

Institute of Actuaries of India

Subject ST4 – Pension & Other Employee Benefits

May 2014 Examinations

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 :

From the perspective of plan sponsors

Pros:

- Increase transparency for financial reporting and measurement
- The Employer can focus on operating their core business
- May decrease cost of capital and make it easier for the employer to borrow with fully funded position
- Provide a measure of plan's cost that is more consistent with pension plan costs being used for accounting purposes
- Reduce the influence of actuarial assumption selection process and manipulation of pension plan cost
- No asymmetric surplus risk

Cons:

- This means to value the pension liability based on risk-free rates instead of the expected investment return of the plan's assets; As the risk-free rate is lower than the expected investment return, the pension liabilities and contributions will increase significantly
- Increase volatility on balance sheet and contributions, no smoothening possible
- The requirement of maintaining fully funded status will force financially distressed sponsors to freeze, terminate (wind-up) the DB plan, or to convert DB plans into DC
- The requirement could force financially distressed sponsors into bankruptcy
- The proposed legislation will discourage employers from setting up new DB and this will accelerate the decline in DB plans

From the perspective of members/participants of DB plan

- Members no longer bear creditor risk which they are unable to evaluate or diversify
- Eliminate intergenerational risk transfers
- Increase the security of the promised benefits for plan members
- Plan participants are not exposed to implicit contract risk

From the perspective of shareholders

- Increase transparency of financial reporting and measurement so investors can make better decisions; Reduce agency costs by increasing transparency which allows shareholders to focus on company's operating performance without any pension distortions
- Shareholders will no longer be misled by smoothing which disguises true cost of pension plan
- No longer conceals volatility and risk through pension accounting and anticipated unearned risk premium
- Shareholders' value is increased when the pension plan must maintain fully funded status
- Reduce the company's pension fund risk so the company can take risk in their operating business
- Reduce costs and resources spent on the management of the pension plan

Pension legislators

- Increase the security of the promised benefits for plan members
- Pension legislators should be concerned that plan sponsors will wind-up or convert DB plans into DC; hence, less DB plans available

[10 Marks]

Solution 2 :

i)

a)

Longevity risk

- Option 1 provides protection against longevity risk since the normal form of payment would be an annuity benefit
- Option 2 provides no protection against longevity risk since the benefit is payable as a lump sum.
- Option 2 – members can protect themselves against longevity risk by purchasing an annuity

Inflation risk

- Option 1 provides protection against pre-retirement inflation as it relates to salary since final pay is used to determine benefit amounts.
- An additional note is that contributions are based on pay each year, while the final benefit is determined based on final pay.
- This offsets some of the inflation risk protection since there is a higher chance benefits will need to be cut if salary inflation is high because assets are less likely to be sufficient.
- Option 2 provides less protection against pre-retirement inflation as it relates to salary since contributions are based on pay each year
- Neither option 1 nor option 2 provide protection against inflation after retirement

Investment return risk

- Option 1 provides no protection against investment return risk since employees' benefits may be reduced (before or after retirement) if there are unfavorable asset returns
- Option 2 provides protection against pre-retirement investment return risk since there is a minimum guaranteed interest crediting rate
- Post-retirement risk borne by employee under option 2

[4]

(ii)

Option 1 - Advantages

- The contributions each year are predetermined as a fixed % of pay
- The investment return risk is hedged since benefits may be reduced if assets perform poorly

Option 1 - Disadvantages

- The company retains longevity risk since the benefit payable upon retirement is an annuity benefit, however benefits may be reduced if increasing life expectancy leads to underfunding – this can mitigate this risk
- There are higher administrative costs since employees remain plan participants after termination/retirement (until annuity payments are complete)

Option 2 - Advantages

- The contributions each year are predetermined as a fixed % of pay
- The interest crediting rate is tied to the plan's asset return, so that hedges some of the investment risk
- The company does not retain longevity risk since the benefit is paid as a lump sum upon termination/retirement
- Administrative fees are lower since employees are paid out upon termination/retirement

Option 2 - Disadvantages

- There is higher exposure to downside investment return risk since there is a floor crediting rate
- The company is not rewarded for good plan asset performance since the excess asset returns are passed on to participants.

- The potential long-term savings that DC plans can offer to companies is not available if the plan cannot earn higher asset returns than what is credited to accounts

[5]

[Total Marks-9]

Solution 3 :**Advantages for shareholders**

- May reduce cost of benefit because equities are expected to achieve a higher rate of return than other asset classes
- Shareholders become indirectly large institutional investors (through pension fund), which tends to empower shareholders
- If insurance on pension plans could cover losses, investors become exposed to the potential to earn equity risk premium, while having the risk being covered by an insurance company

Disadvantages for shareholders

- Asymmetric risk: Equity gains can turn into unrecoverable surplus
- Taking into account exposure to default risk with probably no adjustment to compensation for the risk, investment in bonds may be preferable
- Exposure for risk of litigation, if fund underperforms affecting stakeholders
- Shareholders invest in the company, not as a pass-through to other companies.
- Shareholders would prefer risks being taken in the company's core business and not in the pension trust
- Reward for taking equity risk may be passed to participants through larger benefits.

Advantages for participants

- Participants are exposed to potential surplus (which can translate to increased benefit)

Disadvantages for participants

- Participants bear "default risk" (Risk the plan will default on their pensions due to poor asset returns)
- Taking into account exposure to default risk with probably no adjustment to compensation for the risk, investment in bonds may be preferable

Advantages for the company

- Fiduciary duty requires to make investments productive (high reliance on equity "favors" higher return)
- Management themselves may be participants of the plan. Hence, they may have the same advantages as participants (exposure to surplus,)
- Reduces pension expense

Disadvantages for the company

- High equity allocation increases funded status volatility and contribution volatility
- Fiduciary duty requires to invest with care and diversify (high asset allocation may be too risky)
- Exposure for risk of litigation, if fund underperforms affecting stakeholders
- Requires management to act as an institutional investor (increased work around defining investment goals and beliefs, risk tolerance, proxy voting procedures, fund management and overview)
- Management themselves may be participants of the plan. Hence, they may have the disadvantages as participants (default risk)

[10 Marks]

Solution 4 :**(i) Key points for Funded versus Unfunded****Key advantages**

- Increased security for employees
- Better cash flow management
- Contributions can be smoothed thus allowing for better business planning
- Not exposed to the risk of unexpected benefit payments
- Reduced volatility of expenses on accounting basis
- There may be attractive tax incentives for contributions and investment returns

Main disadvantages:

- Opportunity costs of working capital
- Greater governance and administration of Trusts
- Risk of overfunding
- Risk of lower than expected returns

[4]

(ii) Key advantages for external funding**Investment**

- Burden of investing the trust funds are transferred to the insurer. Onus of monitoring the fund manager performance is what remains
- There may be limited flexibility of investment available under self-managed funds. For insurer managed funds, investment regulations may be different that may offer more flexibility and room for better returns

Flexibility

- There may be availability of various unit linked and traditional products among insurers
- Various options are available for re-direction of funds without additional costs

Administration

- Savings in both man-hours spent by Trustees in administration of trust matters

Liquidity

- No need to set aside as many liquid funds for paying gratuity claims through external arrangement
- Reduced risk of having to sell securities at a loss to make unexpected payments

[4]

(iii)

There are a number of different reasons for providing pension benefits:

- many employees may prefer the cash now but may suffer later if inadequate retirement provision is made
- other employers provide benefits therefore not doing so puts you at a competitive disadvantage
- you may benefit from tax or other financial incentives
- you may want to reward certain groups, e.g. key employees
- employees may expect some form of pension
- can be used to ease through a redundancy exercise, i.e. aid manpower planning.

Reasons for providing death benefits:

- relatively cheap to provide death benefits, especially if employees are young
- popular, hence good value for perceived worth
- cheaper on group terms than for individuals
- many people are actually underinsured

- many people rely on employer cover
- no benefit provided on death can generate bad publicity

[6]

(iv)

Advantages of final salary schemes (employer's perspective)

- can target benefits, as a percentage of final salary, more accurately
- in particular, gives better rewards to those whom you may like to see better rewarded, e.g. high fliers
- the timing of contributions for funding of the promised benefits is flexible
- (within the limits of any regulation)
- can produce a surplus if experience favourable (e.g. high investment returns)
- no risk of unexpected complaints at retirement since benefits are defined
- may be more comparable with competitors' benefits if many firms offer final salary benefits
- can be popular with employees (particularly older employees) and their representatives
- expenses may prove cheaper for a large employer

Disadvantages of final salary schemes (employer's perspective)

- exposed to risk of bad experience (e.g. low investment return, increasing longevity)
- contributions can be volatile
- may be pressure to provide additional benefits if surplus funds arise
- may be perceived as unfair by members leaving service, if there is no/lower vested rights
- cost of provision increases with age, which may influence employment policy more than job ability
- may be easily comparable with better value final salary schemes offered by competitors
- expenses may be larger for a small employer (e.g. compliance costs) when compared to a simple form of DC scheme
- benefit at retirement is not a predictable amount in absolute terms, only as a proportion of final earnings if the member stays to retirement.

[7]

[Total Marks-21]

Solution 5 :**(i) Reasons why the service credit provided by new scheme is less than five years**

On leaving the employment of Old scheme Mr Nadella will have lost the link of his benefits to final salary. Instead the benefits are likely to be receiving revaluation at a lower rate (perhaps capped price inflation) until retirement. This will be reflected in the transfer value.

When the transfer value is used to purchase service in the new scheme, this link to final salary needs to be re-established in the receiving scheme. This will be reflected in the service credit offered and is often the main reason why a lower service credit is provided in new scheme.

Mr. Nadella may have had a pay rise on changing employer, to the extent that this also means that pensionable salary is higher in new scheme than Old scheme then this would also reduce the service credit.

The transfer value from Old scheme may have been reduced because the scheme is in deficit or the sponsor is weak. Such a reduction is justifiable to ensure the security of remaining members' benefits.

The basis for the transfer value calculation (investment returns, mortality *etc.*) in Old scheme may have been weaker than that used in new scheme to calculate the service credit.

The service credit calculation in new scheme needs to reflect the cost of the guarantee. There will be expenses incurred in the transfer value calculation and in the calculation of the service credit. To the extent that these expenses need to be met from Mr Nadella's transfer value it will lead to a lower service credit.

No allowance for discretionary increases may have been made in the transfer value calculation in Old scheme, but an assumption may have been made that they will be awarded in new scheme.

There may be differences in scheme design, for example a lower service credit would be explained by (in comparison with Old scheme) New scheme having:

- a better accrual rate
- a lower retirement age
- better protection benefits
- higher pension increases
- higher dependant benefits.

[5]

(ii) Transfer value

The transfer value of Rs 78, 00,000 has been calculated as:

$$78, 00,000 = 10/\text{Acc} * S_{45} * ((1 + \text{reval}) / (1+i))^{(NRA-45)} * a_{NRA}$$

The service credit of 4 years and 6 months can be valued using the same formula as above, in other words the value is:

$$78, 00,000 * 4.5/10 = 35, 10,000$$

This needs to be compared against the value of the guarantee which, assuming it was received as soon as Mr Nadella joined new scheme is:

$$21, 50,000 * (1.06)^{10} = 38, 50,300$$

Given the guarantee bites the total value of the transfer is:

$$\text{Rs}78, 00,000 + \text{Rs}38, 50,300 = \text{Rs} 1, 16, 50,300$$

[3]

(iii) Derivation when the minimum guarantee is likely to apply

The guarantee has a value of:

$$TV * (1.06)^{10}$$

The original service credit calculation was carried out as follows:

$$TV = 4.5/Acc * Sal_{35} * (1+e/1+i)^{(NRA-35)} * aNRA \quad \text{-----} \quad (1)$$

Assuming there is no change to the transfer value basis and the benefit structure has not changed, then when Mr Nadella subsequently leaves the revised transfer value calculation TV* will be calculated as:

$$TV^* = 4.5/Acc * Sal_{35} * (1+e^*)^{10} * (1+reval/1+i)^{(NRA-45)} * aNRA \quad \text{-----} \quad (2)$$

Where e* is actual earnings growth pa between ages 35 and 45.

Substituting (1) into (2) gives:

$$TV^* = TV * (1+e^*/1+e)^{10} * (1+i)^{10} * (1+reval/1+e)^{(NRA-45)}$$

So the guarantee will apply if:

$$(1.06)^{10} > (1+e^*/1+e)^{10} * (1+i)^{10} * (1+reval/1+e)^{(NRA-45)}$$

Therefore the guarantee is likely to apply when:

- transfer value in basis was very strong compared to 6% pa roll up, ie little service credit given
- actual earnings growth over the 8-year period is low relative to that assumed in the service credit calculation
- if the assumed rate of earnings growth up to retirement is high relative to the assumed revaluation rate.

The guarantee may bite if Mr. Nadella completes only a short period of service in new scheme before leaving.

In addition, the guarantee may bite if the basis used to calculate the transfer value is weakened between the two transfer dates.

The guarantee is more likely to bite if new scheme is under-funded or the sponsor is weak at the time that the transfer value is taken, (such that the transfer value calculated is reduced to reflect the reduced security, but the guarantee is not).

[4]

(iv) Thoughts on setting investment strategy***General points***

The scheme will aim to maximise its net (of tax and expenses) investment return subject to an acceptable level of risk.

The principal factor in determining the investment strategy is the liabilities held by the scheme, in particular the need to match by nature, term, currency and uncertainty.

This is a final salary scheme and may have a mix of real (active liabilities linked to earnings growth) and fixed (if zero or fixed pension increase) liabilities. The liabilities will be dependent upon the maturity of the scheme and its cashflow requirements, eg an immature scheme will be a net investor and have very long-term liabilities and therefore it may be able to take more risk.

The investment strategy is also dependent on the assets available and their nature, term, currency etc.

The scheme's funding level will influence the strategy, the better the funding position the greater the scope to mismatch to increase returns. If benefits are fully funded on the transfer value basis then there may be a degree of investment freedom.

The risk appetite of the sponsor and trustees needs to be taken into account. Note this is a final salary scheme so investment risk lies with the sponsor.

The size of the scheme will be important, larger schemes are able to adopt a greater degree of investment freedom and can invest in some classes, *eg* direct property that would not be available to smaller schemes.

The insurance program being used should be considered:

- if protection benefits are insured then there is greater scope to mismatch with remaining assets
- if pensions are to be bought out at retirement then this affects the term of the liabilities and to minimise mis-matching risk requires a move to bonds close to members' retirement ages.

Regulation will impact on the strategy, for example the need to:

- meet statutory valuation requirements at regular intervals
- adhere to any restrictions or requirements on holdings of certain assets or asset classes.

The financial strength and size of the employer relative to the scheme will be considered and its willingness / obligation to make up any shortfall that arises.

The investment strategy of competitor schemes will also be considered.

Investment strategy while considering the guarantee

The scheme cannot match both the service credit liability and the guarantee liability at the same time – other than perhaps by using derivatives.

Active member liabilities are likely to be matched by equities and index-linked bonds to give a broad match against earnings inflation in the long term.

However, the guarantee is best matched by fixed-interest bonds if they offer a “guaranteed” return of at least 6% *pa*, if not a mixture of bonds and higher yielding assets such as equities will be required.

The extent to which the scheme should focus on investing to match the guarantee will depend upon how likely the guarantee is to bite and the financial significance of it biting. For example, if a small percentage of members will be affected and the cost per member would not be significant then the scheme should focus on matching the benefits provided if members do not transfer out of the scheme.

On the other hand if the guarantee is likely to be onerous and matching is a primary aim of the investment strategy then it may be altered to hold more fixed-interest bonds to take this into account.

[7]

[Total Marks-19]

Solution 6 :

(i) Advantages and disadvantages of fund based approach

Whether social security systems (or schemes) should be funded is subject to much debate.

The arguments in favour of funding (as opposed to adopting a PAYG approach) are:

- It increases the level of savings, at least in the short term whilst funds are building up. This requirement to pay contributions may be very acceptable to the population if they are made to appreciate that this money will be used to provide their benefit provision. However, this is generally not the case here due to the generational nature of the methods.
- it develops capital markets, the markets will naturally develop suitable investments to meet the investment need that will arise

- it eases the pressures of an ageing population
- Investment returns earned may reduce the long-term cost of benefits. (There may, however, be an opportunity cost associated with tying up the money in a fund.)

However, others argue that:

- Overall saving may not rise, it may just be redirected. If the population had not been required to contribute this money into the social security fund then they may have chosen to invest (at least some) of this money themselves. Hence the overall level of saving may not be greatly affected.
- Even if overall savings rise it may not create real investment. The money may not be used for the creation of fixed capital, for example building infrastructure. The social security fund investment may simply replace other investments leading to no increase in capital investment. (Note the buying and selling of existing shares etc. does not create real investment.)
- It does not solve the problems of an ageing population, as the cost of providing benefits would increase whether the system is funded or not.
- The transition to funding can be problematic, if earlier unfunded.
- The fund may prove a political temptation – in other words money may be diverted for other uses.

[2.5]

(ii) General average premium (GAP)

The GAP Method

Under this system the contribution rate is set such that a level rate will be payable throughout the lifetime of the scheme. This means that a relatively high rate will be payable when the scheme is first established, compared to the equivalent contribution rate in a PAYG system.

GAP contribution rate

At the inception of a scheme, the GAP contribution rate would be determined as:

$$\frac{\text{pv of all future benefit expenditure (inc. that arising from future new entrants)}}{\text{pv total salaries contributing population in all future years (inc. future new entrants)}}$$

At later contribution rate reviews, it would also be necessary to take account of the reserves which will have built up.

So the contribution rate at subsequent review would be determined as:

$$\frac{\text{pv of all future benefit expenditure (inc. future new entrants) - fund to date}}{\text{pv total salaries contributing population in all future years (inc. future new entrants)}}$$

Stability of the GAP contribution rate

The contribution rate required under such a system is stable if the assumptions are borne out in practice.

- The contribution rate is stable even with increasing age – as long as the initial assessment of how the system would age (*ie* the assumptions over future new entrants and mortality) was correct throughout different generations of membership.
- Obviously, in practice, these assumptions are unlikely to be borne out.

- For a newly established arrangement (where no past service benefits are offered) then initially (and for many years as the system matures) the GAP contribution rate will exceed the rate that would apply under the PAYG system. Also the annual contributions and investment income will exceed the annual disbursements. Thus a fund will build up to meet future expenditure.
- **Substantial reserves are set up under such a scheme** if it is assumed the system will age or mature. **However, it is not the same as full funding** (*ie* does not aim to cover the value of the accrued benefits to date), **although it may approximate to this**. Note the GAP method targets the contribution rate rather than the fund.

[4.5]

(iii) Differences between projecting social security system and occupations scheme :

Projecting social security benefit expenditure is similar in many ways to projecting benefits under occupational schemes, but there are some differences:

- it is more likely to be based on population effects and data rather than scheme membership.
- it is unlikely that individual data will be available, or that projections will be made at individual level.
- The funding position or assets may not be relevant – this will be the case if a PAYG approach has been adopted.
- Projections are usually on an open membership basis, allowing for future new entrants, rather than just considering current members and their accrued rights. Assumptions about new entrants are therefore required, *eg* the number, their age and gender.
- there is no fixed idea of a “member”, a “deferred member”, *etc* – membership will vary with employment, unemployment, *etc* throughout an individual’s career, with people moving back and forth between groups.

[2.5]

(iv) List of the critical assumptions for projections of social security benefits :

Critical assumptions in the projections include:

- mortality improvements
- future fertility
- future migration
- price inflation
- earnings inflation
- rate of pension increases
- contribution earnings limit increases
- economic activity rates
- invalidity rates
- age of retirement.

[2.5]

[Total Marks-12]

Solution 7 :**(i) Factors that increase deficit and recommended contribution rate**

- Mortality increases in life expectancy
- Falls in real gilt yields
- Lower price inflation increasing the value of any guaranteed pension increases
- Poor investment performance
- Higher salary increases than expected
- Adverse decrement experience
- Inadequate contributions in the criterion
- Augmented benefits awarded

For closed schemes

- There is a reduced ability to smooth experience as the active memberships dwindle
- Expense ratios increase
- The average age of membership increases over time
- Changes to funding method
- Changes to Investment strategy
- reducing equity holdings and reducing the potential returns

[5]

(ii)**Membership Profile**

The scheme will mature over time as the average age of the membership gradually increases although the impact may be relatively slow initially as there will be retirements and leavers
 The shape of the profile will change and result in greater volatility & risk
 The active membership becomes increasingly irrelevant
 The Scheme has a finite life but this may be many years

Funding Method & Assumptions

The funding method & assumptions needs to reflect the changing Scheme profile
 The Attained Age funding method may be the most appropriate as it allows for the increasing average age
 The Investment policy adopted is likely to change over time and the investment assumptions used need to reflect this
 Valuation assumptions need to reflect the finite length of the Scheme
 The ability to smooth the experience over future generation is reduced and there will also be less time to take corrective actions
 Mis-matching reserves may be appropriate
 Communication of the risks becomes more important
 Expressing contributions as a % of salary may become volatile therefore look at expressing it as monetary amounts

Investment Strategy

Matching considerations become more important as the ratio of actives to pensioners changes
 Fixed Interest & Equity holdings will change as the Scheme matures
 Benefit outgo is likely to exceed contributions and investment income at some stage hence cashflow and liquidity considerations become more important
 Use of ALM studies can help to develop a suitable investment strategy.

[9]

(iii) "Total cost known in advance"

The total cost is not known in advance as it will depend on the number of employees joining the scheme.

Furthermore the total cost *per employee* is only known in advance (as a percentage of pensionable salary) if the contribution rates are fixed, and even then future pensionable salary is not known with certainty.

However, the total cost per employee may not be known in advance if:

- some elements of the scheme benefit structure are not provided on a defined contribution basis, *eg* lump sum on death in service as a multiple of salary
- the scheme offers any guarantees, *eg* a minimum annual investment return on contributions
- the rate of company contributions depends on the members' chosen rate, *eg* if the company agrees to match employee contributions
- rate of company contributions depend on members' age / service
- there is moral pressure on the employer to provide higher benefits if funds should prove inadequate.

Future administration expenses are uncertain.

Future legislative changes may impact on the cost of scheme provision.

[5]
[Total Marks-19]
