – The real value of the pension will erode if it is not increased periodically. Future salary increases will not be considered as they would have been if retirement occurred at the normal retirement age.
- Medical coverage – Retirees may face higher costs without coverage as compared to an employee.
- Risk of wrong doing – Retirees are at risk that the sponsor or fund manager inappropriately invests the plan assets.
- Risk of public policy changes – new taxes, means testing of government benefits

[6]

[12 Marks]

Solution 7:**i) Response to Finance Controller**

- Salary increase assumption is a long-term item set consistently with other items...
- ... what was the inflation assumption in valuation?
- If actual inflation more than expected then loss would occur in absolute terms (but may better have been allocated to the “inflation” item in AoS)
- Note impact was small / these assumptions are not generally the most important ones.
- What measure of inflation is Finance Controller using? Is it same as valuation assumptions?
- Is there a timing difference? ...actual salary increases often based on inflation from previous year.
- Promotional increases?
- Basic salary may have increased in line with inflation
- ... whilst pensionable salary may include overtime, bonus etc.
- How did Finance Controller calculate average salary increase?
- ... Possibly just increase in total payroll over period
- ... Could include employees who aren't members of scheme
- Members of scheme with larger liabilities could have had higher salary increases
Meaning average salary increase weighted by liability would be higher than inflation
- Note the parallel to the effect of one significant pensioner on surplus
- Significant change in active membership over valuation period could have affected analysis
- e.g. large salary increases in first year, then a reduction in membership followed by smaller increases

[6]

ii) The due diligence XYZ Company should complete prior to entering into a buy-in annuity contract.

- Authority to Invest – The Plan document and investment policy statement must allow for the investment
- Pricing and Transaction Costs – conduct appropriate due diligence when negotiating the pricing of buy-in.
- Solicit bids from several insurers through RFP process.
- Counterparty Risk and Coverage – Consider the overall financial health of the insurer, which may involve assessing factors such as the insurer's corporate governance practices, credit ratings and any applicable regulatory requirements including capital or solvency requirements.

- Determine the extent of coverage available to the plan in respect of the buy-in annuity in the event that the insurer becomes insolvent
- Consider whether it is reasonable and appropriate in the circumstances to diversify the investment by entering into separate buy-in annuity contracts with multiple insurers.
- Contract Terms – Ensure that the terms of any buy-in annuity contract are clear and permit the administrator in all circumstances to administer benefits in accordance with the plan terms and fully comply with all applicable statutory requirements, as they may change from time to time.
- Plan Wind Up – Confirm that the buy-in can be converted to a buy-out at any time. And Confirm that the contract can be terminated at the time of plan wind up
- May need to select a safer insurer carrier at the time of plan wind up

[6]

iii) **Compare and contrast the two strategies in relation to XYZ Company's objective.**

Compare

- Default Risk – Default risk is held by the plan sponsor
- Interest Rate Reduction – Both are intended to reduce interest rate risk
- Balance Sheet – Assets are still held on balance sheet.
- Benefit Payment Matching – Both are intended to cover current and future benefit payments.

Contrast

- Longevity – Buy-in contracts eliminate longevity risk. Duration matched fixed income does not address longevity risk.
- Counterparty Risk – Counterparty risk is spread across more parties in a duration-matched fixed income portfolio.
- Monitoring/Rebalancing - Do not have to continually monitor investments and liabilities/constant rebalancing.
- Cost – There is an additional cost/margin to purchase buy-in annuities.
- Contract/Flexibility risk – There is no contract in a fixed income portfolio and it is easier/less costly to unwind.
- Capacity Limits – No limit on the number of annuity buy-ins versus only so many long-duration bonds issued.
- Experience - The insurance industry has a long history of managing assets on the basis of matching liabilities and is therefore well-equipped to manage pension risk
- Reinvestment – Annuity buy-ins are not subject to reinvestment rates.
- Assumptions – Duration-matched fixed income is subject to assumption changes that predict future cash flows.

[4]

[16 Marks]

Solution 8:

i)

- Compensation philosophy
- Income protection philosophy
- Tax benefits for compensation versus deferred compensation
- Level of cost sharing
- Executive arrangements are possible with DC
- Attraction / retention / performance management
- Competitive standards
- Costs – can be changed in light of bad business performance in profit sharing plan
- Administration costs in DC, none in comp
- Should employees bear interest / inflation risk?
- Offer annuity purchases in DC
- Paternalism / social obligations
- Increased legal / fiduciary responsibility
- Cash compensation over DC: Younger employees prefer cash, don't value pensions,
- DC over cash compensation: Protect employees, can use vesting as retention mechanism, forced / disciplined savings

[4]

ii) **The risks that employees will face at retirement:**

- Longevity (outliving savings): Offer annuities, educate about needs and adjust spending, stagger annuity purchases
- Death of spouse: Estate planning,
- Inflation: Equity exposure, indexed annuities
- Interest rate risk: Invest in bonds or mortgages closer to retirement, company can negotiate with potential carriers
- Stock market risk: Diversify, buy principal-protected investments
- Business risk: Avoid concentration of retirement money in stock
- Employment risk: Part-time employment in retirement, can't depend on bridge job
- Public policy risk: Tax-free investments
- Unexpected health care needs / costs: Consider supplemental coverage beyond DC plan
- Change in housing needs: Consider long-term care insurance outside DC plan
- Loss of ability to live independently: Get long-term care insurance outside DC plan
- Change in marital status: DC account can be split
- Lack of appropriate consumer info for decision-making: Company can offer appropriate education
- Income adequacy: Additional savings may be required

[4]

iii) Use of Actuarial Control Cycle

- Need to consider the commercial and economic environment
- And apply any professional guidance/requirements

Specify the problem

- First step of Actuarial Control Cycle is to analyse what the risks are
- ... and quantify the financial consequence of the risk events occurring
- Main risk to company is higher costs than expected
- ... failure to anticipate predictable increase in long term costs as LTIP matures
- ... unexpected increases due to changes in employee turnover
- ... periods of high inflation combined with pressure to continue past policy of increasing awards
- Other risks include timing and volatility of payments
- Including requirement to potentially make payments at commercially unattractive times
- Analysis may conclude that problem is not as significant as Finance Controller considers
- But if the risks are not felt to be acceptable then ..

Develop the solution

- Consider reduction of benefits
- Consider and quantify appropriate methods of managing risks
- Consider actuarial models to project the contributions to and outgo of the scheme
- Make appropriate assumptions i.e.
- ... how many employees qualify for benefits each year?
- ... how much benefit (allowing for inflation)?
- Interpret results and consider implications
- Determine solutions and consider alternatives
- ... is PAYG appropriate or some form of funding?
- ... if funded need to consider appropriate reserves and contributions
- ... and investment strategy

- Consider sensitivities and scenario testing (stochastic models?)
- And communicate the solution in an understandable way

Monitor experience

- Identify causes of departure from expected outgo
 - i.e. number of employees receiving awards more / less than expected
 - ... and impact of inflation / discretionary increases to awards
 - Particularly if scheme is relatively new so impact on employee behavior is uncertain
 - ... is the structure and level of awards appropriate given objectives of scheme?
 - Feed experience back to the specifying problem / developing solution stage as appropriate
- [6]

iv) Establishing an actuarial value

- Need appropriate employee data
- ... including age/qualifying service/contribution information
- Full details on rules of long-service award scheme
- Any documentation on how/when awards are increased
- ... and any employee communications on either of the above
- Past turnover experience
- Company indications as to expected future changes
- Need to determine an appropriate model to allow for level and incidence of cash flows
- May extend to a stochastic model to assess variability/range of outcomes
- What is an appropriate funding method?
- ... given criteria such as security, stability, realism, flexibility
- Economic and demographic assumptions will be needed
- ... withdrawals, retirements, deaths, new entrants
- ... assumed rate of increase in awards
- ... investment return on invested assets
- Company's objectives are key to determining appropriate strength

- ... prudent if want to minimise risk of unexpected calls on company funds
- ... best estimate if want to minimise costs in short term
- Consider how company wants to pay contributions (e.g. % of monthly salary etc.)
- Treatment of any surpluses that build up may be important in this decision
- ... particularly as employees leaving shortly before completing a service milestone may result in a significant release of reserve
- Need to consider any relevant legislation on funding
- Company may also need to consider any relevant accounting rules

[8]

[22 Marks]
