Actuarial Society of India

Examinations

May 2006

ST4 – Pensions and Other Employee Benefits

Indicative Solution

Sol 1 (a)

Advantages:
- ? No mortality risk for the scheme after purchase (could be a disadvantage if described as lost opportunity).
- ? No investment risk after purchase.
- ? Competition between insurance companies can produce advantageous terms.
- ? No expense risk after purchase.
- ? Insurance company may take over the administration and pay annuities direct to the members.

Disadvantages:
- ? Overall cost may be higher because of insurance company's profit loading.
- ? Contingency margins, expenses and possibly more constrained investment profile (gilts rather than equities).
- ? Arrangements can become complex if discretionary increases granted.
- ? Cash flow and liquidity problems when buying the annuities.
- ? Realisation of assets may be needed in adverse conditions.
- ? May save little or no administration (particularly if discretionary increases are given).
- ? May have to purchase annuities when rates unfavourable.
- ? Investment decision which cannot be reversed.
- ? May be unable to buy an annuity which matches the benefit promise.

(4)

Sol 1 (b)

Advantages
- ? likely real return in the long term
- ? rents generally only go up
- ? generally lower volatility of returns than equities
- ? provides diversification from equities
- ? higher running yield than equities

Disadvantages
- ? lower long term expected returns compared to equities
- ? poor liquidity and marketability
- ? large unit size
- ? unoccupied property means no rental income
- ? dealing costs

The relative advantage/disadvantage of each depends on the following factors:
- ? The absolute size of the fund - the smaller the fund the less likely it will be able to invest directly in property – as the fund becomes smaller could invest via unitised property funds

- ? The balance between active members/deferred pensioners/pensioners – the smaller the proportion of actives, the less likely that property (or equity) investment is to be suitable
- ? The type of benefits provided
    - if deferred benefits and/or pensions in payment increase at a fixed rate then property investment will become less suitable as the proportion of actives reduces.
    - if these benefits are linked to increases in the RPI then property investment will be OK.
- ? The funding level of the scheme - if the scheme has little surplus then property investment is unlikely to be suitable unless it matches the liabilities.

(6)
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Sol 2 (a)
- ? Date of birth
- ? Current fund value
- ? Charging structure of personal pension policy
- ? Current charges – Fixed and/or variable.
- ? Potential charge increases
- ? Conditions applying at retirement - charges on annuity purchase - rates basis.
- ? Current salary
- ? How is the managed fund invested?
- ? What is the current contribution rate?
- ? Does he have any protected rights funds?

(5)

Sol 2 (b)
Investment return before retirement
- ? need to look at short and medium term prospects for the economy (retiring in 10 years)
- ? take account of fund management charges (if % of fund)
- ? any investment preferences e.g. equity versus bond and any advice required.
- ? after discussion, assume a move out of Growth Fund gradually to Balanced Fund and probably 100% in Bond Fund close to retirement

Investment return after retirement
- ? Intends to purchase an annuity at retirement so need to estimate the return to be used by life offices
- ? RPI pension is wanted so real returns used are relevant

Salary growth
- ? discuss with Mr X, taking account of general economic assumptions
- ? general salary growth in the financial services sector

Inflation
- ? need to look at relatively short term prospects for the economy
- ? economic assumptions need to be consistent with each other

Expenses
- ? look at annual charges made by life office and potential increases pre retirement
- ? impact of charges incurred by switching between funds, if any.
- ? consider the charges made by life offices for annuities

Mortality
- ? pre retirement - assume he survives
- ? post retirement - estimate of assumptions used by life offices

Commutation
- ? a % of fund – maximum allowed by regulations.

Tax
- ? any tax incentives on contributions.
- ? tax treatment of retirement benefits.

Other
- ? any possible job changes – move to a different sector with a different salary scale
- ? any plans to move to another pension plan with different investment and charging features.

(10)

Sol 2 (c)

Asset liability modelling:
- ? Objective: Determine the probability of meeting the desired level of benefit given a selected contribution rate.
- ? Stochastic variables:
  - o Investment returns
    - ✍ Equities – For investment return on Growth/Balanced Funds.
    - ✍ Bonds – For investment return on Balanced/Bond Funds and also for annuity rate calculations.
  - o Inflation rate
  - o Salary escalation.
- ? Parameters: The means and variances of the stochastic variables should be consistent with the economic outlook of the country concerned. The correlation between the variables should be modelled explicitly.
- ? Other assumptions: Choice of investment options – Bond/Balanced/Growth Fund. Rest as in 2b.
- ? Produce a large number of simulations, say 10,000, based on a selected contribution rate. Determine how many of these simulations result in the objective being met. Estimate the required probability. Perform this exercise for a number of contribution rate and investment strategies.
- ? Cross-check the results using deterministic projections.
- ? Communicate the results to Mr X in a suitable format depending on the financial sophistication expected.

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Sol 3)

The following points are relevant for inclusion in an answer to the Finance Director.

Target Benefits

- ? If a contribution rate is determined to fund a particular benefit eg normal retirement pension, this may produce an inappropriate rate to fund another benefit, for example an early retirement pension or leaving service benefit.
- ? A decision will be needed on which benefits were the most appropriate to target.
- ? An average rate could be used, but this would quite possibly ensure that no benefits were adequately targeted.
- ? It is likely that whatever contribution structure is taken for retirement/leaving service benefits, alternative arrangements will be needed for death in service and ill health benefits.
- ? These would probably need insurance, which would lead to variation in cost.
- ? The actual benefits will depend on the individual experience of the member.

Assumptions

- ? The actuarial basis used to assess the money purchase contributions needs to be set.
- ? Investment return- If the investment return is not a best estimate, presumably more conservative, the money purchase account will on average accumulate to a greater sum than is needed to provide the defined benefit.
- ? Salaries - The actual salary progression of the individual member is likely to be different from an average assumption; therefore the ultimate benefit will differ.
- ? Pension increases (and other discretionary benefits) - If guaranteed benefits only are valued the member effectively loses the opportunity to receive discretionary benefits. The company could provide an allowance for a discretionary benefit at retirement, but would need to fund it specifically at that time.If discretionary benefits are included they become guaranteed.

Administration

- ? Each member will require an individual calculation at joining.
- ? This will be relatively cumbersome, and will produce a different contribution rate depending on age, profile etc.
- ? Overall costs will therefore be dependent on the make up of the population, and this could still vary over time.

Communication

- ? What benefits do you actually promise to the member?
- ? It will be difficult for members to compare benefits with their peers or with the market.
- ? Investments - The assumptions will need to reflect a particular investment profile.
- ? If individuals are given a choice they may choose investments with a different profile from that assumed
- ? If they choose capital secure investments (eg cash) the likely level of investment return will be somewhat lower than anticipated; also, as the member approaches retirement the account will be vulnerable to changes in the cost of securing pensions with an insurance company.

- ? Lifestyle investments can reduce but not eliminate this uncertainty
- ? Ongoing administration will be more onerous/expensive

[10]

Sol 4)

Employer contributions
- ? allowed as a business expense
- ? not assessed as benefit in kind in the hands of employee

Employee contributions
- ? deductible at the employees' marginal rate of tax, subject to a maximum rate of contribution

Investment returns
- ? free of income and capital gains tax
- ? unless excessive assets have accumulated

Benefits
- ? pensions taxed as earned income
- ? tax-free lump sum (retirement or death)

Investment:
- ? Set rules for investment of approved schemes e.g. no overseas investment, at least 50% investment in government bonds.
- ? Make investment income / gains from certain sources taxable:
- ? Could have a scale of rates e.g. overseas investments taxable at full rate, investments in the country other than bonds taxable but at a low rate.
- ? Have to ensure that there are enough government bonds to support demand.

Higher paid:
- ? Exclude the higher paid from scheme membership altogether.
- ? Only allow pensionable earnings up to a cap or pensions up to a cap.
- ? Only allow employee contributions to be deductible at basic rate of tax (but this might merely encourage non-contributory schemes).
- ? Higher rates of tax for the higher paid on pension investment income (difficult if scheme is a group DB scheme).

Disabled:
- ? Make payments to support disabled dependants a permissible scheme benefit.
- ? Allow special tax privileges (e.g. tax deductibility) for those who pay contributions to a pension plan for a disabled relative.
- ? State pays contributions/matches contributions made for the disabled.

Pension:
- ? Don't allow lump sum benefits from approved schemes, or if they are allowed do not make them tax-free.
- ? Require pension schemes to provide index-linked benefits, so that value does not erode in older age.

[10]

Sol 5a)

Earnings threshold and Earnings ceiling

1) Both benefits and contributions may have either;

  ? A limit below which benefits/contributions are not paid (threshold)

  ? A limit above which benefits/contributions are not paid (ceiling)

2) If the financing of State pension is not to be redistributive or regressive, an important point is that benefits and contributions should have the same threshold and ceilings.

3) The advantage of a threshold is that, regardless of the level of benefits, people who can not afford to can be excluded from contributing. If this threshold also applies to benefits, then these people will also not receive the benefits.

4) Placing an upper limit on benefits and not on contributions will allow the State to redistribute resources, although this would be inappropriate if a correspondence between contributions and benefits is desired. Also it may be viewed as unfair by those required to pay higher contributions for no additional benefits.

5) Conversely it is possible, although unlikely to act progressively and redistribute in favour of the higher paid, if contributions are subject to a ceiling but benefits are not.

(6)

Sol 5b)

Advantages	Disadvantages
1) Contribution rate is more stable and predictable over time,	1) The benefits are not guaranteed, for example poor investment performance could lead to in sufficient pension.
2) Individuals may understand and appreciate the arrangement for its simplicity,	2) Requires that there are sufficient investment instruments are available,
3) Individuals may view the arrangement as more secure since they are not exposed to the State changing the benefit formula (a risk for a DB arrangement},	3) Additional arrangements are needed if extra protection benefits are to be provided,
4) It may afford reduced administration and consequent hustles if outsourced to Private Companies with necessary overseeing by the State.	4) Some of these disadvantages may lead the State to guarantee a minimum level of benefits thus ending up carrying the investment risk to some extent.

(4)

[10]

Sol 6 a): Uses of Population Projection;

1) An estimate of the size of the working population compared with the retired population is needed to assess the level of contributions required for State pension provision under a PAYG system.

2) To estimate the demand for food, power, services (such as transport, healthcare etc.) and products (such as housing).

3) To estimate the need for specific welfare services (such as those for children and elderly).

Factors for Projection;

1) "New entrants" in the form of birth and migrants in to the population (immigrants),

2) Exits by death or outward migration (emigration).

(5)

6 b) Definitions of Fertility Rates and methods of calculation:

1) **Age specific Fertility rates** could be expressed in terms of ratio of numbers of live births to either the number of mails at each age or number of females at each age.

2) However normally the fertility rates are related to female population that generate births and expressed as age-specific rates. A commonly used measure is Total Fertility Rate (TFR) which the sum of age-specific fertility rates over child bearing ages, say 15 – 49 years.

3) TFR can be calculated on "period" basis that is at a given point in time and summed up for all ages at that point in time.

4) TFR can also be calculated on "cohort" basis i.e. age-specific rates for women all born in a specified period of time i. e. cohort and then summed up.

5) **Crude Fertility Rate** is the number of live births per 1000 of females population.

6) **Crude Fertility Rates** could be age related where in the denominator is counted out of numbers within a given age band.

7) **The Crude Fertility rate** calculated on cohort basis and corresponding TFR will then give average number of children expected to be born to a woman during her child bearing years assuming she survives throughout the period.

(7)

[12]

Sol7 a)

The key assumptions are;

1) The age at which benefits become payable,

2) The likelihood of each type of benefit becoming payable,

3) The rate at which benefits will increase,

4) The rate of investment growth of scheme assets.

5) The events that might trigger the benefits payment,

6) Factors affecting the amount and duration of the benefit payments.

(6)

Sol 7 b):

Scenarios under which members' individual circumstances are more relevant;

1) It may be more significant to the results,

2) The scheme is small so that each member is statistically significant,

3) One member represents a large proportion of the total liability, in which case such a member's actual circumstances should be used,

4) Spouses' benefits are large relative to members' benefits,

5) In case the Objective is to investigate the cost of the spouses' benefits i.e to determine the effect of changes in such benefits.

6) The average is different from the population eg Executive scheme

(6)

[12]

Sol 8 a): Generalised Model formula;

The Projected Benefit outgo in a future year, t, is represented in a simple form as $\mathbf{B_{k,t}}$,

representing the benefits paid to the Kth beneficiary in year t and summed over all the beneficiaries say N.

In order to perform this projection, assumptions are required for the probability of the benefit being paid and the amount of the benefit to be paid.

The above generalised formula can be used to allow for more realistic situations such as;

1) Individuals at other ages,

2) Individuals who are not yet eligible to receive pension,

3) Ineligibility other than through death,

4) Increase to the pension once in payment,

5) Pensions that differ between individuals,

6)   Payments more frequent than annual,

7)   Benefits other than single life pensions.

(8)

Sol 8 b): Emerging Cash flow approach;

The emerging cash flow approach takes each future projected payment and applies a discount factor to obtain a present vale. These are then summed to give th total value of the liabilities.

The discounted value of Projected Benefit Outgo in a future year t can be represented by $\mathbf{B}_{\mathbf{k,t}}\mathbf{V}^{\mathbf{t}}$ for $\mathbf{k}^{\mathbf{th}}$ beneficiary and summed up for all the beneficiaries, N over period t.

In order to calculate the above factor the estimate us required for amount of the payment and the probability of that payment being made. Hence in this emerging cash flow approach the summing is done for individual expressions of the form;

Probability of payment-event X discounting factor X amount of payment.

The present value of all benefit outgo is the sum over all individuals for all future years.

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