

Institute of Actuaries of India

Subject SA6 – Investment

September 2017 Examination

INDICATIVE SOLUTION

Solution 1:**i) Nature of the liabilities**

Consideration needs to be given to the characteristics of the liabilities in order that appropriate matching assets can be identified. For example, the insurer needs to consider the following characteristics:

a) The nature of the existing liabilities – are they fixed or “real” in monetary terms. The majority of general insurance liabilities will be real in nature.

Examples: Property damage or bodily injury claims on public liability business are real in nature.

Claims from fixed-benefit classes (such as personal accident, medical expenses) are fixed in nature.

(2)

b) Currency of existing liabilities – many domestic, personal and commercial insurers may have portfolios predominantly denominated in their local currency. However, international insurers and reinsurers have portfolios that contain a range of currencies. Example: the principal currencies used in the London insurance market are sterling, euro, yen and US, Canadian and Australian dollars.

(2)

c) Term of existing liabilities – most general insurers’ portfolios are likely to contain a significant proportion of short-term liabilities (1–3 years), with a smaller proportion of medium-term (4–10 years) and long-term liabilities (10 years and above for example asbestos liabilities).

This will also depend on whether the insurer has been subject to recent large losses, and whether business volumes are growing or shrinking each year, as well as the position in the insurance cycle and so on.

Examples:

Short term – most property damage claims.

Medium term – bodily injury claims from liability classes such as public liability and product liability.

Long term – bodily injury claims on employers’ liability business, e.g. asbestosis.

(2)

d) The other factor that determine the investment strategy are

i. Level of uncertainty of existing liabilities – both in amount and timing.

ii. Estimated future liabilities arising from the portfolio of business planned this will depend on the volume and classes of future business written.

Location of liabilities

For example, trust funds for Singapore, USA, and so on may require assets to be held locally, and may restrict profit payments and the assets in which investments are held.

Whether the liabilities are discounted.

Whether the liabilities include expenses.

(2)

ii)

The general insurer should consider the:

- size of assets, in relation to the current liabilities – the larger the quantity of free assets, the more that the company has freedom to invest widely
- expected long-term return from various asset classes
- expected volatility within the various asset classes
- existing asset portfolio
- Non-investible funds – not all of the assets will be available for investment, *eg* moneys held by brokers, policyholders or reinsurers.

These funds may not generate any return to the insurer and thus can distort the overall return. In other words, these funds form part of the asset portfolio but since they do not generate a return they lower the average return on the portfolio.

Economic outlook and its likely impact on security and return on investments, *eg* future inflation affects the return on index-linked bonds

Risk appetite.

(4)

iii) The final payment amount for the majority of claims will depend on when they are settled as the claim amount will be subject to inflation. For example:

- price inflation will affect the costs of property repair and replacement costs for motor and household business

- Earnings inflation, medical inflation and judicial inflation will affect bodily injury claims for liability business.

The expenses of settling claims will also be subject to inflation. Expenses are likely to be linked to both salary and price inflation.

Because claims (and expenses) are subject to inflation, the insurer will need to consider investing in assets whose income and capital values also tend to increase with inflation, in order to achieve a matched position.

Such assets could include index-linked securities if these are available in the relevant currency, but we should bear in mind that the inflation affecting the claims and other outgo may not be the same as that on which the index is based.

Both equity shares and property are real investments and may increase at a rate in excess of price inflation.

The income and capital values generated by investment in equity shares and property may in the long run tend to keep pace with claims inflation, but may be subject to considerable fluctuations in the short term.

However certain contract types such as personal accident and fidelity guarantee may have fixed claims amounts. In these cases, inflation will be a minor issue and the appropriate investment policy will lean more towards fixed-interest vehicles.

(4)

iv)

The risks relating to the investment strategy of a general insurer are summarized Below:

a. Liquidity risk – the risk of not having sufficient cash to meet the liabilities

As they fall due. Liquidity risk is defined as the risk that a firm is unable to meet its obligations as they fall due as a consequence of having a timing mismatch or a mismatch between assets and liabilities.

This risk is associated with the processes of managing timing relationships between assets and liabilities.

Example

If an insurer locks into investments with a fixed term, it is exposed to the risk that the cash will be needed to settle claims before the term expires. A general insurer's liabilities are very uncertain in both amount and timing and therefore the insurer must maintain a reasonable level of liquidity in its portfolio.

Example

Exposure to a catastrophe event creates an immediate demand for claims payment.

b. Currency risk – the risk that changes in the value of the assets, or the liabilities of the company adversely impact the available capital or investment funds. If the assets and liabilities are not matched by currency, movements will not exactly offset each other; that is, one could increase relative to the other.

c. Market risk – the risk relating to changes in the value of the portfolio due to movements in the market value of the assets held. General insurers typically have relatively short-term liabilities that may be matched by cash or short-term bonds. These asset classes are in general less volatile than

Long-term bonds and equities; hence market risk is generally lower.

d. Economic risk – the risk of investing in certain asset classes at certain (disadvantageous) stages in the economic cycle.

e. Credit risk – the risk that a counterparty to an agreement will be unable or unwilling to fulfil its obligations. The largest credit risk for a general insurer is likely to be the failure of its reinsurer(s). Credit risk is also correlated with insurance risk; *eg* following a catastrophe loss in the market, insurers may also face increased credit risk through default of their reinsurers. Insurers can also be exposed to credit risk from other assets, *eg* the downgrading of any bonds held would be a credit risk.

f. Operational risk – includes the risk of loss due to fraud or mismanagement within the insurer itself.

g. Relative performance risk – the risk of underperforming comparable institutional investors. For general insurers, this risk is not as significant as liquidity, market and credit risk.

h. Group risk – the risk arising from belonging to a group. For example, an insurance subsidiary might be required to change investment strategy following a change in the parent's requirements. Liquidity risk might crystallize if, for example, the parent requires a dividend from the subsidiary.

i. Contagion risk; that is, that the collapse of one insurer is more likely to bring down others.

Note that pure underwriting risk is uncorrelated with market risk, making the cost of capital for an insurer lower than, for example, banks.

(10)

v)

Factors to consider when assessing liquidity risk

- the extent of mismatch between the assets and liabilities
- the amount of assets held in highly liquid forms
- the uncertainty of the liability cash flows
- the variation in the level of free assets over each stage of the underwriting cycle
- correlations with both insurance and market risk
- failures to forecast cash flow requirements accurately
- process weaknesses, such as poor credit control and poor management of disputes
- ability to manage unplanned changes in funding sources
- severity of the scenarios used in any scenario testing, and correlations between variables in each scenario

(4)

vi)

1. Liquidity risk can be measured using one or more of the following approaches:

- Liquidity Gap Analysis
- Duration Analysis
- Scenario Analysis

2. Under Liquidity Gap Analysis, assets are allocated to one of two categories – liquid or illiquid, All liabilities are classified as either stable or volatile

The focal point of the analysis is the concept of net liquid assets which is expressed as the level of liquid assets less the amount of volatile liabilities. If the net liquid assets is negative, then the insurance company is exposed to liquidity risk. A six-month remaining maturity criterion is typically used for classifying assets as “liquid assets” and liabilities as “volatile liabilities”.

In analyzing the net liquid assets position, the cost of liquidation (included in converting the non-cash items into cash) must be considered. This cost will include elements like the brokerage fees and the bid-offer spread in the market prices for the assets involved.

3. Duration analysis involves the following steps:

[a] Calculate the present value of the assets and the present value of the liabilities using the “cost of funds” as the discount rate. Therefore the value of the insurance company’s equity will be equal to the present value of the assets less the present value of the liabilities.

[b] Measure the change in the value of the equity arising from a change in the cost of funds [arising from an increase in the risk premium paid for raising the money]. This change in the value of equity is called as the Liquidity Risk Elasticity [LRE].

If the LRE is close to zero, then the insurer has negligible liquidity risk. If the LRE is sharply negative then the insurer is exposed to significant liquidity risk.

4. Scenario analysis is a common approach for assessing liquidity risk. This approach involves projecting the cash inflows and outflows under a range of scenarios. Examples of such scenarios can be rising interest rates; incidence of a large single insurance claim pay out; sudden termination of a large reinsurance contract, etc.

Once the cash inflows, cash outflows and sources of liquidity have been modelled, liquidity risk can be assessed by examining scenarios where the cash outflows will exceed available cash at future points in time; and the likelihood of the occurrence of such scenarios.

While performing such scenario analyses, it is important to allow for the interactions between liquidity, market and interest-rate risks.

It is important to consider both short-term and long-term scenarios.

(Maximum: 6)

vii)

(a) Short-term bonds are suitable for household contents.

Longer-term bonds are unsuitable as the liabilities are short tailed.

Direct property would be unsuitable for household business because of lack of marketability and large unit size. Also investments would be too long-term.

(b) Bonds would not really be appropriate for employers' liability as real assets would be a better match.

Property is also probably unsuitable. Although the nature and term may be about right (or less wrong than other assets), the lack of marketability could be a problem.

The large unit size would also make it difficult to hold a sufficiently diversified portfolio.

(c) Bonds are not normally appropriate for free reserves. We prefer assets that have a higher expected return and offer better protection against inflation.

Direct property could be acceptable for a portion of the free reserves. The insurer's own office may form part of the assets.

(3)

viii)

The company may choose not to match the liabilities (*eg* if it has plenty of free reserves).

- If the company is making underwriting losses, an unmatched position may be taken to try to make investment profits to offset these losses.
- The company may be forced to invest in much shorter, liquid assets with a more stable market value, in order to protect its statutory solvency position.
- The timing of the liabilities will be uncertain and therefore difficult to match.
- It may not be possible to match, *eg* if claims inflation is different from the inflation protection available from real assets.
- There may be regulatory limits on the amount of assets that can be invested in certain asset classes.
- Matching assets may not be available.

(3)**ix)**

To consider the progress of the insurer on an ongoing basis, allowance must be made for future new business. This is a difficult assumption to set. The purposes of such an investigation might be to assess:

- a.** the future solvency of the company under different volumes of new business, or
- b.** the future solvency under different scenarios for asset distributions, or
- c.** the likely levels of profitability.

Although a deterministic model (with variations in the assumptions) could be used, a stochastic model would be the most effective way of incorporating allowance for the volatility in asset values and the uncertainty in the claims experience

(2)**x)**

It is dangerous to rely heavily on a high level of future new business because the amount of premium income may be less than anticipated. This could leave the company exposed to the possibility of having to realize long-term assets to meet short-term liabilities (i.e. mismatching).

(2)**[46 Marks]**

Solution 2:

(i) The plausible reasons for the changes made in the mandated investment pattern can include the following:

- The new guidelines stipulates a minimum and maximum for investment in debt securities and term deposits of banks. This can be aimed at [a] deepening the market for corporate debt securities and [b] increasing the lendable resources of the banks
- The new guidelines stipulates a minimum and maximum for investment in equity and equity related instruments. This is to ensure that a growth in the equity markets and promote a value-based investing culture because institutional investors like provident funds and pension funds are long -term investors who look for long term capital appreciation rather than short-term gains Also investing in equity stocks can provide a better match for those liabilities of institutional investors which are index-linked [better match for liabilities denominated in “real terms”]
- The new guidelines allow investment in exchange traded funds and indexed funds which can allow institutional investors like PFs and Pension funds to pursue a more passive equity investment strategy.
- The new guidelines allow exposure to derivatives [for the purpose of hedging] which will allow the Provident Funds to hedge its risk exposure to the underlying assets without necessarily foregoing the upside potential [eg by investing in equity index options].
- The new guidelines promotes investment in more innovative capital market instruments like asset-backed securities and units of Infrastructure /Real Estate Investment trusts which provides a diversification avenue for the Provident Funds which otherwise would be constrained in conventional debt and equity instruments.

(4)

(ii)

AS far as Equity is concerned, only exchange traded derivatives are permissible as the guidelines. Therefore OTC derivatives would not be allowed.

Also Derivatives can be used only for the purpose of hedging (and not speculative).

For Debt, the approved CDS can be used to invest in asset classes below AA rating in order to sweeten the yields required under the portfolio.

Put Option on Stock Index

A put option on the stock index might be a perfect hedge if the manager invests in passive funds (tracking funds) that mirrors the performance of a stock index (say NIFTY 50). Hence the manager

can invest in the Nifty tracking passive fund but buy a put option on the same in order to hedge the risk of a sharp fall in the stock value resulting in the underpin guarantee biting.

The maximum loss would be restricted to the option premium paid.

Put Option on Stocks

A put options on the respective stock itself can be bought. The stock in question should have a market capitalization of at least Rs.5000 crore as at the date of the investment.

The maximum loss would be restricted to the option premium paid.

Stock Futures and Index Futures

The manager can use stock futures or index futures to hedge against a risk of fall in the value of constituent stock or index. The contract can be used to sell the index or stock at a pre-determined time in the future at a pre-determined price in order to ensure that their objectives are met.

If the price of the stock or index rises, the gain made on the stock or future would be offset by the futures contract.

CDS on Bonds

Where the rating of the Bonds considered for investment is below grade AA, as long as the bonds are purchased along with corresponding credit derivatives (CDS) which fully cover the underlying credit risk, then investments would be allowed in the said bonds.

The amount of swaps purchased themselves would be counted as part of the Debt and Related instruments category.

(10)

iii)

Risk budgeting involves designing an asset portfolio that:

1. manages and controls the overall level of risk taken in a portfolio relative to its liabilities
2. allocates the risk to the areas where the sponsor is willing to take risk
3. allocates less risk to areas where the sponsor feels that risk will not be rewarded.

The various stages of the process are:

- assessing the requirements of the investor – here the requirement would be to have a minimum growth rate in line with that notified by the Government. Also any other internal benchmarks that the investor has needs to be considered.
- determining the required level of sophistication of the process – given that the fund size is massive, it might warrant various scenarios to be considered and presented before the management taking into account for regulatory limits for each asset class.
- being aware of behavioral issues – the mindset of the investor needs to be considered considering that it can be heavily anchored on their past practices
- setting assumptions – Assumptions would be required for the means, volatility and correlations across different asset classes. While setting the assumptions, the following factors need to be considered :
 - the length of time over which observations should be used
 - the way that outliers are treated.
 - accommodating the fact that economic factors may not be the same now as they were when the market data was extracted.
 - how to accommodate the fact that markets do not behave in a similar fashion even when economic factors are the same as when the data was extracted.
 - changes in the risk levels of asset categories (for example, changes in gearing levels can increase or decrease the systematic risk in the equity markets over time and make historical comparisons invalid
 - how to manage liability outgo that contains discretionary elements, which are hard to predict
 - the fact that asset income flows can be affected by political interference, legal and tax changes which cannot be predicted with any accuracy.
- deciding upon the set of feasible asset categories – the asset mix chosen has to be in line with the Regulations. Also the risky asset classes would be the source of the guarantee biting (viz., the underpin biting). Therefore different sets need to be considered with respect to the risky asset classes (equity, Mortgage backed securities etc.) in order to demonstrate the risk return trade-off appropriately to the investor. The extent to which the permitted derivatives can be used for hedging the underlying asset risks will also influence the feasible combinations of the assets.

- deciding upon the risk budget and where the risk should be taken – The investor needs to decide how much risk should be accepted, and where that risk should be taken. This is a difficult process as it involves weighing up the two competing requirements of:
 - enhancing returns through taking risk
 - ensuring security and protecting the net assets.

The investment policy therefore needs to reflect the extent to which the risks of lower stability and security are to be taken on in order to aim for higher returns. This will typically include:

- Establishing an appropriate asset mix for the fund — the strategic benchmark. The strategic (or policy) risk of the fund is the risk of poor performance of the strategic benchmark relative to the value of the liabilities. In the current context it would be the risk of the strategic benchmark not meeting the minimum rate as notified by the Government or any higher internal benchmarks
- The tactical implementation of this strategy by the selection of one or more managers and a decision on the appropriate level of risk that these managers should take relative to the strategic benchmark. This is known as the active (or manager or implementation) risk. Usually measured through the tracking error metric.

Within XYZ, there could be different sector specific managers (bond, equities etc.) who might be given the mandate in terms of tracking error.

- There may also be some structural risk associated with any mismatch between the aggregate of the portfolio benchmarks and the total fund benchmark. For large schemes structural risk can be reduced if “peer group” benchmarking is avoided. Style identification can be used to ensure that the best managers (within each style) are picked while keeping the fund as a whole “style neutral” (unless an exposure to style risk is particularly warranted).
- reviewing the results continuously and rebalancing if necessary - market volatility and correlation can change quickly in the real world with a consequent knock-on effect on the assumptions used for modelling.

(10)

iv)

- Performance Returns should be net of fees.
- In order to assess the impact of any performance related fees- a transparent assessment of the fees paid versus returns achieved needs to be made.
- Performance figures to be given by asset category and by individual asset holding.
- Performance figures to be outlined in an appropriate and suitable manner to enable an assessment of relative performance
- Performance figures should allow for an assessment of the level of risk taken. Adequate risk adjusted performance statistics should be included in the report. This could be in terms of tracking error or information ratios.
 - Tracking error: Standard deviation of the relative performance, where relative performance would be a time series of (perhaps monthly) differences between the fund return and the benchmark return. The measure is usually quoted on an annualized basis. Passive funds would aim to get the tracking error close to zero, whereas active funds aim to take active risk.
 - Information ratio: The annual relative return over the observation period, divided by the tracking error over the same period. Easily explained to trustees as it is a “return per risk” measure, therefore popular.
- Attribution analysis needs to be carried out to enables an assessment of what were the main positive and negative contributing factors are.
- Time periods for the performance statistics needs to be adequate
- Is there detailed disclosure of trading costs, third party expenses, and other manager fees?

(6)

v)

1. The underlying rationale for using the option pricing approach is that the interest rate guarantee embedded in an exempt provident fund scheme is similar to the obligation of the seller of an interest rate floor, who has to compensate the buyer when the actual rate of interest [on the interest reset date] turns out to be less than the guaranteed rate.
2. Under the Option Pricing Approach, the value of the interest rate guarantee is set equal to the value of the interest rate floor.
3. The value of the interest rate floor can be calculated using a closed –form model like the Black’s option pricing model for valuing interest rate derivatives like caps & floors.
4. If the PF Trust can retain the entire surplus interest earnings (surplus being equal to the excess of the actual investment return over the guaranteed rate of interest) for funding

future interest rate shortfalls, then the value of the interest rate guarantee will be equal to the value of the interest rate floor less the value of the interest rate cap – both being valued using the Option Pricing Model.

5. The typical inputs required for using the Option Pricing Model are

- The gilt yield curve as on the date of valuation (which will be used to determine the implied forward rate curve)
- The annual investment returns on the plan assets backing the PF scheme for a period of five to ten years immediately preceding the valuation date.
- The current guaranteed rate of return which is equal to the recent credited rate of interest declared by the Employees Provident Fund Organization
- The member's PF account balance as on the date of valuation. This will be equal to the member's contributions plus the company's (employer's) contributions plus the interest credited on the member's contributions and the company's contributions up to the date of valuation
- The expected working life time of the active members of the exempt provident fund as on the valuation date or such shorter period as the Actuary considers to be appropriate
- The demographic assumptions related to decrements such as future attrition rates and mortality rates
- The discount rate-typically set equal to the market yield on Government of India bonds for a term equal to the decrement adjusted remaining term of obligations

(10)

[40 Marks]

Solution 3:

i)

	Clg Assets (1)	Opg Assets (2)	Op. Prop (3) [(2)/Total of (2)]	1 yr Return (4) [(1)/(2) - 1]	Strat Benchmark (5)	Opg Exch Rate (6)	Clg Exch Rate (7)	Gain/(Loss) (8) [(7)/(6) - 1]	Currency Return (9) $\sum[\text{Col (8)} * \text{Col (3)}]$
A	880	800	40%	10%	50%	45	50	11.11%	2.9%
B	720	600	30%	20%	20%	20	20	0%	
C	500	300	15%	66.67%	20%	25	25	0%	
D	300	300	15%	0%	10%	600	540	-10%	
Total		2000	100%		100%				

	Clg Index (10)	Opg Index (11)	Clg Index (in Rs.) (12) [(10)*(7)]	Opg Index (in Rs.) (13) [(11)*(6)]	Return (in Rs.) (14) [(12)/(13)-1]	Benchmark Return (15) Σ[Col (14) * Col (5)]	Fund Return (16) Σ[Col (4) * Col (3)]	Benchmark Returns with Actual weights (17) Σ[Col (14) * Col (3)]
A	11	10	550	450	22.22%	14.41%	20%	13.08%
B	11.2	10	224	200	12%			
C	10.5	10	262.5	250	5%			
D	11	10	5940	6000	-1%			
Total								

Outperformance = Fund return (16) – benchmark return (15) = 20% - 14.41% = 5.6%

Stock selection performance = Fund return – Benchmark Ret with Actual Wts (17) = 20% - 13.08% = 6.92%

Asset allocation performance = 17– 15 = 13.08% -14.41% = -1.33%

Assumptions:

No tax, no cash flows during year, currency unhedged, no transaction costs or fees.

(10)

ii)

EMH implies that one cannot outperform the market in the long run (adjusting for research and transaction costs including taxes), except due to temporary anomalies (i.e. out of sheer luck). This means that the outperformance above is purely co-incidental. This is especially true for the stock selection profits.

In other words, if markets were indeed efficient, then the stock selection profits should be zero! Only asset allocation profits should remain.

The fund has outperformed its benchmark –due to stock selection profits rather than asset allocation profits. This is only one year of returns and performance should also be assessed over longer time intervals. Also, the asset allocation performance is not only significantly less than the stock selection performance, it is also negative.

The above results can only be explained as an “anomaly” or temporary dis-equilibrium in the market – if the markets were efficient.

(4)

[14 Marks]
